REPORT

OF THE

INTERNATIONAL CONFERENCE

OF PHYTOPATHOLOGY AND ECONOMIC ENTOMOLOGY

HOLLAND
1923

—

PUBLISHED BY THE
COMMITTEE OF MANAGEMENT

EDITOR:
T. A. C. SCHOEVERS
SECRETARY OF THE COMMITTEE

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Before the Town-hall of Wageningen

Before the Aula of the Agricultural University of Wageningen

INTERNATIONAL CONFERENCE

OF

PHYTOPATHOLOGY AND ECONOMIC ENTOMOLOGY

24—30 JUNE 1923

HOLLAND

PREFACE

ORIGIN OF THE CONFERENCE

When visiting foreign countries in 1919, 1920 and 1921 Prof. Dr. H. M. QUANJER convinced himself, that among scientists and practical men, who occupy themselves with plant-diseases and plant-pests, there prevailed a general feeling that a get-together of phytopathologists and entomologists of all countries was urgent and promised to be of great use; an international meeting would help to re-establish and extend the relations among the workers of the various countries; it would facilitate the exchange of ideas, materials and literature, and through personal acquaintance it would lead to a better knowledge and appreciation of each other's work, and would unquestionably result in economy of efforts, time, and money. For the solution of several problems, for the study of questions of etiology of plant pests and diseases, of host and environmental relations, of disease spreading etc., co-operation and team work is imperative, especially as such questions ought to be studied under a variety of conditions, both in the Old and the New World.

In several countries the leading phytopathologists and entomologists have felt the necessity of keeping foreign diseases and pests of plants out of their borders. In consequence various laws and requirements have been put into action.

The great amount of damage done in several cases by imported parasites, is generally acknowledged and regretted. It can not be denied however, that rigorous laws cause great difficulties and in some cases even make trade impossible, to the great loss of the parties concerned. For this reason the matter needed to be discussed also from a commercial and an economical point of view in an international meeting of competent persons.

It is well known that in this matter the Phytopathological Services, both of importing and of exporting countries, already play an important role and will do so still more in future. Therefore a mutual understanding and, if possible, co-operation between the leaders of the Phytopathological Services of various countries may tend to facilitate the inevitable measures, which each country has to take to protect itself against the introduction of foreign plant pests.

On several occasions Mr. N. v. POETEREN, Chief of the Dutch Service, has found his colleagues of other countries expressing their readiness and even their desire for a conference on this subject.

For several reasons Holland seemed to be the country where such a get-together of phytopathologists and entomologists of all countries would be first of all possible. This country, with its intensive agriculture, highly developed horticulture and production of fruit and truck crops, potato-culture, flower bulbs and ornamentals, appreciates the work of the phytopathologist; it is doing its best in fostering the development of phytopathology and economic entomology, both as a science and in practice; therefore it would be glad to receive the phytopathologists of the world.

Furthermore several colleagues from abroad had already expressed their desire to pay a visit to Holland to see the work on potato-diseases etc. done to secure healthy crops in co-operation with the Phytopathological Service, and also to study the extension - and other work of that Service.

In consequence of the above-mentioned considerations a committee of arrangement was formed at the initiative of Prof. QUANJER; this committee succeeded in convincing the Government of the Queen of Holland of the great importance of the projected international conference, with the result, that the Government, enlightened by Dr. P. v. HOEK, Director-General of the Ministry of Agriculture, gave its full support to the plan. Thanks to this, in October 1922 the committee could send out a call for an international conference to all countries, and to those phytopathologists and entomologists, with whom its members were in personal connection.

It soon became evident, that the plan met with general approval; in the early spring of 1923 there had already arrived enough promises of participation to carry out the plan to its full extent.

It was a matter of course that Wageningen was to be the place where the first part of the Conference would be held. In Wageningen the potato research work referred to above, is being done; it is also the head-quarters of the Dutch Phytopathological Service and the plan for the Conference originated in Wageningen. Furthermore the Agricultural University with its Institutes, among which the new Laboratory for Mycology and Potato Research, and two important State Experiment stations are also situated at Wageningen. For these reasons this small country town offered a suitable centre for a conference like the one planned.

The committee felt, that it would be of advantage to members to show them also in the field something of the Dutch cultures and their state of reasonable exemption from diseases and insect-pests, thanks to the co-operation between phytopathological and entomological science and practice, which cooperation is chiefly in the hands of the Phytopathological Service. Besides the experiment stations at Lisse and Groningen, where scientific phytopathological work is in progress, were considered well worth visiting. Therefore two days of excursions through the country were inserted between the meetings. After those excursions the meetings were continued at Baarn, the site of the Phytopathological laboratory Willie Commelin Scholten. In this laboratory the collection of cultivated fungi, originally belonging to the „Association internationale des Botanistes" is kept under the direction of Miss Prof. Dr. J. WESTERDIJK; by continuing the meeting in that laboratory members would be able to become acquainted with that interesting collection and with the research work carried out at this place. —

The Committee considers it justified to state, that its efforts have had excellent results. The conference was actually attended by 65 members from abroad and about 30 Dutchmen, representing 25 nationalities and some 30 dominions and protectorates; during the meetings and excursions a spirit of mutual esteem and good-understanding prevailed among the members, so that not a single dissonant note was heard. New bonds have been formed, and old ones drawn tighter, by which the world may profit in future. —

Of the very interesting papers read and conclusions taken, a full account will be given in this Report; the Committee would also have been pleased to publish in full the, so cordially received, addresses of welcome of the several authorities and officials; but owing to the high charges of printing this has proved impossible; for the same reason only the most important part of the discussions has been printed. —

At the end of this preface the Secretary begs to insert a personal note: he insists upon expressing his sincere and cordial thanks to all those, who helped him in accomplishing his task. Excluding, as he does, all personal acknowledgements, yet he begs to mention especially those members of the Committee outside Wageningen, who arranged excursions etc., and in general he wishes to thank the foreign members for the kind way, in which they accepted and followed his hints and directions.

Having acted as secretary throughout the Conference, he feels sure that he expresses the feelings of all members, if he does not finish without tendering thanks to H.E. the Minister of the Interior and of Agriculture, representing the Government of H. M. the Queen of Holland, for his patronage and generous support, and to Prof. Quanjer for his initiative.

For the Committee of Management,
T. SCHOEVERS,
Secretary

INTERNATIONAL CONFERENCE

OF

PHYTOPATHOLOGY AND ECONOMIC ENTOMOLOGY

24–30 JUNE 1923

HOLLAND

Patron:

His Excellency Jonkheer Dr. CH. J. M. RUYS DE BEERENBROUCK, Minister of the Interior and of Agriculture.

Presidents of Honour:

Jonkheer Dr. S. VAN CITTERS, Governor of the Province of Gelderland, President of the Board of Curators to the Agricultural University of Wageningen, Arnhem.

Dr. L. O. HOWARD, Chief of the Bureau of Entomology, Department of Agriculture, Washington, U. S. A.

Honorary Members:

Dr. P. VAN HOEK, Director-General of the Ministry of Agriculture, the Hague.

Prof. Dr. J. RITZEMA BOS, Emeritus-Professor of Phytopathology and Economic Zoölogy, Wageningen.

Committee of Management:

Prof. Dr. H. M. QUANJER, Wageningen, Acting-Director of the Phytopathological Institute and Potato Research Laboratory, connected with the Agricultural University, President.

Prof. Dr. Joh. WESTERDIJK, Baarn, Director of the „Phytopathological Laboratory W. C. Scholten", Professor of Phytopathology in the Utrecht University, (also in charge of the „Centraal Bureau voor Schimmelcultures"), Vice-president.

N. VAN POETEREN, Wageningen, Director of the Phytopathological Service, Vice-President.

J. HUDIG, Groningen, Director of the Agricultural Experiment Station for soil-researches, Division for sand- and peatsoils.

Dr. E. VAN SLOGTEREN, Lisse, Phytopathologist for the Bulb-district.

G. KRUSEMAN, Halfweg, Farmer, formerly Member of the Council of the Holland Agricultural Society.

J. C. DORST, Leeuwarden, Scientific Adviser of the Frisian Agricultural Society.

J. G. HAZELOOP, Alkmaar, Director of the State Winterschool of Horticulture.

E. H. KRELAGE, Haarlem, President of the General Bulb-growers' Society.

J. H. VAN STRAATEN VAN NES, Boskoop, formerly President of the Ornamental Plant-Growers Association.

Dr. J. OORTWIJN BOTJES, Oostwold, Farmer, Member of the Council of the Groningen Agricultural Society.

Dr. L. P. LE COSQUINO DE BUSSY, Amsterdam, Director of the Division of Commerce, Colonial Institute.

Prof. Dr. W. ROEPKE, Wageningen, Entomologist, Professor in the Agricultural University.

T. A. C. SCHOEVERS, Wageningen, Phytopathologist, Assistant-Director of the Phytopathological Service, **Secretary.**
Address: Nassauweg 28, Wageningen.

Members from abroad:

COUNTRY	NAME
Australia........	GEOFFREY SAMUEL, Lecturer in Plant Pathology in the University of Adelaïde.
Austria	BR. WAHL, Landw.-bakt. und Pflanzenschutzstation, Wien.
	G. KÖCK, Landw.-bakteriol. und Pflanzenschutzstation, Wien.
Belgium.........	D. VAN HOVE, Inspecteur van den Phytopathologischen Dienst, Gent.
	R. MAYNÉ, Chef de Zoologie à l'Institut agronome de l'Etat, Gembloux.
Brazil	CARLOS MOREIRA, Director do Instituto biologico de Defesa agricola, Rio de Janeiro.
	fr. v. D. HOEVEN, ?.
Canada	A. GIBSON, Dominion Entomologist, Department of Agriculture, Ottawa.
	H. T. GÜSSOW, Dominion Botanist, Central Experimental Farm, Ottawa.
China	KOUNG SIAN, Sécrétaire de la Légation de Chine, La Haye.
	LAI PING YANG, Attaché à la Légation de Chine, La Haye.

COUNTRY	NAME
China	T. C. TANG, Agronome, ?.
Czecho-Slovakia .	FR. STRANÁK, Director of the States Phytopathological Station, Prague.
	ED. BAUDYSZ, Director Experiment Station, Valecov.
Denmark	E. GRAM, Statens Plantepatologisk Førsøg, Lingby.
Dutch East Indies.	W. C. v. HEURN, Zoöloog aan het Instituut voor Plantenziekten, Buitenzorg, Java.
Finland	J. IWAR LIRO, Prof. in the University, Helsingfors.
France	L. GAUMONT, Directeur de la Station Entomologique à Chalette (Loiret).
	Prof. ET. FOËX, Directeur de la Station de Pathologie végétale, Paris.
	V. DUCOMET, Ecole nationale d'agriculture de Grignon.
	L. MANGIN, Membre de l'Institut et de l'Académie d'Agriculture de France, Directeur de la Musée d'histoire naturelle, Paris.
	P. MARCHAL, Directeur de la Station Entomologique de l'Etat, Paris.
Germany	L. REH, Abteilungsvorstand am Naturhist. Museum, Hamburg.
	O. APPEL, Direktor Biologische Reichsanstalt, Berlin-Dahlem.
	C. BÖRNER, Biologische Reichsanstalt, Berlin-Dahlem.
	H. W. WOLLENWEBER, Forschungsinstitut für Kartoffelbau, Berlin-Dahlem.
	VON BREHMER, Forschungsinstitut für Kartoffelbau, Berlin-Dahlem.
Great Britain ...	A. D. COTTON, Keeper of the Herbarium, Kew Gardens, Richmond.
	J. C. F. FRYER, Director Pathological Laboratory, Harpenden.
	E. HOLMES SMITH, Advisor Mycologist, Botanical Departement, University, Manchester.
	D. W. DAVIES, Advisor Mycologist, University College of Wales, Aberystwyth.
	S. G. PAINE, Assistant-Professor in the Dept. of Plant Physiology and Pathology of the Imperial College of Science and Technology, London.

COUNTRY	NAME
Great Britain ...	I. WHITEHEAD, Adviser in Plant Pathology, University College of North Wales, Bangor.
	KENNETH M. SMITH, Advisor Entomologist, University, Manchester.
	Miss ENID S. MOORE, Department of Botany, University College, Southampton.
	Miss DOROTHY M. CAYLEY, John Innes Horticultural Institution, Wimbledon.
	H. H. STIRRUP, Adviser in Plant Pathology, Midland Agricultural and Dairy College, Loughborough.
	Miss KATHLEEN SAMPSON, Plant Pathologist, University College of Wales, Aberystwyth.
	W. F. BEWLEY, Director Experiment and Research Station, Cheshunt.
	W. A. MILLARD, Department of Agriculture, The University, Leeds.
	N. C. PRESTON, Harper Adams College, Newport Salop.
	W. BUDDIN, Mycologist, Laboratory of plant pathology, University College, Reading.
Hungary	I. BERNATSKY, Landw. Inst., Abteilung für Mykologie, Budapest.
	HERMANN KERN, Director des kgl. Ungarischen Institutes, Budapest.
	GABRIEL BAKO, Vorstand des kgl. Ungarischen Entomol. Versuchsstations, Budapest.
Ireland	P. MURPHY, Royal College of Science, Dublin.
	C. BOYLE, University College, Cork.
Italy	B. TRAVERSO, Direttore R. Stazione di Patologia Vegetale, Roma.
	J. FRANCHINI, Institut Pasteur, Paris.
Japan	T. HEMMI, Prof. in the Dept. of Agriculture in the Kyoto Imperial University.
	S. ITO, Prof. of Plant Pathology at Sapporo, Hokkaïdo.
	S. KUSANO, Prof. of Botany and Phytopathology, Tokyo Imperial University.
	HACHIRO YUASA, Economic Entomologist, Prof. in the Dept. of Agriculture, Kyoto Imperial University.
Latvia	M. EGLITS, Dir. Institut für Pflanzenschutz, Riga.

COUNTRY	NAME
Lithuania	St. MOSTOVSKY, Entomologist Agricultural College, Datnow.
Poland	L. GARBOWSKI, Director Division of Plant Pathology, Agricultural Institute, Bydgoszcz.
Portugal	Miss MATHILDE BENSAUDE, Lisboa.
Sweden	JAKOB ERIKSSON, Royal Academy of Science, Stockholm.
	IVAR TRÄGÅRDH, Statensförsöksanstalt, Experimental-Faltet.
Switzerland	A. VOLKART, Schweiz. Landw. Versuchsanstalt, Oerlikon, Zürich.
	H. FAES, Directeur de la Station Fédérale d'essais viticoles pour la Suisse Romande, Lausanne.
U. S. A.........	L. O. HOWARD, Chief of the Bureau of Entomology, Dept. of Agriculture, Washington D.C.
	HAVEN METCALF, Pathologist in charge, Bureau of Plant Industry, Washington D. C.
	C. L. SHEAR, U. S. Dept. of Agriculture. Washington D. C.
	W. RUDOLFS, State Experiment Station, New Jersey.

PROGRAMME OF THE CONFERENCE

Sunday June 24:

Arrival of members at Wageningen.

8.— p.m. Meeting in the Great Hall of the University.

Address of welcome by Prof. Dr. J. C. KIELSTRA, Vice-Chancellor of the University (p. 19).

Demonstration of a film „Holland", showing interesting scenes of Dutch nature, culture, architecture, folklore etc.

Monday June 25:

9.15 a.m. Meeting in the Great Hall of the University.

Opening-address to the Conference by H. E. THE MINISTER OF THE INTERIOR AND OF AGRICULTURE (p. 19).

H. M. QUANJER: Seven potato diseases of the curl type. (p. 23).

Opening-address by Jonkheer v. CITTERS to inaugurate the new Laboratory for Mycology and Potato Research (p. 28).

Demonstration of laboratory and experimental garden work (p. 30). KENNETH M. SMITH: Demonstration of some peculiar pathological conditions in the leaves of potatoes, affected with mosaic disease (p. 30); GAUMONT: Demonstration of some slides on potato-aphids (p. 58). QUANJER on curl-diseases (p. 23); MISS DE BRUYN on oöspores of *Phytophthora infestans* (p. 30); MISS VAN DER MEER on *Verticillium-wilt* (p. 31); DR. ATANASOFF on stipple-streak disease of potato and on *Fusarium* in cereals (p. 32); DORST on flax-rust and resistance (p. 33); J. ERIKSSON: Demonstration of some slides on the Mycoplasmaform of *Phytophthora infestans* in potato-leaves (p. 33); S. J. WELLENSIEK: Premature tuber-formation (p. 34); D. ELZE. Experiments on potato-aphids (p. 35).

12.30 p.m. Light refreshments in the Laboratory.

1.30 p.m. Meeting in the Great Hall of the University.

Address by the President of Honour Dr. L. O. HOWARD on: International Co-operation in combating plant diseases and insect pests (p. 36).

E. GRAM: Potato leaf roll influenced by the origin of tubers (p. 38).

V. DUCOMET: Sur la visibilité des symptomes de la mosaïque de la pomme de terre (p. 39).

G. KÖCK: Die Bewertung der Saatkartoffeln vom pflanzenschutzlichen Standpunkt (p. 43).

L. REH: Ist Trennung der Phytopathologie in praktische Botanik und praktische Zoö-(Entomo-)logie erwünscht? (p. 48).

Discussion (p. 50).

E. GRAM: How do we receive and keep information of phytopathological progress? (p. 51).

C. L. SHEAR: International phytopathology (p. 53).

4.45 p.m. Tea in the Town-hall of Wageningen, at the kind invitation of the City Council.
Address of welcome by Mr. J. M. A. WIJNAENDTS VAN RESANDT, Burgomaster of Wageningen (p. 58).

7.50 p.m. Meeting in the Great Hall.

L. GAUMONT: L'étude de la famille d'Aphididae (p. 58).
Les pucerons de la pomme de terre (p. 65).

C. BÖRNER: Die Bekämpfung der schwarzen Blattlaüse (p. 66). Das Problem der Reblausrassen (p. 69).

J. DAVIDSON: The penetration of the stylets in plant tissues and the source of the food supply of aphids (Mr. DAVIDSON being unable to attend, this paper was kindly read by Dr. J. C. F. FRYER; p. 72).

S. G. PAINE: Internal rust spot of potatoes (p. 74).

W. A. MILLARD (and S. BURR): The supposed relation of potato skin spot to corky scab (p. 78).

v. BREHMER: Die anatomischen und mikrochemischen Veränderungen des Kartoffelleptoms (p. 79).

(The papers read in the evening were all illustrated by lantern-slides).

Tuesday June 26:

8.45 a.m. Meeting in the Great Hall.

N. v. POETEREN: Organisation and methods of the Phytopathological Service of Holland (p. 86).

H. T. GUSSOW: Plant disease legislation as viewed by a scientific officer of an importing country (p. 96).

A. GIBSON: Remarks on plant disease legislation in Canada (p. 107).

L. REH: Die Verschleppung von Insekten und Einfuhrverbote (p. 110).

Discussion (p. 113).

J. C. KIELSTRA: Remarks on the economical questions connected with plant disease legislation (p. 113).

Owing to lack of time the demonstration of the control of American gooseberry-mildew with alcaline Burgundy mixture, control of smut and stripe disease in cereals with germisan etc., control of cabbage-maggot with tarred paper cards, and various other experiments, to be demonstrated by members of the staff of the Phytopathological Service, had to be omitted; see however p. 116 – 124.

Demonstration of the furrowing wheel, devised for destroying leather jackets, by M. W. POLAK (p. 125).

2.— p.m. Meeting in the Great Hall.

I. BERNATSKY: Forschungsfehler und Misbräuche bei der Begutachtung von Bekämpfungsmitteln (p. 126).

O. APPEL: Der Pflanzenschutz im Unterricht (p. 135).

Now there was an opportunity to visit the Seed Testing Station, the Experiment-Station for cattle food etc., the Laboratories for Plant-Physiology and for Microbiology, the Arboretrum etc.

During the meetings there was in the Great Hall a permanent exhibition of diseases and insect pests of cultivated plants of Holland by the Phytopathological Service and the Seed Testing Station, and of photographs and drawings of noxious insects from the Dutch East Indies by W. ROEPKE. See p. 135.

Wednesday June 27 and Thursday June 28:

TRIPS THROUGH THE COUNTRY

SUBDIVISION FOR AGRICULTURE

(*Trip to Groningen and Oostwold* (p. 136—149)

Wednesday June 27:

8.35 a.m. Departure from Wageningen for Groningen (via Arnhem)
1.22 p.m. Arrival at Groningen. Lunch at Groningen.
2.— p.m. Visit to the Agricultural Experiment Station (Division for sand and peat soils).
Address of Mr. HUDIG, member of the committee, on diseases of crops on alcaline and sour soils (p. 136).
Demonstration of experiments.
6.— p.m. Dinner at Groningen.

Thursday June 28:

7.34 a.m. Departure for Oostwold.
9.30 a.m. Arrival at Oostwold.
Visit to potato selection fields and farm of Dr. OORTWIJN BOTJES; short address of Dr. O. B. on his experiments (p. 142); id. of I. WHITEHEAD (p. 147).
3.— p.m. Departure for Groningen.
4.35 p.m. Railway journey Groningen—Leeuwarden (Friesland) —Zuiderzee to Amsterdam.
7.— p.m. Dinner on the steamer between Stavoren and Enkhuizen on the Zuiderzee.
9.31 p.m. Arrival at Amsterdam.

Friday June 29:

9.19 a.m. Departure for Baarn.
9.57 a.m. Arrival at Baarn.

SUBDIVISION FOR HORTICULTURE

Trip to Boskoop, Aalsmeer, Haarlem (bulb-district) and Broek op Langendijk (p. 149—164).

Wednesday June 27:

7.15 a.m. Departure from Wageningen for Gouda.
9.33 a.m. Arrival at Gouda.

9.45 a.m. Departure for Boskoop by motor-boat.
10.45 a.m. Arrival at Boskoop.
Visit to several nurseries of ornamental-stock, evergreens, flowers, etc.

12.30 p.m. Luncheon, at the kind invitation of the Town Council of Boskoop.

2.— p.m. Trip to Aalsmeer in motor-boats.
Arrival at Aalsmeer about 3.45.
Visit to nurseries as above.
6.15 p.m. Departure by railway for Amsterdam.
6.42 p.m. Arrival at Amsterdam.
±7.—p.m. Dinner at Amsterdam.

Thursday June 28:

9.30 a.m. Trip in motor cars from Haarlem to Lisse (arrival 10.15).
Address of Dr. v. SLOGTEREN, member of the Committee, on modern methods of combating bulb diseases. (p. 150).
Visit to some bulb nurseries.

1.30 p.m. Luncheon at Haarlem, at the kind invitation of the Bulb-Growers' Association.

2.30 p.m. Departure in motor cars for Broek op Langendijk (near Alkmaar).
4.— p.m. Arrival at Broek op Langendijk.
Visit to the public auction of potatoes and vegetables, after which to some fields of vegetables and early potatoes; address of Mr. J. G. HAZELOOP, member of the Committee (p. 162).

7.— p.m. Dinner at Alkmaar.
8.59 p.m. Departure for Amsterdam.
10.15 p.m. Arrival at Amsterdam.

Friday June 29:

9.19 a.m. Departure for Baarn.
9.57 a.m. Arrival at Baarn.

Friday June 29:

11.— a.m. Meeting at Baarn in the „Phytopathological Laboratory Willie Commelin Scholten".
Miss J. WESTERDIJK: The „Centraalbureau voor schimmelcultures" (Centralbureau for fungus cultures). (p. 165).

Discussion (p. 169).

Miss J. WESTERDIJK: *Nectria coccinea Pers.* und *Nectria galligena Bresadola* (p. 171).

Miss M. LÖHNIS: On the resistance of the potato-tuber against *Phytophthora* (p. 174).

Discussion (p. 178).

Inspection of the collection of funguscultures. (p. 179).
Light refreshments in the garden of the laboratory.

2.— p.m. H. METCALF: History of plant pathology in America (p. 181).

ET. FOËX (de la part de Mr. CAVADAS): Recherches sur le *Vermicularia varians,* parasite de la pomme de terre. (p. 181).

ET. FOËX: Quelques faits relatifs aux Erisyphacées (p. 184).

Discussion (p. 190).

J. FRANCHINI: Sur les protozoaires des plantes (p. 191).

Discussion (p. 195).

L. MANGIN: Un nouvel ennemi de nos habitations: le *Phellinus cryptarum Karst* (p. 196).

Saturday June 30:

10.— a.m. MLLE MATH. BENSAUDE (on the part of J. BEAUVERIE): The critical period of wheat (p. 199). On the development of wheat rusts in relation to climatic conditions. (p. 201). — (on the part of F. R. JONES): Root rot of peas in the United States (p. 203). Mycorrhizal fungi in the roots of legumes (p. 204).

J. ERIKSSON, European phytopatholigic collaboration (p. 205).

RESOLUTIONS AND DISCUSSIONS (p. 214—225).

12.— a.m. Closing of the Conference.

1.41 p.m. Departure for the Hague (arrival 3.44).

4.30 p.m. Meeting at the Office of the Minister of the Interior and of Agriculture.
Farewell Audience by H. E. THE MINISTER.

6.30 p.m. Dinner at Scheveningen, at the invitation of the Committee. Several ladies honoured it by their presence.

Monday Jule 1:

About 25 members joined in another trip from Scheveningen to the Westland, where several nurseries of vegetables and fruit, grape-, peach-, tomato- and cucumber houses were visited (p. 231).

[It will be seen that the important papers by our Russian colleagues and also some others, mentioned in the programme issued in May, are omitted above, owing to our Russian colleagues and Prof. SCHAFFNITT from Bonn not being able to obtain permission from their 1espective Governments to cross the frontier. The author of another paper had not been able to prepare it in time.

Several of those papers arrived after the closing of the Conference; it was thought desirable to publish these papers with some other ones in the Report, although they were not actually read in the Conference. They will be found on pages 232—288. — Editor.]

REPORT

With only two or three exceptions all members arrived at Wageningen on Sunday June 24. In the evening they all attended the demonstration of the film Holland, kindly provided by the Society „The Netherlands Abroad". Before the production of the film Prof. Dr. J. C. KIELSTRA, Vice-Chancellor of the Agricultural University, delivered an address of welcome to the members in the (temporary) Great Hall of the University. Being an economist, he pointed out the influences of plant-diseases on economical welfare; as an instance he took the calamities, which followed on the outbreak of potato-blight in Europe in 1845. It was however also the cause of the development of phytopathology. He also pointed out the necessity of international co-operation; the task of the phytopathologists, meeting at this Conference, is to prove the possibility of co-operation. He hoped that this Conference would tend to make civilized nations understand that they required each other's assistance for their material and immaterial prosperity.

The President of Honour Dr. L. O. HOWARD responded.

The film, to which the Secretary gave some explanatory words when needed, and which drew much attention, was generally appreciated, as it gave the foreign members a bird's-eye view of Holland and its people.

On Monday June 25 the sessions commenced; all members met in the Great Hall at 9 a.m., where H. E. THE MINISTER OF THE INTERIOR AND OF AGRICULTURE, after having been welcomed and introduced by the President, delivered the following address:

Mesdames, messieurs,

Ce fut avec un véritable plaisir que je prêtai l'oreille à la demande flatteuse, que m'avaient adressée deux membres du Comité d'organisation, savoir un des professeurs de l'Université de Wageningen et un homme de pratique à Boskoop, en m'imposant la tâche honorifique qu'implique le patronage de la présente conférence internationale de pathologie végétale et d'entomologie agricole.

Ce fut avec d'autant plus de plaisir, puisque je suis d'avis que de la collaboration de la science et de la pratique il résulte incontestablement un profit considérable pour l'agriculture et que, en outre, cette collaboration est impérieusement nécessaire pour permettre aux deux sciences-soeurs, représentées à cette conférence, de prêter assistance aux agriculteurs dans les circonstances difficiles qu'ils traversent de nos jours.

Certes, la science en matière agricole a fait au cours du siècle dernier des progrès remarquables. Cependant, quelle qu'en soit l'importance, ils n'ont pas su tenir tête aux ravages croîssants qu'ont causés les parasites nuisibles. L'accroissement des relations commerciales ainsi que l'extension des transports à grande distance ont inévitablement augmenté les risques de contagion; la spécialisation et l'intensitivité des cultures modernes ont favorisé la multiplication des parasites. La main d'oeuvre, étant devenu plus rare et plus coûteuse depuis la guerre mondiale, ne suffit plus, comme autrefois à protéger nos cultures, qui par conséquent se trouvent à la merci d'attaques de plus en plus acharnées, de sorte que, pour ainsi dire, il ne nous reste à récolter que ce que les parasites nous ont laissé.

Les évaluations des pertes qu'ont causées les maladies parasitaires sont de caractère vraiment alarmant. Pour en démontrer la rigueur il n'est point nécessaire de rappeler à la mémoire la maladie de la pomme de terre de 1845, qui a causé la famine en Irlande et a provoqué une émigration en masse; ni d'autres périodes de crise, dont la crise phylloxérique et la dévastation de forêts par des chenilles sont les plus connues. Nous n'avons qu'a constater que les pertes annuelles, causées par la rouille des céréales s'évaluent à $ 250.000.000 et que le montant des pertes pour ce qui concerne les pommes de terre et les fruits approche d'assez prêt le même chiffre, tandis que les différentes maladies de la vigne causent à la récolte mondiale des vins de formidables pertes par an, montant à une somme de $ 2.500.000.000.

De nouveaux fléaux sont pénétrés en Europe. Le Sphaerothèque des grosseillers, transplanté primitivement de l'Amérique en Angleterre, a envahi la région septentrionale entière, savoir la Scandinavie, la Russie et l'Allemagne, et a poursuivi son chemin jusqu'en France et aux Pays-Bas. Le Doryphore de la pomme de terre vient de s'établir en France. La continuation de tout celà, où nous mènera-t-elle?

Tout de même, il me semble que le soleil commence à percer les nuages. Vrai, les forces humaines sont bien faibles en comparaison de la multiplication prodigieuse des parasites. Cependant, quelle qu'en soit la faiblesse, l'oeuvre humaine, guidée de l'espoir et de la confiance, a réussi à trouver quelquefois des moyens prophylactiques d'une efficacité remarquable. Je n'ai qu'à mentionner l'action des sels de cuivre et des composés arsénicaux. Grâce à cette collaboration de la pratique et de la science en faveur de laquelle notre maître RITZEMA BOS et ceux qui l'ont suivi ont travaillé avec une si belle ardeur, on a été à même d'ajouter quelques nouvelles acquisitions à l'arsenal du phytopathologiste et de l'entomologiste.

Mais je ne veux pas, Messieurs, en prolongeant mon discours retenir plus longtemps votre désir de nous éclaircir sur les progrès que ces deux sciences ont pu enregistrer grâce à vos illustres travaux. Permettez-moi de terminer en exprimant trois voeux. Que votre conférence parvienne à mieux organiser ainsi qu'a combiner les forces humaines dans leur lutte contre les parasites nuisibles aux plantes cultivées. Que vos travaux ouvrent des horizons nouveaux aux deux science-soeurs, réunies à cette conférence. Et puis, si ces conférences portent des fruits et vont être reprises, que le souvenir que vous emporterez d'ici, contribue à vous faire revenir aux Pays-Bas.

Before reading his paper on potato-diseases, Prof. QUANJER said a few words about

THE NEW LABORATORY

Professor HUGO DE VRIES to whom on this occasion honour may be rendered, and whose statue adorns the new laboratory, told his students twenty-five years ago that in spite of the fact that the „sereh-disease" of the sugar cane had been ascribed to a multitude of bacteria, fungi and nematodes, its actual cause at that time was obscure. „However this may be", he continued „scientific research requires evidence from infection-experiments and the first essential for such experiments is a supply of healthy plants. This disease however is spread about in the island of Java to such an extent that it is almost impossible to secure disease-free plants."

What Prof. DE VRIES has said of the sugar cane disease, the cause of which to-day is still as obscure as it was twenty-five years ago, holds good for a number of plant diseases. Even when the cause of some disease has been discovered our ignorance frequently surpasses our small amount of knowledge when we wish to help the practical man in getting a healthy crop. One of the reasons for this annoying state of things is that most plant pathologists include in their range of interests all the diseases of all the plants known to them. The number of plant disease inducing organisms is so enormous, that it has consumed the time and energy of most of our workers to catalogue them and to study the life history of a few of them. Though the relations between the parasite and the plant appear to be simpler than between the parasite and the animal, yet it must be admitted that the science of plant pathology is far behind that of animal pathology in understanding relations of this kind. In human and animal pathology the life of the patient is of pre-eminent value; attention is focussed on the means of protecting and restoring health. Experience has convinced me that we cannot understand the diseases of a cultivated plant, like the sugar cane and the potato, nor lessen their ravages, unless we study the host as well as the parasite. Full credit must be given to the entomologists, mycologists and bacteriologists, who thus far have occupied a leading place in this science; we have learned from them the method of pure culture which is of fundamental value for our study. An immense amount of work on parasites is still required; and for a great number of them our present microscopes and laboratory methods have failed to elucidate their nature; we only are convinced of their existence by the behaviour of sick and healthy plants. The future of plant pathology lies for a great deal in a comparative study of the healthy and the diseased plant. We shall have to learn a great deal more of plant physiology and of the technique of securing and propagating pure cultures of the host.

In the conviction that a deeper insight in crop hygiene can be attained only by a study of the host as well as of the parasite, I tried ten years ago to convince authorities of the necessity of greenhouses and other equipment for plant cultivation in connection with plant pathology. But I was far from successful in being understood until bye and bye it became clear to me that success in getting the equipment would depend upon success in improving agricultural practice through scientific methods. Since no crop gives more evidence of being open to improvement as a consequence of modern research than the potato, the name „Potato research laboratory" exerted a magic influence in this respect. This you will directly see from the new building properly fitted for the purpose of studying potato diseases, and set amidst grounds and greenhouses. I bring a warm word of thanks to the respected Board of Curators, the Director of Agriculture and his Excellency the Minister for having granted the necessary funds, and may offer this expression of thanks also to my colleague Prof. VISSER who secured the grounds and to the able architect Mr. v. HOUTEN who, together with his assistent FRESEN, constructed the building.

GENERAL REMARKS ON POTATO DISEASES OF THE CURL TYPE

BY

H. M. QUANJER [1])

(Plates I—IV)

Coming now to the potato diseases of the curl group the following points must be emphasized.

1. The terms „curl" „Kräuselkrankheit" and „dwarf" of earlier authors have been used for designating the diseases, which at the present time are known as leaf roll, crinkle, stipple streak and different kinds of mosaic.
2. What passes for degeneration of potatoes is nothing more than one or other of the diseases of this group.
3. Experimental work must be based on separation and breeding of pure lines of each of these diseases and — on breeding disease free potato plants for infection.
4. The first method by which it was proved that infection takes place in these diseases was the same as has been already used in the infectious chlorosis of the Malvaceae; namely bringing about a physiological union between the diseased and the healthy plant by grafting.
5. In many cases identifying can only be done by intervarietal grafting.
6. It has been proved that aphids play a role in the transmission of these various diseases.
7. Since, generally, primary symptoms are faint, infection experiments must, as a rule, be extended over two years. The results should be watched in the progeny of infected plants, and these results can only be accepted when insects have not touched the plants and tubers. On account of expenditure and technical difficulties the experiments with aphids have not proceeded as far as the grafting experiments.
8. Since infections thus far could be brought about either by grafting, whe.e the phloem joins first, or by aphids, inserting their probosces into the sieve strands, and since efforts to transmit these diseases by mechanical infection of juice or by insects with courser mouth parts have led to doubtful results, it is believed, that the causative organisms are conveyed in the sieve tubes. This view is supported by the fact that the

[1]) For titles etc. see list of members.

symptoms always appear first in just those parts to which the elaborated food is directed.

9. The supposed protozoan organisms seen by RAY NELSON in the sieve tubes of mosaic plants cannot be the cause of the diseases of this group, whose aetiology will continue to be a subject of discussion until successful and convincing inoculation experiments with pure cultures of such, or other possible organisms, have established their relation to any of these diseases in each case.
10. That overwintering of the causative organisms takes place in the soil is improbable. What has been considered as overwintering in the soil seems to be nothing else but overwintering in tubers which have not been killed by frost.
11. Most, if not all, of the diseases of this group occur in every country where potato culture exists. With decreasing latitude and altitude and in the neighbourhood of the winter quarters of disease carrying aphids they appear to greater extent.
12. Potato diseases of this group are controlled in Holland by seed selection and by the separate planting and multiplying of healthy plants from the best fields. It is due to the instigation given by a cooperative system of field inspection, that the selection of disease free potato strains has become a common practice in several parts of Holland, especially in the neighbourhood of the sea, where aphids are less prevalent.

THE DIFFERENT DISEASES OF THIS TYPE

The inspection of the plants and experiments in the laboratory grounds will enable all of us better to recognise these diseases, and thereby produce a closer mutual understanding, which may not only be stimulating, but may actually avoid waste of labour.

EXPLANATION OF THE FIGURES

LEAF-ROLL. Pl. I, Fig. 1 and 2.

Leaves of upper part of potato plant with primary leafroll. Note upright habit of stalks, funnel shape of leaflets, nearly complete absence of undulation of margins, change of colour at basal part and necrotic stipples at upper part of leaflets. In its secondary form leafroll shows commonly on the lower portion of plants. True leaf-roll is always, and in all varieties, characterized by prohibition of starch transportation from the leaves downward and by phloem-necrosis. Net-necrosis in tubers is not found in Holland. Sprouts may or may not be weaker than sprouts of healthy plants. Aphid transmission proved in 1919/1920 by Dr. OORTWIJN BOTJES in Holland and in 1920 in United States. Tomato, Tobacco, Atropa Belladonna, Datura Stramonium, Hyoscyamus niger, Solanum nigrum and S. dulcamara when infected by grafting or by means of aphids carry the disease without showing it, as may be concluded from the fact, that it is transmitted back by grafting potato vines with tops of such infection carriers.

MARGINAL LEAF-ROLL. Pl. I, Fig. 3.

The margins only of leaflets are shortly curled upwards, often more in the upper part than in the lower portion of the plant. Leaflets do not take the upright habit. Transport of starch only prohibited in margins. No phloem necrosis in midribs, petioles and stems. Experimental work with grafting and aphids is in progress. Identity with FERNOW's marginal leaf-roll can only be decided by intervarietal grafting.

INTERVEINAL MOSAIC. Pl. I, Fig. 4 (= Duke of York mosaic).

Pale patches chiefly between veins; the leaf tissues directly in contact with the veins remaining green. Margins of leaflets often a little undulated and turned upwards. Transportation of starch not seriously prohibited; no phloem necrosis. Transmission by grafting has been accomplished to other potato varieties, to tomato, tobacco and Solanum nigrum, all of which show same symptoms.

AUCUBA MOSAIC. Pl. I, Fig. 5 of potato, Fig. 6 of tomato.

Yellow patches more or less round, more in upper part of leaflets than in lower part. No undulation or curling, no notable prohibition of starch-convey, no phloem-necrosis. This disease is less serious than the other ones. In extreme cases half of the surface of the leaf is lacking chlorophyl. [1]) Transmission by grafting has been accomplished to several potato varieties; to tomato, Solanum nigrum, S. dulcamara, all of which showed the same symptoms; also to tobacco, Atropa Belladonna, Datura stramonium and Hyoscyamus niger, which did not show them (perhaps as a consequence of slow development) but carried the disease back to potato, when grafted back.

COMMON MOSAIC. Pl. II, Fig. 7.

Axillary shoot of potato plant, infected by grafting mosaic tomato top which previously had been infected by grafting with potato-mosaic. Pale patches, fainter than in the two foregoing diseases and irregularly spread over surface of leaflets. In hot dry summers the mosaic is little distinguishable, only the somewhat crinkled and glistening leaflets giving proof of their diseased condition. [2])

Second growth after rainy weather does show the mottled appearance

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1) This disease is infectious and not identical with the true or non-infectious periclinal variegation. In the last case a white band occupies a variable area along the margin, the normal green being limited to the centre, usually surrounding the midribs and separated locally from the whitish area by a lighter hazy green. Whether HUNGERFORD's „calico" is infectious Aucuba mosaic or non infectious periclinal variegation is not clear from his description (1922).

2) The crinkling of plants with whitening of the margins of leaflets seen at Long Island in 1919 and confused by many participants of the conference with mosaic, was the common symptom of poisoning by calcium cyanamid applied previous to planting.

again. Aphid transmission proved in 1919 in United States and in 1919/1920 in Holland. Disease has been transmitted by grafting to tomato and back (Fig. 8 mosaic tomato leaflet). Grafting experiments on tobacco have often been made, but only exceptionally transmission took place. In the variety Zeeland Blue, which is very susceptible, the margins near the top of the diseased leaflets are more or less necrotic. Comparing fig. 9, which shows the undulated appearance and necrotic edges with fig. 10, which is a copy of one of SCHACHT's coloured figures of potato-curl (1856) one is led to believe that at least some of SCHACHT's „Kraüselkrankheit" is identical with the present mosaic.

CRINKLE, Pl. III.

Fig. 11. Crinkle in leaf of upper part of plant. Leaflets with marked corrugations; margins and tips curled downwards.

Fig. 12. Lower leaves with fine dark stipples, yellowing and dropping off prematurely. Veins on lower side of leaves here and there brown with fine stripes sometimes on stems.

MURPHY (1919) was the first to use the name crinkle, which name, in agreement with him, was used by the author at the international potato conference London (1921) [1])

Aphid transmission experiments are under way. Transmission by grafting on different potato varieties and on tomato, Solanum nigrum, Datura Stramonium, Atropa Belladonna and Hyoscyamus niger has been accomplished; the symptoms in these plants resemble those in potato.

Fig. 13. Potash hunger, may be confounded with crinkle, as regards curling downwards of margins, but no corrugation takes place as in the case of crinkle.

Fig. 14. Crinkle showing dark points before leaflets turn yellow. Also very fine brown stripes on petioles are present. No phloem necrosis, but necrosis of collenchyma and cortical parenchyma in these stripes.

Fig. 15. Crinkle transmitted to tomato by grafting.

STIPPLE-STREAK. Pl. IV.

Fig. 16. Secondary form. Leaves spotted and hanging down.

Fig. 17. Heavy case of primary infection.

Fig. 18. First symptoms of primary infection on leaves. Stipples bigger than in case of crinkle and angular by joining the veins. From attacked leaves long brown streaks extend downwards. Diseased leaves dry up and often remain hanging on the stem. In sections of stems are seen rusty specks in pith and cortex.

Fig. 19. Tuber of early variety. (Victory or Midlothian Early) showing necrotic tissue around the eyes. In some varieties necrotic tissue cracks. Rusty specks in outer pith and cortex of tubers may be present in some varieties. Eyes do not always develop sprouts. Apparently healthy eyes develop the second year stunted sprouts with marked streak.

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[1]) KRANZ and BISBY have confused crinkle with mosaic (1921). The same has been done by JOHNSON (1922). BLODGETT's „Yellow dwarf" seen at Long Island (1919) and afterwards described by BARRUS and CHUPP (1922) seems to be a combination of crinkle and stipple-streak. HUNGERFORD's „Russet dwarf" (1922) seems to be crinkle combined with leafdrop-streak. Decision depends on separation into pure lines and intervarietal grafting.

Lower leaves drop off early and the plant takes on a palm tree like form. Such plants die prematurely and produce only very small tubers, usually incapable of further development.

This disease is identical with W. A. ORTON's „streak". ATANASOFF (1921, 1922) has proved that this disease can be transmitted by grafting and aphids to other potato plants. Necrosis takes place in parenchyma and collenchyma and seems often to extend from phloem-strands; Phloem necrosis though not absent, is not continuous as in the case of leafroll.

LEAF-DROP STREAK.

Probably more than seven diseases of this type may be detected. One of these seems to be „leaf drop streak".

Not yet pictured. Streaks on leaf petioles and stem shorter and broader than in the case of stipple-streak. Very marked dropping of leaves. May be identical with MURPHY's leaf-drop (1920). Experimental work in progress.

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OPENING-ADDRESS TO INAUGURATE THE LABORATORY FOR MYCOLOGY AND POTATO-RESEARCH

BY

JONKHEER S. VAN CITTERS

Excellency, Ladies and Gentlemen,

This is a glorious day for Prof. QUANJER, to see his new laboratory coming into use at the time that this distinguished conference meets in Holland and that this laboratory is the first scientific institution to be honoured by its visit.

I may begin to offer to Prof. QUANJER my most sincere and cordial congratulations and express the hope that this new laboratory may prove to be a valuable expedient to his interesting and highly appreciated scientific work.

Why has this laboratory been built?

In those European countries where a phytopathological service has been introduced, as for instance in Italy and Holland, this service has been connected hitherto with existing institutions. The original and natural task of these institutions, that is investigation and experimentation, has been seriously hindred by this arrangement.

Some five years ago, when the Wageningen-school of Agriculture became an Agricultural University, this abnormal condition was remedied and the Dutch Phytopathological Service was made independent. But the Phytopathological Institution soon proved to be poorly equipped.

It was also badly understaffed, as most of our plant-pathologists had been called up for the service department.

The only two eminent men, who remained, were Prof. RITZEMA BOS, now retired, and Prof. QUANJER, who, having specialized in the study of the potato, did not wish to abandon his own subject. This would have been necessary, in part at least, had he been obliged to organize and to manage a big Institute for plant-pathology and economic entomology.

The Board of Trustees doubted at first, whether it would be right to grant funds for so specialized a part of a science. But the invitations extended to Prof. QUANJER by the American plant-pathologists and by the Government of France and England, and the International Conference of London, together with the wish frequently expressed in Holland, for more research in this field, showed that this subject of potato-diseases was not so limited as had been thought.

And now that we see the work in progress, we realise that interesting studies are being made by Prof. QUANJER and his staff of workers, concerning not only the diseases of potatoes, but also the diseases of wheat, cherries and lilacs.

However interesting these studies may be, on the other hand we must remember to keep Prof. QUANJER'S own standpoint in view: „better everything of something, than something of everything".

For efficiency is the watch word of our times, and we must impress it on the minds of those young and enthusiastic workers, who in their efforts to gain all may risk losing all: „Grasp all, lose all".

What is true of individual workers is much more so of the various countries. Let each local station devote itself chiefly to the study and solution of the problems connected with the main crops of this particular country.

The northern to northern field and fruit crops, the southern to subtropical and semi-tropical plants as grapes, oranges and olives. Then let us meet together in the spirit of friendly intercourse and mutual understanding, as at this conference, and all will profit by the experience of each. This division of labour will yield the best and most efficient results for all.

We hope the workers in this new building will continue to pursue their duties with ever increasing devotion and enthusiasm, and we trust that this laboratory may influence for good the students of our university. May they learn to interrogate nature, may they learn that the answer they receive, will depend upon their powers of concentration and observation in conjunction with the skillful use of modern instruments. So they will enter life better equipped and more able to help forward the cause of agriculture and horticulture.

I wish in conclusion to express a hearty word of thanks to Prof. VISSER, Director of the Institute of Farm Machinery and Architecture, for his help in the purchase of the grounds, and to Mr. VAN HOUTEN for the fine and fit construction of the laboratory.

The company was now divided into eight groups, each composed of people understanding the same language, under a guide; each group made separately a tour through the building and along the experimental plots; an account of the demonstrations presented is here inserted.

DEMONSTRATIONS IN THE LABORATORY

KENNETH M. SMITH: *Some peculiar pathological conditions in the leaves of potatoes affected with mosaic disease.*

This demonstration consisted of a series of microtome sections of mosaic potato leaves — the sections being cut through the pale yellow areas of the diseased leaves — which were fixed and stained by different methods. The first slide showed the presence of some peculiar vacuolated bodies in the cells of the leaf. These bodies were in close connection with the cell nucleus and in some cases were apparently attached to it. They were somewhat „amoeboid" in shape with a definite wall and usually contained two or more sharply defined vacuoles. In these vacuoles there appeared to be a small central granule. The bodies were only found in mosaic tissue and appear to be confined to the yellow areas.

The second slide was a similar preparation but fixed and stained in a different manner; this showed the same pathological conditions as the first. The third slide was a section through a healthy potato leaf and acted as a control to the first two.

The next demonstration was a flat tangential section of a portion of a mosaic potato leaf, this showed the apparent extrusion of the nucleolus from the nucleus, all stages in the passage of the nucleolus to the exterior being visible.

The last slide was a section through a mosaic infected potato leaf with an aphis *Myzus persicae* in situ showing the passage of the insect's proboscis down into the phloem of the leaf.

These peculiar pathological conditions, so briefly mentioned, were set forth for the criticism and opinion of the Conference and no statement was made as to their nature.

HELENA L. G. DE BRUYN: *Oospores of Phytophthora infestans (Mont.) de By.*

To the list of artificial media in which oospores of *Phytophthora infestans* are produced some new ones can be added. Oospores have been found by the writer in corn meal agar (made of ground maize kernels) and in oat extract agar in which medium they were not observed by PETHYBRIDGE. The writer has seen them also in cultures on raw potato pieces as was already demonstrated by PETHYBRIDGE at the International Potato Conference in London. One oospore was discovered in sterilized bog-soil covering a pure culture on raw potato, while other oospores were also seen in pure cultures on soil but always disattached from the mycelium, so that no absolute certainty could be obtained that they belonged to *Phytophthora infestans*. The probability that oospores are formed in soil under natural conditions is however materially strengthened by the finding of one oospore in a pure culture on soil.

In relation to the saprophytic life of *Phytophthora infestans* on soil, it is of importance to mention the fact that sterilized manure proved to be an excellent medium for this fungus.

JIKKE H. H. VAN DER MEER: *Verticillium-wilt.*

This disease, a tracheomycosis caused by *Verticillium* spp., has been described on a large variety of plants in the northern zones of Europe and America. In Holland the following plants are attacked by this disease:

Beta vulgaris L.
Aconitum Napellus L.
Papaver Rhoeas L.
Eschscholtzia californica Cham.
Ampelopsis Veitchii Ht.
Ribes rubrum L.
Prunus acida Ehrh. (Meikers).
Cherry-varieties: Bieskers, Eysdensche kers, Spaansche kers.
Prunus austera Ehrh. (Morel).
Prunus Mahaleb L.
Lupinus polyphyllus Lindl.
Phlox decussata Lyon.
Solanum tuberosum L.
Solanum Lycopersicum L.
Syringa vulgaris L.
Cucumis Melo L.
Cucumis sativus L.
Dahlia variabilis Desf.

The isolated *Verticillium* spp. show morphologic differences, so that they can be divided into two groups:

a. Verticillium from potato, cucumber, tomato and cherry, agreeing with *Verticillium albo-atrum* Rke & Berth..

b. Verticillium from Aconitum, Lupinus, Phlox, Papaver, Eschscholtzia, Dahlia, Ribes, Prunus Mahaleb, lilac, morello and potato, apparently identical with *Verticillium Dahliae* Klebahn.

Stem-inoculation with both types of fungi caused wilting of Phlox, Lupinus, Aconitum, potato, tomato and cherry. The two first named plants did not show much difference when attacked by group A or B, whereas cucumber wilted only with type A.

Verticillium (A and B) grows saprophytically on sterilized sand, clay and leafmould. Such cultures were set outside during the winter of 1921—1922, when it was freezing during 26 periods of 24 hours and 22 nights. The minimum temperature of —12° C. was reached twice. Those cultures when transferred in May 1922 to cherry-agar developed a white mycelium of the same *Verticillium* spp. after two days. Stem-inoculations with these fungi caused wilting of different plants.

Verticillium-wilt of cherry.

The first symptoms, a yellowing and dropping of the leaves at the bases of branches are seen in July and August. Often only one side of the tree is attacked. The wood of stem, branches and roots shows a characteristic brown-colouring and contains *Verticillium* in the vessels. In some orchards *Verticillium*-wilt was also found among potatoes growing under the cherrytrees.

Stem-, root- and soil-inoculations with *Verticillium* isolated from cherry and potato (type A) caused wilting of one year old cherries. The wilt of potatoes may be a source of infection for the cherries.

D. ATANASOFF: *Stipple-streak disease of potato.*

Writer's investigations on the stipple-streak disease of potato since the publication of his first work [1]) on same disease have shown that it can be transmitted in a small number of cases by means of sap infections, but it has not been possible so far to establish what conditions favour this as in most cases the sap-infections give negative results.

It has been further established that aphids when fed on sprouted diseased tubers for several days, then transferred to healthy sprouted tubers, will transmit the disease to the latter, which becomes visible on them within one month, if only kept at a temperature of 15—20° C. Such tubers upon planting give rise in all cases to secondary stipple-streak plants.

D. ATANASOFF: *The Fusarium disease of cereals.*

The cereal crops and some of the grasses, as is well known, are attacked in various ways by a large number of *Fusarium* spp. which, under certain conditions and in some seasons, may completely ruin the crop. So far the various forms in which one and the same *Fusarium* species may attack these plants have been generally considered as different and independent diseases; this is especially true of Europe, where this disease is little understood. Writer's studies on this disease made in the United States and various east and west European countries have shown that the various *Fusarium* diseases of the cereal crops known under the names: seedling blight, snow mould, foot rot, head blight, etc. represent nothing else than different forms of one and the same disease and stand in direct or indirect relation to each other.

Though a large number of *Fusarium* spp. have been found to cause these disease, they are not equally important in all countries and under all conditions. In the wheat growing section of the United States, Southern Russia, and Bulgaria *Gibberella saubinetii* is by

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[1]) D. ATANASOFF, Stipple-streak disease of potato. Mededeelingen van de Landbouwhoogeschool te Wageningen. Deel 24, verh. 5 : 1—32. Pl. 5. 1922.

far the most common cause of the disease, while in Northern Russia *Fusarium avenaceum* is the most important pathogene. In Oregon, U. S. A., Holland, Germany and possibly France and the Scandinavian countries *Fusarium culmorum* is the most common cause of the disease.

J. C. DORST: *Resistance of several strains of white flowering flax to Melampsora lini.*

Flax is grown in Holland, in the first place for fibre, in the second place for seed. Two species of flax are grown, viz:

a. Blue flowering or Russian flax.

b. White flowering or Frisian flax.

White flowering flax is grown especially in the North of Holland, it is a population of many biotypes.

In 1920 I selected 125 plants with the following characteristics:

a. good length,

b. little or no branching, such branching as there is being only quite near to the top.

c. good colour without any spots on the stems, leaves or fruits. These plants were increased separately.

In 1921 many differences appeared among the strains. There was also a great difference in the degree in which the attacks of *Melampsora Lini* (flax-rust or firing) took place.

In a field that was suffering severely from this disease in that same year, I selected 10 plants that had remained exempt. In the year following, the progeny of three of these plants also proved to be exempt from attack, the others being more or less infected with the disease. The progeny of plants that had been subject to rust spots, and which had grown under the same conditions, were, generally speaking, subject to severe attacks.

When flax is attacked by *Melampsora Lini,* it shows, in the later stages of its growth, black incrustations on the stem, leaves and fruits. That black incrustation is also found on the fibre after retting and scutching, while at those places the fibre is week. *Melampsora Lini* has an extremely diminishing effect upon the quality of the fibre and it is a matter of great importance to be able to cultivate a strain that is resistant or immune to this disease.

The results of the experience mentioned make it probable that it will be quite possible to cultivate such strains that will also possess the required good characteristics.

JACOB ERIKSSON: *Das Mykoplasma-stadium von Phythopthora infestans.*

ERIKSSON demonstrierte mikroskopisch eine Zahl cytologischer

Präparate über die Entstehung und die Entwickelung von *Phytophthora infestans* in den auf den Kartoffeldern gewöhnlich Anfang oder Mitte August hervortretenden *primären* — d.h. den aus dem Mykoplasma-stadium des Pilzes direkt entstandenen — Krankheitsflecken auf den Kartoffelblättern, wie die genannten Phasen in „Arkiv för Botanik", Bd 14, No. 20 (Stockholm, 1916) und in „Revue Générale de Botanique", T. 29—30 (Paris, 1917—'18) ausführlich beschrieben worden sind. Besonders wurden die in dem meistenteils zerstörten, periferischen Blattgewebe dieser primären Flecken vorhandenen Oosporen, ihre Keimung und das Austreten ihrer Keimschläuche durch die Spaltoffnungen des Blattes zur Bildung des *primären* Luftmycels vorgezeigt.

S. J. WELLENSIEK: *Premature tuber-formation in early-potato-varieties.*

Under certain conditions the tubers of early-potato-varieties fail to come up above the ground and frequently form some small tubers. This phenomenon appeared in such a large extent in the early potato growing districts of Holland during the years 1915, '17, '19 and '22 that in some cases the loss amounted to 100 $^0/_0$. It has been observed also in England, France, Germany, and perhaps in the Bermuda-islands.

No organisms are connected with this condition and it can be brought about by a combination of anorganic factors.

In connection with this phenomenon the effect of temperature during the period of storage and after the planting on the variety „Schotsche Muis" (Midlothian Early) has been studied.

Storing of the tubers at 9° or at 13° C. leads to a very rapid sprouting. The first sprouts, according to the general practice, are taken off, as they are formed at a time long before the time of planting. This taking away of the sprouts is done several times and seems to lead to a condition in which the tubers, when planted, form prematurely new tubers without further growth.

Tubers stored at 1,5° or at 5° C. never form premature tubers.

Low temperatures after the planting (3°, 6°, 9° C.) favour the premature tuber-formation, if only the tubers have acquired the predisposition for it. Tubers that are apt to form premature tubers, may develop normally, when growing at 15° C. Intermediate forms are found at 12° C.

Premature tubers were formed only on seed-tubers planted with sprouts, as is the common practice in the early potato culture in Holland.

In the fields premature tuber-formation apparently occurs when the weather has been dry during the later part of the vegetative period, which leads to an early ripening of the tubers, which in turn favours early sprouting and results into a great loss of materials.

This phenomenon can be prevented if the fields are kept sufficiently moist during the later part of the growing period and also by storing the tubers at temperatures as low as possible up to 0° C., if possible in the light, and by not too early planting.

D. L. ELZE: *Insect-transmission of „curl" diseases of potato.*

The work in progress consists in:

1. The identification of the insects feeding on potatoes.
2. Infection experiments with these insects as carriers of disease.
3. Biology of disease-transmitting insects.

1. The most common insects feeding on potato plants are *Psylliodes affinis* (potato-fleabeetle) only in the neigbourhood of bushes; the aphids *Myzoides persicae Sulz., Macrosiphum solanifolii Ashm., Myzus pseudosolani Theob.* and *Aphis solanina Pass.*, the Cicadine *Eupterix aurata* and some plant bugs. *Aphis rumicis* L. is rarely seen on potato.

2. Experiments to test the ability of the commonest of the insects listed above to carry leaf-roll and other virus diseases are in progress Since evidence has been given originally in America by SCHULZ and FOLSOM and in Holland by OORTWIJN BOTJES and QUANJER, of the role played by aphids as disease carriers, a great deal of attention has been paid to this group of insects as concerns the question whether there is an exclusive specific relationship between aphids and the actual cause of leaf-roll, mosaic and related diseases, which is presumably an organism. Whether other carriers, not belonging to the family of Aphids must be concerned in the matter is another part of the problem studied.

3. In connection with their biology the mode of hibernation, the influence of the host and other environmental factors on the growth and propagation of aphids are being studied.

After the examination of the laboratory etc. the members united again at lunch, offered in the potato-cellar of the laboratory, which was gaily decorated with the colours of the nations participating in the Conference. The Wageningen girl-students, who under supervision of MRS. QUANJER had prepared the unpretentious lunch, charmingly acted as waitresses.

At 2 p.m. the session was continued in the Great Hall; the Chairman Prof. QUANJER called on Dr. HOWARD to read his paper on international collaboration.

INTERNATIONAL COOPERATION IN COMBATING PLANT DISEASES AND INSECT PESTS

BY

L. O. HOWARD

Let me first of all express my deep appreciation of the honor of the office of Honorary President of this conference. I attribute this action on the part of the organizers of the conference as a compliment to the whole body of active workers in economic entomology and phytopathology in the United States where, from the great necessity for relief from the tremendous ravages of injurious insects and plant diseases, extended investigations by an army of trained workers have been thought to be of the greatest importance.

The international aspect of the situation is so apparent as to need few words. Plant diseases and insect pests are no longer confined to the countries or regions of their origin. The necessities of the human race have resulted in an enormous extension of agriculture. Valuable food crops, by the help of artificial selection and plant breeding, have been made to grow successfully around the world and far to the north and south. Their original home pests have spread with them, and with these natural selection has almost kept pace with the artificial selection exercised by man and they have flourished practically wherever their host plants have flourished. Moreover, in many of the new regions the crop disease or the insect enemy has found itself existing under greatly more favorable conditions and has increased beyond all precedent. In addition, in the new regions into which crop plants have been introduced, native species take to the new importations and become pests of the first importance.

Most of these difficulties have arisen through international commerce, and the problems arising have become international ones. In the past twenty-five years international exchanges of pests have greatly increased, owing to increased commerce and increased rapidity of carriage. As a result, during this recent period international quarantines have been established, to the disturbance of some branches of commerce, a disturbance which necessitates re-adjustments often of a serious nature. No one can deny, however, the broad statement that quarantines of this character are necessary and that in the long run they will work to the ultimate benefit of all interests concerned. All nations should protect themselves from introductions of this character just as they try to protect themselves from the introduction of the bubonic plague or Asiatic cholera.

Allow me at this time to congratulate the organizers of the present conference upon the fact that they have made it a joint conference of phytopathologists and economic entomologists. This designation is particularly gratifying to the economic entomologists of the United States of America, since in that country they began their studies of a practical nature at a comparatively early date and have been able to build up a great public service which ramifies in many directions and all under the title economic entomology. This branch of applied science as developed in America includes not only agricultural entomology but medical entomology and the whole field of the damage done by insects to scores of the manifold important interests of the human species. It will readily be seen that, having brought the whole subject together in this way and under this title, having built up a comprehensive and at the same time concrete branch of applied science, we are inclined to deprecate the removal of agricultural entomology and the classification of this perhaps the preponderating aspect of our work under the title phytopathology. Yet it has been so classified and so administered by one or more of the European governments, and it is so classified and so administered by the International Institute of Agriculture which has its seat at Rome. It seems to us in America that, since training for the two fields requires such different methods, and since the technique involved in the investigations in the two fields is so different, it is unwise to class them together in the same general category.

It is perfectly true that the necessity for co-operation between the two groups of workers is becoming more and more apparent, especially when we consider that class of plant diseases which is carried by insects either as occasional or accidental factors or as the principal ones. Here plainly the control of the disease depends to a large extent on the control of the insect factor, and both groups of workers should coöperate to the fullest extent.

The recent announcement of the discovery of a protozoal organism as the possible or probable cause of one of the so-called mosaic diseases of plants and the possibility that this organism may have a necessary secondary host makes co-operation absolutely necessary. We have our plant pathologists and our animal pathologists (at least so far as the Mammalian series goes), and we must now have our insect pathologists.

These facts are the justification for the calling together in this international conference of both phytopathologists and agricultural entomologists. If we were to attempt to coin a group phrase which would include both the maladies of plants and the animals that destroy plants, we should choose some other name than phytopathology, since pathology implies disease alone.

The proceedings of this conference have been carefully planned, but it is practically an initial international conference, and as it is called as a joint conference, it is plain that it is called to consider matters of joint interest and importance. I conceive, however, that in future conferences it will be desirable, in bringing together these two groups of workers, to go further and to arrange for general sessions in which matters of co-operation or of joint interest shall be considered, and then, in addition, to hold distinct sessions of the phytopathologists and of the economic entomologists.

The entomologists, speaking in a general way, began to hold their international congresses before the great war. One was held in Brussels during the Brussels exposition, and a later one was held at Oxford in 1912. In the second congress there was a section devoted to economic entomology, but economic entomology is so important and now so numerously represented among scientific workers over the world that it should hold its own international conferences, and these could be held very happily and very appropriately in connection with the phytopathologists. I think we can hardly do better than to perpetuate the idea of the organizers of this conference and to entitle other international conferences which may be called in future years, congresses or conferences of phytopathologists and economic entomologists. Let us hope that a second conference of this kind, and under this designation, will be held before many years have passed.

POTATO LEAF-ROLL INFLUENCED BY THE ORIGIN OF THE TUBERS

BY

E. GRAM

I. The degeneration due to continued a-sexual propagation has never been verified, and the deterioration (Abbau) caused by deficient adjustment to extreme environmental conditions is not well segregated. The study of potato leaf-roll has, since it was discovered during a visit by Appel in Denmark in 1905, worked towards a point where the external symptoms, the pathological anatomy, and the physiological anomalities all, by inoculation, can be proved to be caused by a micro-organism.

The symptoms should be taken with some caution. Thus the rolling of the leaves may appear from many other causes; the conservation of the seed tuber may be upset by black-leg (*Bacillus phytophthorus*) or it may occur independently on sandy soils, particularly when the spring is very favourable to the sprouting. The

Phloëmnekrosis has been found constantly by QUANJER in a series of Danish samples of stems from leaf-roll plants, and also in single cases of other anomalities.

The reports on the influence of heavy and light soils on leaf-roll are contradictory. The influence of different fertilizers has not been fully investigated. In a permanent Danish field experiment the potassium used produced a distinct rolling which on examination was not the disease leaf-roll. It is more generally recognized that a cool and moist climate has a marked effect on the frequency of the disease.

II. In a Danish experiment, two separate heaps of Magnum Bonum, S, which was healthy in 1914, and B, which was healthy in 1911 but badly infected in 1914, were distributed to 10—12 different experiment stations and grown there until 1919. During each autumn, samples were sent to Kvistgaard in North-Seeland, where they were grown during the following year, for comparison, of the local influence on leaf-roll and cropping. It appeared that on some stations the diseased potatoes have recovered, on others, the healthy potatoes have been highly infected. The soil was of some importance, peat and sand helping their recovery, but the climate is predominant, and a revision of the local records shows, that with a certainty of 80 percent, a cool and moist May—June will the next year manifest itself by a decreased infection, probably due to the lack of aphids or other agents.

III. Where the leaf-roll is common, it is counteracted by continued import of tubers from healthy parts of the country; when scarce, selection in the field is useful.

SUR LA VISIBILITÉ DES SYMPTOMES DE LA MOSAIQUE DE LA POMME DE TERRE

PAR

V. DUCOMET

D'après la signification du mot *mosaïque,* le diagnostic de la maladie devrait être aisé. Malheureusement, les plages claires ne sont pas toujours faciles à saisir. Avec leur parfaite visibilité, on se trouve en présence de deux facies:

a. *feuilles planes,*

b. *feuilles deformées.*

Les déformations appartiennent elles mêmes à deux types principaux:

1. ondulations des bords du limbe;

2. gaufrures, boursouflures ou crispation de la surface.

Les déformations de la surface sont en relation avec la situation des plages décolorées du debut: régions nerviennes ou parenchyme internervien. Plus les nervures sont largement intéressées, plus le mal progresse rapidement dans les tissus des nervures et leur voisinage et plus la déformation est accusée.

Quel que soit le cas, *la visibilité est conditionnée par l'ambiance.*

L'observation et l'expérience s'accordent pour autoriser cette conclusion.

a. Si l'on envisage l'ensemble du territoire français, on peut dire que l'année 1921 a été sèche, alors que l'année 1922 a été humide. Or, la mosaique a été infiniment plus visible en 1922 qu'en 1921; *la maladie a paru beaucoup plus commune.* L'été 1922 a cependant été très sec dans certaines parties du Sud-ouest; la mosaïque n'a été bien visible qu'à l'arrière-saison, à l'arrivée de la période humide. Mais durant la période sèche, dans les champs arrosés ou simplement humides, la *mosaïque* était parfaitement nette. Dans un champ partiellement irrigué, dans les Pyrénées, j'ai vu la mosaïque rigoureusement limitée à la surface mouillée.

D'un autre côté, en 1921, si la mosaïque était rare sur l'ensemble du domaine de Grignon, elle était visible: 1. dans un champ situé en bordure du ruisseau qui traverse le domaine (terre basse, fraîche et riche, plantes très vigoureuses, dont les tiges retombantes ou couchées depassaient parfois 1.70 M.), 2. sur des plantes de semis d'une très grande vigueur, cultivés en terre enrichie et regulièrement arrosés.

b. 1. En 1922, un lot de pommes de terre de même origine (Roode Star) a été divisé en deux. Une partie a été plantée au début d'avril, la deuxième en juillet. Mosaïque nulle ou difficilement perceptible dans le 1er cas; mosaïque très accentuée et générale dans le 2e, au début du mois de Septembre. Un pied a été élevé sous cage vitrée pour éviter l'intervention des pucerons; la plante s'est developpée plus rapidement et plus vigoureusement que ses voisines elevées à l'air libre.

C'est sur ce pied, évolué en milieu plus chaud et plus humide, au moins en ce qui concerne l'atmosphère, que la mosaïque a apparu en 1er lieu, avec les macules les plus larges et les plus tranchées.

2. Au cours de l'hiver dernier, pour une douzaine de variétés à état sanitaire connu, d'après les observations faites au cours des années 1921 et 1922, les tubercules ont été coupés en 2; les deux motiés ont été plantées dans deux serres différentes, l'une peu

chauffée (12—15°, en février—mars), l'autre chauffée davantage (17—22°). Pour une même touffe, une partie des tiges a été mise sous cloche, alors que le reste se développait librement.

La culture a été faite dans la mousse, de façon à faire vivre la plante sur les réserves du tubercule.

Resultats:

a. La mosaïque se perçoit plus nettement dans la serre la plus chauffée.

b. La visibilité est maximum avec le developpement sous cloche.

Les différences de visibilité existent aussi bien dans le cas de feuilles planes que dans le cas de feuilles déformées. Les déformations sont toujours moindres en milieu humide et chaud. Dans la serre la moins chauffée elles sont parfois seules visibles, alors qu'elles sont accompagnées de décolorations dans la serre la plus chauffée.

Donc *basses temperatures et air sec favorisent les déformations; temperatures élevées et air humide favorisent la maculature.* 1)

La maculature peut s'atténuer au point de disparaitre; les déformations peuvent s'atténuer, mais elles restent toujours saisissables. En dehors de ces faits, je signalerai les suivants:

a. J'ai dit qu'en plein champ, en 1922, dans une région a été sec, la mosaïque n'avait été bien visible que dans les milieux exceptionnellement humides, ou que tardivement, à l'arrivée de la période humide. En réalité, la constation du maximum de visibilité à l'arrière-saison peut se faire chaque année, au moins sur les variétés dont les bourgeons axillaires évoluent facilement et sur celles qui ont une tendance marquée à repousser (2e poussée des tubercules, redressement aérien des rhizomes).

Dans mes essais en serre, l'expérience a été compliquée de pincements effectués tant sur les tiges libres que sur les tiges développées sous cloche. La mosaïque est bien plus visible sur les rejets ou repousses que sur les feuilles des tiges intactes; elle est encore plus nette en milieu chaud et en milieu humide. 2)

b. Les déformations se comportent comme la maculature: elles sont couramment plus accentuées à l'arrière-saison; on les voit avec une particulière netteté sur les pousses axillaires tardives. Le pincement est suivi du développement de rejets à feuilles plus déformées que celles des tiges à allongement direct.

Les observations et expériences dont je viens de rappeler briève-

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1) La lumière joue également un rôle défavorisant sur lequel je reviendrai ultérieurement.

2) Il est à remarquer que l'influence des *facteurs externes* est à distinguer de celle des *facteurs internes*. Les symptômes s'aggravent à mesure que s'épuisent les réserves du tubercule mère, lorsque la plante se développe par ses propres moyens.

ment les resultats me paraissent présenter de l'intérêt pour des raisons diverses.

a. L'aspect mosaique et l'aspect frisolée constituent deux facies d'une meme maladie que l'on pourrait dès lors appeler la frisolée-mosaïque. [1]) Mais cela ne veut pas dire que tous les cas de maculature et tous les cas de déformation doivent être rattachés à une seule et même maladie.

Pourquoi des maladies différentes ne présenteraient elles pas des symptômes tellement apparentés que nous ne savons pas encore les distinguer? Pourquoi, d'autre part, des variétés ne seraient pas caractérisées, par des attributs que nous ne savons pas distinguer de symptômes de maladies?

Ces questions sont posées parce que depuis trois ans je note le fléchissement progressif de lignées atteintes de mosaïque parfaitement caractérisée, sans déformation, alors que je ne vois pas de diminution de vigueur dans des lignées dont le feuillage présente des caractères de frisolée.

b. Selon le caractère auquel on fait appel pour définir la *frisolée-mosaïque*, la maladie peut être considérée comme présente ou absente, commune ou rare, grave ou bénigne. Le changement de climat, et même le changement de milieu sous un même climat, peuvent produire des modifications telles qu'il est facile de confondre apparition ou disparition et transformation de symptômes. Et la même confusion peut être faite dans les essais de contamination si les témoins ne sont pas judicieusement choisis, si l'épreuve expérimentale de l'état sanitaire n'a pas été faite au préalable.

D'une manière générale, la maladie est pour moi caracterisée par deux ordres de symptômes: Déformation et décoloration. Le dernier symptôme est extériorisé ou non, mais il est susceptible d'extériorisation, par l'emploi de la méthode expérimentale. Le premier me parait d'une bien plus grande constance. Mais quel est vraiment le premier caractère visible? Je ne crois pas pouvoir me prononcer encore. De même que les premières traces de décoloration sont très difficiles à saisir, les premiers indices de déformation me paraissent souvent impossibles à definir. Qui dira où commence la frisolée de Roode Star, de Wohltmann, de Saucisse, etc? Je ne me prononcerai pas davantage sur l'influence relative, au point de vue du flèchissement progressif de la vigueur, des conditions de milieu favorables à la manifestation de l'un ou de l'autre des symptômes.

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[1]) Le nom de *streak* a bien été remplacé par l'expression de *stipple-streak,* à juste titre d'ailleurs (ATANASOFF 1922).

Le problème de l'influence du milieu sur la valeur pratique des semences reste posé sous une forme spéciale. Le problème de l'influence de la *culture retardée* sur la production des bonnes semences est posé en même temps.

c. Les considérations dans lesquelles on vient d'entrer sont également intéressantes au point de vue de la sélection et de l'appréciation des produits.

Je crois que la sélection se ferait plus sûrement si le diagnostic ordinaire était complété:

1. par le pincement à l'arrière-saison;
2. par l'épreuve expérimentale en serre, à la fin de l'hiver, dans les conditions les plus favorables à la manifestation du facies mosaïque.

Je crois de même que cette épreuve *d'avant-culture* est capable de rendre quelques services dans l'appréciation de l'état et par conséquent de la valeur d'un plant commercial d'origine inconnue ou douteuse.

DIE BEWERTUNG DER SAATKARTOFFELN VOM PFLANZENSCHUTZLICHEN STANDPUNKT

VON

G. KÖCK

Bei keiner anderen Kulturpflanze vielleicht ist die Zahl der durch das Saatgut weiterverbreitbaren Krankheiten so gross als gerade bei der Kartoffel. Neben dem Krebs und den zahlreichen Schorfkrankheiten (*Spongospora*schorf, *Actinomyces*schorf, *Rhizoctonia*-schorf) sind es die verschiedenen Arten der Knollenfäule (Bakterienfäule, Bakterienringkrankheit, *Phytophthora*fäule, *Fusarium*fäule), welche gewöhnlich durch Saatknollen, die die Anfangsstadien dieser Krankheiten aufweisen von einem Jahr auf das andere übertragen werden. Es kann keinem Zweifel unterliegen, dass beispielweise die gewaltige Herabminderung der Hektarerträge im Kartoffelbau bei uns in Oesterreich in den letzten 10 Jahren zum Grossteil seine Ursache in der Verwendung kranker Knollen für Saatzwecke hat, dass also die geringe Aufmerksamkeit, welche dem Gesundheitszustande der Saatknollen zugewendet wurde, eine Hauptursache der Herabminderung der Produktion war. Neben *Phytophthora* und gewöhnlicher Bakterienfäule waren es hauptsächlich Schwarzbeinigkeit, Bakterienringkrankheit und verschiedene Arten von Blattrollkrankheit, die bei uns in Oesterreich in den letzten Jahren in bedeutend stärkerem Masse sich bemerkbar machten als früher und deren Wirkungen zweifellos die starken Ertragsschmälerungen zuzuschreiben sind. Die Erkenntnis von der Wichtigkeit der gesundheitlichen Qualität des Saatgutes für den Wert des künftigen Feldbestandes hat zu der gewiss segensreichen Einführung der Saatgutanerkennung geführt und es wäre gewiss im Interesse einer wohl in jedem Lande anzustrebenden Produktionserhöhung zu begrüssen, wenn auch der kleine Landwirt ausschliesslich anerkanntes Saatgut zum Anbaue verwenden würde. Vom pflanzenschutzlichen Standpunkte aber muss unbedingt gefordert werden, dass bei den Saatgutanerkennungen und überhaupt bei der Bewertung einer Ware als Saatgut unter allen Umständen auch dem Phytopathologen eine gewichtige Entscheidung zufalle, was leider noch immer nicht überall im wünschenswertem Masse der Fall ist. Die beispielsweise in den bei uns in Oesterreich geltenden Leitsätzen in Aussicht genommene fakultative Einholung des Gutachtens eines Phytopathologen bei auffallenden Kränkheitserscheinungen kann nicht als zweckentsprechend und genügend bezeichnet werden, weil die Beurteilung, ob es sich in einem konkreten Falle um eine gesunde oder kranke Pflanze handelt und ob einer beobachteten krankhaften Veränderung eine praktische Bedeutung zukommt oder nicht, auf keinem Fall dem Nichtfachmann überlassen werden kann und soll.

Die Berechtigung der Forderung nach obligatorischer Teilnahme eines Phytopathologen bei den Saatgutanerkennungen und den Saatgutbewertungen wird wohl von keinem der Anwesenden bebestritten werden und ich möchte mir, um dieser pflanzenschutzlichen Forderung an die massgebenden Stellen in jenen Ländern, wo derselben bis jetzt nicht in wünschenswertem Masse Rechnung getragen wurde einen grosseren Nachdruck zu verleihen, den Vorschlag erlauben:

Der Kongress wolle gelegentlich seiner Tagung eine Resolution beschliessen, in welcher die Wichtigheit der unbedingten Zuziehung von Phytopathologen zu den Saatgutanerkennungskommissionen und bei der Bewertung von Saatgut im Hinblick auf die Gewährleistung eines gesundheitlich einwandfreien Saatgutes als dringend geboten zum Ausdruck gebracht wird.

Vor Allem wichtig aber erscheint es auch, dass bei der Bewertung der einzelnen Krankheiten und Schädlinge eine gewisse Uebereinstimmung herrscht, was bis jetzt leider auch noch nicht der Fall ist. Was im Speziellen die Kartoffel anbelangt, so sei nur daran erinnert, dass beispielsweise bezüglich der Wertung der einzelnen Schorfkrankheiten die Ansichten einzelner Fachkollegen und auch verschiedener Praktiker ziemlich weit auseinandergehen. Während manche sogar auf dem Standpunkte stehen, dass Schorf gewissermassen nur als Schönheitsfehler zu werten sei, halten andere auch schon einen geringen Grad von Schorf bei Saatknollen für einen Aberkennungsgrund. Gerade die Frage der Wertung der einzelnen Schorfkrankheiten aber erscheint mir von grosser Wichtigkeit und zwar schon deshalb, weil mit der Bezeichnung „Schorf" kein eindeutiger wissenschaftlicher Begriff verbunden ist. Ueber die Schorffrage hier mich zu verbreitern fehlt leider die Zeit.

Auch bezüglich der Schwarzbeinigkeit, die beispielsweise in Amerika sehr streng gewertet wird, in Deutschland und bei uns in Oesterreich weit milder beurteilt wird, herrscht keine einheitliche Auffassung. Ebensowenig ist dies bezüglich der verschiedenen neueren Staudenerkrankungen vom Typus der Blattrollkrankheit der Fall. Und speziell diese letzteren Krankheiten spielen bei der Feldbesichtigung zum Zwecke der Saatgutanerkennung eine grosse Rolle. Mit der Blattrollkrankheit, über welche seit ihrer Entdeckung durch APPEL schon soviel geschrieben wurde und die heute noch immer in ihren verschiedenen Formen mir nicht genügend wissenschaftlich geklärt erscheint, kann ich mich leider auch nicht mit Rücksicht auf die kurze zur Verfügung stehende Zeit eingehender befassen, hoffe aber, dass gerade diese Tagung geeignet ist, Klärung auch in diese für den Kartoffelbau so wichtige Frage zu bringen. Meiner Ansicht nach ist der lange geführte Streit über die eigentliche Natur der Blattrollkrankheit, der Streit nämlich ob die Blattrollkrankheit eine pilzparasitäre oder eine nichtparasitäre, physiologische Krankheit ist, ganz überflüssig und hinfällig und nur dadurch entstanden, dass die einzelnen Forscher eben ganz verschiedene Krankheiten, die zufällig in dem einen Symptom des Blattrollens miteinander eine äussere Aehnlichkeit aufwiesen, immer wieder mit diesem Namen bezeichneten und aus einem Krankheits*symptom* einen Krankheits*begriff* machten. Die Wahl des Namens Blattrollkrankheit war sicher begreiflich, da das Blattrollen ein sinnfälliges Krankheitsmerkmal darstellt und APPEL damals nicht wissen konnte, dass dasselbe oder zumindest ein sehr ähnliches leicht zu verwechselndes Krankheitssymptom auch bei anderen wesensverschiedenen Krankheiten auftreten würde. Heute muss wohl gesagt werden, dass der Name „Blattrollkrankheit" als Krankheitsbegriff schlecht gewählt ist. Leider hat der von HIMMELBAUER meiner Ansicht nach ganz berecht geprägte Ausdruck „*Fusarium*blattrollkrankheit", wodurch eine bestimmte Blattrollkrankheit eindeutig bezeichnet wurde, keinen rechten Eingang in die pflanzenschutzliche Nomenklatur gefunden. Das Vorkommen von Tracheomykosen, und zu diesen gehören ja die durch *Fusarium*- und *Verticillium*arten verursachten Blattrollkrankheiten, ist ja einwandfrei festgestellt und ich kann nur sagen, dass bei uns in Oesterreich, wie die seinerzeit an unserem Institute durchgeführten zahlreichen Untersuchungen einwandfrei erwiesen haben, diese Formen der Blattrollkrankheit in Vordergrund stehen. Nach dieser kleinen Abschweifung kehre ich wieder zum eigentlichen Thema meines Referates zurück.

Ein gewisses Mass von Subjektivität, sowie eine gewisse Latitude wird bei der Beurteilung der einzelnen Krankheiten und Schädlinge gelegentlich einer Bewertung von Saatknollen beziehungsweise bei der Durchführung einer Saatgutanerkennung auf dem Felde immerhin offen bleiben müssen und ich möchte dies sogar als Notwendigkeit bezeichnen. Müssen doch die jeweiligen Verhältnisse in den einzelnen Jahren und in den verschiedenen Gegenden bis zu einem gewissen Grade berücksichtigt werden. Die Beurteilung kann, mit anderen Worten gesagt, nie eine absolute, sondern immer nur eine relative sein. Dass bei der phytopathologischen Beurteilung von Feldbeständen bzw. von Saatknollen natürlich nur jene Krankheiten und Schädlinge zu berücksichtigen sind, die durch die Saatknolle weiterverbreitet werden können, ist selbstverständlich. Von diesen dürfte meiner Ansicht nach nur der Kartoffelkrebs die einzige Krankheit sein, die auch dann schon zu einer Aberkennung des ganzen Feldbestandes bzw. der ganzen zu begutachtenden Saatgutmenge führen müsste, wenn sie auch nur in Spuren aufgefunden oder konstatiert würde. Bei allen anderen Krankheiten und Schädlingen müsste aber neben der Anzahl (dem Perzentsatz) der erkrankten Individuen wohl auch die Intensität der Erkrankung bei der Beurteilung entsprechend ins Auge gefasst werden. Keineswegs gleichgültig wird es sein, ob die Bewertung im Herbst nach der Ernte oder im Frühjahr vor dem Auspflanzen geschieht. Eine Bewertung von Saatkartoffeln vom pflanzenschutzlichem Standpunkte wird im Frühjahr sicherer vorgenommen werden können als im Herbst. Bei der Bewertung der Knollen im Herbst wird darauf Rücksicht genommen werden müssen, dass geringfügige Anfangsstadien verschiedener pilzparasitärer Krankheiten, die vielleicht an sich vernächlässigt werden könnten, während der langen Einlagerung der betreffenden Knollen in Mieten oder im Keller sich durch Weiterschreiten der Krankheit und durch gegenseitige Ansteckung sehr zu ihrem Nachteil verändern können. Dass für die Intensitätsbeurteilung keine festen Normen gegeben werden können, ist selbstverständlich. Aber auch bezüglich der zulässigen Anzahl kranker Pflanzen in einem Feldbestand, bzw. kranker Knollen in einem Pflanzkartoffelmuster sollen keine schablonenhaft festen Perzentsätze angegeben werden. Trotzdem würde ich es aber doch für wünschenswert halten, wenn international allgemein geltende Richtlinien für die Wertung der einzelnen Krankheiten und Schädlinge bei Pflanzkartoffelanerkennungen und -bewertungen aufgestellt würden, um innerhalb gewisser durch die Natur der Sache bedingten Grenzen eine Einheitlichkeit der Bewertung der Saatkartoffeln zu gewährleisten. Ein besonderes Augenmerk müsste bei der Ausarbeitung solcher Richtlinien jenen Krankheiten und Schädlingen zugewendet werden, gegen die in einzelnen Staaten gesetzliche Einfuhrverbote bestehen.

Das Anlegen eines allzustrengen, den extremen Forderungen des Pflanzenschutzes gerecht werdenden Masstabes, wie dies nach mir in letzter Zeit zugekommenen Mitteilungen aus der Tschechoslovakischen Republik in diesem Staate der Fall zu sein scheint, halte ich nicht ganz im Interesse der Sache gelegen. Vor Allem müsste dort, wo die Saatgutanerkennung noch keine obligatorische ist und überdies diese Institution erst eingeführt und propagiert werden soll, jede nicht unbedingt notwendige Härte vermieden werden, um nicht durch allzugrosse Ansprüche und Anforderungen abschreckend zu wirken.

Weit davon entfernt, die Freiheit des Saatguthandels irgendwie einschränken zu wollen oder gar einer Monopolisierung desselben in irgend einer Form das Wort reden zu wollen, wurde ich es doch für sehr wünchenswert erachten, wenn die Bildung recht zahlreicher Saatgutwirtschaften auf gut geleiteten grösseren landwirtschaftlichen Betrieben unter entsprechender fachmännischer Kontrolle von den massgebenden Stellen in jeder irgendmöglichen Richtung gefördert würde. Immer wieder muss aber dabei ausdrücklich betont werden, dass die Saatgutanerkennung und die Saatgutbeurteilung nicht, wie dies heute leider noch vielfach der Fall ist, eine rein pflanzenbauliche, sondern zumindest in gleicher Weise auch eine pflanzenschutzliche Angelegenheit ist. Um im Speziellen wieder auf die Bewertung der Saatkartoffeln zurückzukommen halte ich die seinerzeit von der Vereinigung für angewandte Botanik aufgestellten Richtlinien, die mir allerdings auf Grund langjähriger eigener praktischer Erfahrungen derzeit in manchen Belangen abänderungsbedürftig erscheinen, als Grundlage geeignet. Im Rahmen des Referates mangelt mir leider die Zeit mich eingehender mit den meiner Ansicht nach abänderungsbedürftigen Punkten dieser Richtlinien zu beschäftigen und im Referat diesbezügliche Anregungen zu geben und ich möchte daher von den dargelegten Erwägungen und von der Annahme ausgehend dass ein internationaler Kongress auch internationale Arbeit leisten soll, schliesslich noch den Antrag stellen:

Der hier tagende internationale phytopathologische Kongress wolle ein für diese Zwecke zu wählendes Komitee von Phytopathologen der einzelnen hier vertretenen Länder mit der Ausarbeitung eines Ent-

wurfes von international geltenden Richtlinien für die Bewertung von Saatkartoffeln vom pflanzenschutzlichen Standpunkt aus betrauen.

IST TRENNUNG DER PHYTOPATHOLOGIE IN PRAKTISCHE BOTANIK UND PRAKTISCHE ZOO-(ENTOMO-) LOGIE ERWÜNSCHT?

VON

L. REH

M. H.! Phytopathologie ist die Lehre von den gesamten Pflanzenkrankheiten. Deren Ursachen können sein:

a. anorganische: Boden, Düngung, Klima, Wetter usw.

b. organische: 1. Pflanzen, einschl. Bakterien; 2. Tiere, einschl. Protozoen.

War es in den früheren Jahren möglich, dass ein Einzelner das Gesamtgebiet der Phytopathologie beherrschte — ich erinnere nur an den vererhten Nestor der niederländischen Phytopathologen, Herrn Prof. RITZEMA BOS — so ist es heute schon so umfassend, dass dies nicht mehr möglich ist; dabei nimmt es von Jahr zu Jahr in rascher Steigung an Umfang und Vertiefung zu. Arbeits-Teilung *muss* also stattfinden.

Die nächstliegende ist die nach *geographischen* Gebieten. Es ist selbstverständlich, dass der deutsche Phytopathologe sich mit deutschen Pflanzenkrankheiten befasst und nicht mit denen auf Hawaii, und umgekehrt. Aber diese Beschränkung hat ihre Grenzen, soll die Phytopathologie nicht aufhören, eine Wissenschaft zu sein. Denn diese ist international, und viele Pflanzenkrankheiten sind es ebenfalls, selbst kosmopolitisch, und deren Zahl wächst durch Verschleppung in raschem Tempo. Jeder Phytopathologe muss also die Forschungs-Ergebnisse aller Länder berücksichtigen. Schon finden immer mehr Studienreisen von Phytopathologen in andere Länder statt.

Auch die Arbeits-Teilung nach *Nährpflanzen* hat ihre Grenzen. Viele der Krankheits-Erreger sind polyphag, andere migrieren (Rostpilze, Blattläuse). Verwandte Arten leben an ganz verschiedenen Nährpflanzen. Auch sonst geht es nicht an, die Erfahrungen bei anderen Nutzpflanzen zu vernachlässigen. Die Gesetze des Lebens, mit denen wir Phytopathologen ganz besonders zu rechnen haben, sind für alle Pflanzen und für alle Tiere jeweilig nahezu dieselben. Was bei Getreide erforscht und erprobt ist, darf beim

Studium und der Bekämpfung von Obstbaum-Krankheiten nicht unberücksichtigt bleiben.

Die einzige, allen Forderungen gerecht werdende Trennung ist die nach den *Krankheits-Ursachen*. *a* ist das Gebiet des Pflanzen-Physiologen, *b*¹) das des Pflanzen-Pathologen, *b*²) das des Zoologen. Schon unser verehrter Ehren-Präsident, Dr. HOWARD, hat darauf hingewiesen, dass angewandte Botanik und angewandte Zoologie in ihren Grundprinzipien durchaus verschieden sind, ganz andere Vorbildung und ganz andere Arbeits-Methoden verlangen. Niemand, der Botanik *und* Zoologie studiert hat, kann das bestreiten. Zudem ist jedes dieser beiden Gebiete heute schon so umfassend, dass es dringend wieder weiterer Spezialisierung bedarf, die ja auch vielfach schon durchgeführt ist. Jeder Entomologe wird mit mir darin übereinstimmen, dass es ausgeschlossen ist, dass ein botanischer Phytopathologe noch nebenbei das Gebiet der Entomologie beherrschen könne. Nur aus völliger Unkenntnis des ungeheuern Umfanges der letzteren ist es erklärlich, dass manche botanische Phytopathologen noch anderer Ansicht sind. Noch mehr als der Menschenarzt muss sich der Pflanzenarzt spezialisieren.

Die in den letzten Jahren angestrebte Trennung in *wissenschaftliche Phytopathologie* und in *angewandte* birgt Gefahren in sich. Phytopathologie ist immer „angewandt"; der Phytopathologe, der nicht in ständiger Berührung mit der Praxis bleibt, verdient kaum diese Bezeichnung. Und gerade im Verkehre mit der Praxis sind genaueste Kenntnisse erforderlich, wie sie eben nur der Spezialist haben kann. Ein wissenschaftlicher Irrtum hat im Allgemeinen nicht viel zu sagen. Ein Irrtum in der Diagnose aber oder in den Vorschriften zur Behandlung, wie er bei ungenügender Kenntnis nicht zu vermeiden ist, kann verhängnisvoll werden. Er führt zu falschen Massnahmen, die mindestens nichts nützen, leicht aber zu den Schäden durch die Krankheit noch die durch den Phytopathologen fügen können, in beiden Fällen das Vertrauen des Praktikers zu uns Phytopathologen untergraben.

Wo die Phytopathologie ihre Höchstleistungen erreicht hat, geschah es auf Grund einer Spezialierung nach den Erregern; ich erinnere an die Rostpilze, an die führende Rolle der deutschen Forstwirtschaft, in der die Arbeits-Teilung nach Botanik und Zoologie schon seit etwa 2 Generationen durchgeführt ist, an die Alles überragenden Leistungen der amerikanischen Economic Entomologists und an den gewaltigen Aufschwung, den die deutsche angewandte Entomologie zu verzeichnen hat, seitdem ESCHERICH die verzettelten Kräfte zu einer Gesellschaft und in einer Zeitschrift zusammengefasst hat.

Natürlich hat auch die von mir vertretene Specialisierung ihre

Nachteile. Sie können gemildert und selbst ausgeglichen werden durch möglichst vielseitige und gründliche Vorbildung der Phytopathologen und durch Zusammenarbeiten der verschiedenen Disziplinen, wie es namentlich wieder in Amerika in so vorbildlicher Weise geschieht [1]).

DISCUSSION.

Prof. H. M. QUANJER agrees with speaker; he too thinks that a differentiation between botanists and zoölogists is necessary.

Mr. T. SCHOEVERS is not quite convinced, that this differentiation is urgent; in advisory work he thinks it even undesirable. If a division is necessary, he would advise to divide the work between workers on diseases and pests of groups of plants, e.g. fruit-trees, vegetables, cereals, forest-trees etc. He readily understands however, that in pure investigation-work it will be better to specialize in botanical or zoölogical direction.

Dr. O. APPEL says, that first one has to consider that the set purpose must be the control of diseases and pests; it is not a good scheme if every one limits his efforts to a part of the entire sphere of work. It would be the best plan if as a rule the course was followed which the practitioner takes with his patients, i. e. he only calls for the specialist in complicated or new cases. Of course it is a necessity that the plant-doctor knows exactly, just as the physician, to whom he has to apply in every case.
As regards investigation work he agrees with the foregoing speakers; the highest specialization will afford the best results, as has been proved by the work of several well-known investigators on rust, smut, plant-lice etc.

Mr. N. v. POETEREN states, that the Dutch phytopathological Service follows this scheme exactly; it is the custom in the work of the Service to apply to specialists to secure exact information and to gather exact data.

DR. E. GRAM expresses his opinion, that there exists no such problem as differentiation in phytopathology. This word includes all branches of the work on plant diseases and pests;

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1) Dass auch ein Arbeiten ohne die hier vertretene Spezialisierung erfolgreich sein kann, hat mir der Aufenthalt in Holland gezeigt, wo der „Plantenziektenkundige Dienst" geradezu mustergiltig ist. Aber hier liegen ganz besondere Verhältnisse vor, die sich wohl nirgendswo anders wiederholen. — REH.

every body working therein has to follow the bent of his nature; so we shall get specialized investigators and less specialized, but more generally informed advisers.

Dr. R. MAYNÉ is also of opinion, that the word „phytopathology" has an embracive meaning; other words, e. g. the French „entomologie agricole", are much more limited in their meaning; entomologie agricole does not include eelworms, mammals, and of course diseases, but „phytopathology" may include all, diseases of all nature and noxious animals of all kinds.

Dr. L. O. HOWARD says that if one wants to make use of an embracive title, the word „phytopathology" ought to be replaced by another word, for in several countries, among others U. S. A., the word „phytopathology" is only used with regard to diseases of plants, excluding all phenomena of animal origin.

Dr. L. REH in reply to debaters states that the idea plant-doctor (= Pflanzenarzt) is indeed alluring, but it is impossible to draw a parallel with the physician; the latter has chiefly to deal with diseases of physiological origin, the former with phenomena caused by the most divergent agents on very much divergent hosts. He is afraid the so-called plant-doctors would often commit rather big errors, as has been done indeed in several cases known to him. He admits however that there exist, especially in Holland, some very able „plant doctors", but in this country circumstances favour their development (see note on p. 50).

HOW DO WE RECEIVE AND KEEP PHYTOPATHOLOGICAL INFORMATION?

BY

E. GRAM

Many phytopathologists are by their official duties placed on a narrow isthmus between a shallow sea of all-round knowledge and the narrow abysses of specialized research. In all three dimensions they are confined there by a large number of host plants, by a vast multitude of parasites, and by the indefinitely changing circumstantial factors. If they wish to maintain their *strength* they must, like the archaic monster, never loose their touch with the maternal ground; but if they want to conserve their *mobility* they need the hundred eyes of an argus. The problem for many of us is then: How do we receive the knowledge gathered by our colleagues, and how do we reach the highest possible efficiency in utilizing it? Some instances may enlighten the question.

In December 1922 RAY NELSON read at the meeting of the American Phytopathological Society a paper on protozoans found in connection with mosaic and leaf-roll, a matter which may come to interest most pathologists of the world. An American colleague wrote me the news immediately, which I received about the 10th of January. An abstract was printed in „Phytopathology" in January 1923 and must in a few weeks have reached the widely scattered readers of this periodical.

Carrying the date 1922 a Michigan Tech. Bull. was distributed early in 1923 and reached European stations in March-April. Abstracts have further appeared in Crop Protection Circular Jan. 1923 and in Rev. appl. Mycology May 1923 — and may yet appear in Bot. Abstracts, Exp. Stat. Record, Zeitschr. Pflanzenkr., Angew. Botanik, Cblatt. f. Bakt. Abt. 2, Internat. Rev. Science and Practise of Agr. (Rome), Neuheiten (Wien), Rev. appl. Entomology, Zeitschr. angew. Entomologie, etc. and finally it will be registered in the annual bibliography published by Biologische Reichsanstalt in Dahlem.

As another instance let me mention a short article: Durch die Dürre verursachten fehlerhaften Knollenbildungen und ihre Folgen — in „Die Kartoffel" 1 : 168-171 (1921), in which some information was given, new at least to me. As far as I know this article has not been abstracted in any of our 13 and odd journals, nor has it been mentioned or registered anywhere. Not a few of my learned audience — even of the potato specialists present — may therefore have missed this bit of information. Indeed we have many good abstract journals but we still miss *the* excellent one.

In January 1923 Prof. H. C. MÜLLER (Halle) published a short article on experiments with Kalimat and other grain disinfectants in D. Lw. Presse (No. 6), a periodical which the minority of us present see regularly, but still a leading paper in Germany. By chance I heard about it in April, just too late to include Kalimat in this summers experiments. If Kalimat is able to stand future trials as well as in Halle, this year's delay has meant a loss to our farmers — not to mention the manufacturers.

In one field I nourish a painful feeling of being far behind the progress of my Science. A large number of reports and a multitude of abstracts concerning immunity in the last years have passed my hands on their way to the library where they form a procrastination cairn which I shall never be able to work through. In other divisions I may not even be conscious of my ignorance, which makes the condition still more dangerous. A few colleagues are strong enough to be only interested in their personal research, but most of us are neither inclined nor permitted to attempt this elevated position. In this embarrassment a mediation is offered by the annual or biennial digests, as those published up to 1913 by HOLLRUNG or, still better, for small sections of our Science, like the reports on beets by STIFT, or on grain diseases by RIEHM. It may sometimes be a comprehensive work to try out, but it is a highly deserving work and I wish other experts would give us similar reviews of the progress in their line.

Our needs may then, perhaps, be summed up thus: 1) An improved exchange of original publications, 2) A quicker, more reliable and more centralized abstract service, 3) A series of annual or biennial progress reports, written by experts assigned so as to cover the principal sections of Phytopathology.

How this may be accomplished is now open for your discussion, I shall only venture a few suggestions. When an institute does a work duplicated by no other, let us encourage it, let us, for example all help to make the Dahlem bibliography complete. When it is possible to distribute abstracts of publications while the author is finishing his proof-reading, why should we receive abstracts two years later than the original paper — cannot the question be solved by proper whipping? If a hundred pathologists spend part of their time cutting and pasting the material for the card-indexes, why should we not just as well have it printed or mimeographed ready to be put into the drawers? We are fortunate in having an International Institute of Agriculture which all civilized states apparently feel they must support. It is according to its Program and its publications highly interested in Phytopathology, but I fear most of us do not request much aid from Rome and therefore we do not know what we might accomplish with united forces.

I have spoken and freed my mind. If I was not sure that my points are everyday matters I should not have taken the costly time. But they are, and I therefore suggest, Mr. President, that they be taken up for closer investigation, for discussion and for the realization of possible improvements — in the way which you may choose as best serving the purpose.

INTERNATIONAL PHYTOPATHOLOGY

BY

C. L. SHEAR

For the past thirty years or more there has been desultory discussion of International Phytopathological problems mostly in connection with various International Congresses relating to agriculture, horticulture and botany. I shall not attempt to review all that has been said and done in this connection. Previous discussions, resolutions and recommendations have covered various phases of the subject.

Professor ERIKSSON was among the first to take an active interest in the subject and is still pursuing it. Professors DOP, SORAUER RITZEMA BOS, CUBONI, APPEL and others have published papers relating to it.

A brief survey of the present situation and results thus far accomplished may be helpful in preparing a program for the future. Various efforts have been made to secure united action by the nations adhering to the International Institute of Agriculture at Rome, both in regard to the adoption of uniform methods and practices in connection with plant inspection and certification as well as other police and regulatory matters, and I am informed plans are now under consideration for another conference in Rome.

International support has also been urged for the establishment of research laboratories in different countries to be maintained and directed on a co-operative basis. At the last meeting of the International Institute in May, 1922, a resolution was adopted asking the general assembly to call to the attention of the various governments the desirability of the collection and exchange of all the data and results of pathological research secured in the different countries. This general project seems commendable and some work of this character is already done by the Institute. If the necessary funds and expert assistance could be secured the Institute might well act as a clearing house for the compilation, co-ordination and distribution of the results of Plant Disease Surveys and other important phytopathological data contributed by the various pathological organizations in each country. In the present financial condition of most of the nations, however, it would be very difficult to obtain the necessary funds to carry out this plan in a satisfactory manner. In the meantime, the various pathological organizations in the different countries and the individual pathologists might very appropriately devote attention to the subject and be carefully considering the necessary plans and methods for successfully carrying out some such project. Much preliminary work would be needed in preparing and agreeing upon uniform methods of collecting, handling and presenting plant disease data. In connection with plant disease survey work it is perhaps not generally known how imperfect is our knowledge of the occurrence, distribution and destructiveness of plant diseases and disease producing organisms. It is of the greatest importance that we should have as complete and dependable lists as possible for each country, and these lists should be supported by good material and specimens deposited in herbaria and museums where they will be available for study and verification.

Maps and charts should also be prepared showing the distribution of the different diseases, the crops affected and the losses estimated. The collection of accurate data of this kind in connection with intensive field study of all the environmental conditions involved and the host relations and reactions would make it possible to arrive at more dependable conclusions regarding some of the important factors involved in the epidemiology and ecology of plant disease.

In regard to estimating injury and losses from plant disease there is the greatest need of the development of methods and the collection of data in such a manner as to approximate dependable results. This will require much careful and accurate field study of our most important parasites to determine the amount of injury to individual plants and the reduction in crop production due to such injury, and thus establish reliable means of making estimates of crop damage and loss. In this connection I may say that I am speaking simply as an individual pathologist, and my opinions are not necessarily those of any organization, scientific or otherwise, with which I may be connected.

One of the most important questions to be considered at this time is to determine in what way we can most successfully promote the true and permanent advancement of knowledge of plant diseases and pests in the world and secure the greatest benefits in the advancement of science and the promotion of human welfare. We shall devote our attention to the strictly scientific aspects of the problem, as these must be thoroughly understood before any successful practical application can by made in the way of regulatory provisions for the prevention of international distribution of diseases and pests.

Such International meetings as this are of the greatest fundamental importance in preparing the way for better International co-operation and understanding among individuals, organizations and nations. As Dr. APPEL and others have pointed out, it is of the greatest importance that we know and understand each other's conditions and problems, and this can only be done by visiting the different countries, meeting with different pathologists, and studying the problems under the various climatic and other environmental conditions involved. It may almost be accepted as axiomatic that one can never fully or properly understand any important phytopathological problem by studying it in a single locality or in a single country. Neither can one really understand, or evaluate the work of the investigators of the various countries without becoming personally acquainted with them.

We must assume that the primary object of every true scientist, and therefore of every plant pathologist and entomologist is the discovery of truth and the extension of human knowledge. Science can never make great progress or accomplish its true purpose when pursued chiefly or entirely from a commercial or practical standpoint. We need more idealists in science, more ardent lovers of science for science sake, more searchers for truth, who like the great poets and artists pursue it primarily for love of the subject and the good of mankind.

Experience in recent years has demonstrated the need and also some of the possibilities of co-operation as a means of advancing science. Dr. APPEL, in his paper on International Phytopathology has quoted with approval my statement made in an earlier paper, that phytopathological problems are world problems. This might at first glance appear too self evident to need mentioning. We find, however, that many things which might be taken for granted require frequent repetition and emphasis in order to properly impress us with their importance.

If it is accepted as true that we are dealing with world problems, it follows, as Dr. APPEL has pointed out, that in order to most rapidly advance our knowledge of the subject there should be the most effective co-operation among the investigators of all the countries in the world. One of the first requisites for successful co-operative effort is a common aim and purpose on the part of the co-operators and this common aim, as already stated, should be the discovery of scientific truth and the advancement of knowledge, not primarily for personal, national or racial purposes but for the benefit of all mankind.

It may be appropriate in this connection to consider what forms of co-operation are most feasible at present and what are the most practical methods of attaining the desired end. I may venture to suggest some of the ways in which we as scientific investigators, and especially as plant pathologists and entomologists, may be more helpful to each other and to our science.

First. A more general exchange of publications and other information should be carried on, not only between individuals but also between institutions. Of course there is already considerable activity in this direction and it will probably naturally increase and become more helpful as we become better acquainted with each other.

Second. There is great opportunity for mutual benefit and advancement of our work by a much more general exchange of specimens of fungus parasites associated with or causing disease, and also by the loaning of rare specimens or authentic material of poorly known species. Availibility of authentic or correctly indentified specimens or cultures is of the greatest importance on account of the serious errors which now frequently occur in the identification and application of the names of pathogenic fungi. Old, widely distributed, and sometimes well-known fungi are described by pathologists under new names and heralded as new or recently introduced species which are in danger of wider distribution and destruction. While on the other hand newly introduced or newly discovered parasites are identified as old species, and thus neglected until they have become widely distributed and cause serious loss. Some, at least, of these mistakes, could be avoided by a more general distribution and exchange of authentic or accurately determined specimens which should be available for study and comparison, at least in the herbaria of the principal institutions in which pathological and mycological investigations are being carried on.

Third. A greater development of facilities for the exchange or purchase of pure cultures of fungi would greatly aid in the same way as pointed out in regard to the exchange of specimens. In this connection, we may say, that we hope, in the future, that greater facilities of this kind will be developed in the United States, as well as in other countries where little or no work of this kind is at present undertaken. We have already pointed out in a previous paper the importance of the distribution of pure cultures. In connection with the increased improvement and multiplication of sources of pure culture supplies, viewed from the standpoint of a self-supporting project, to say nothing of possible commercial profit, it might be considered of doubtful advisability. I do not think however that this very important and essential aid to research can ever accomplish the good it should as a self-supporting project. To satisfactorily accomplish its purpose it must eventually be supported, primarily by governmental aid or private endowment.

Fourth. As another means of facilitating research the formulation and adoption of uniform methods of collecting and handling plant disease data in the different countries, so that it may be more easily and successfully co-ordinated and compared, would be of great benefit. All that I have said with reference to plant pathology applies equally to economic entomology. The desirability and the importance of greater co-operation between the investigators of plant diseases and plant pests cannot be too strongly stressed. The role of insects as carriers and distributors of plant disease is a vast and important subject which can be satisfactorily advanced only by the cordial co-operation of the entomologist and mycologist.

Another way in which great advance in our science could be made is by the more frequent international exchange of students and professors of pathology. Some progress has already been made in this direction with excellent results and every opportunity should be be improved to promote greater activity of this kind. More frequent and more general International meetings of pathologists and more frequent visits of pathologists to other countries would, also be of the greatest benefit in promoting the advancement of Plant Pathology and Economic Entomology as well as better International relationships.

Progress is being made along all these lines, and by persistent and united effort I believe we shall be able to accomplish much more in the future.

The session was now interrupted and the company went to the Town-Hall where the Burgomaster of Wageningen Mr. WIJNAENDTS VAN RESANDT delivered an address of welcome, in which he pointed out the importance of these days for Wageningen, which town never before had been visited by so illustrious an international company; the Municipality considered it an honour to have this meeting in its town. The Burgomaster, being at the same time a Curator of the Agricultural University, dwelt on the close connections between the University and the town of Wageningen; he mentioned some historical particulars about the old town, which had existed since the time of the Romans. He hoped that the foreign members on returning to their respective countries, would often call to memory the small Dutch town and its University. —

Dr. HOWARD thanked the Burgomaster and the Municipality for their kind reception. — Tea and other refreshments were then served. —

At 8 p.m. the session was continued in the Great Hall, where the following papers, illustrated by lantern slides, were read.

CONTRIBUTION À L'ÉTUDE DE LA FAMILLE „APHIDIDAE PASS"

PAR

L. GAUMONT

(Pl. XV—XVI)

Sous la bienveillante direction de M. le Dr. MARCHAL, Membre de l'Institut et Directeur de la Station Entomologique de Paris, j'ai, depuis plusieurs années, entrepris l'étude de la famille *Aphididae Pass.*, au point de vue de la classification et de la biologie des espèces.

Chacun sait que les représentants de cette famille d'Hémiptères causent à l'agriculture de tous les pays un préjudice qu'il n'est pas exagéré d'évaluer par milliards de francs; c'est dire combien il importe d'entreprendre contre eux une lutte sans merci.

Anciennement un certain nombre d'entomologistes de grande valeur se sont déjà occupés de cette importante question; et DE GEER, ZETTERSTADT, HARTIG, KALTENBACH, KOCH, PASSERINI, LICHTENSTEIN, BUCKTON, et tant d'autres, nous ont laissé sur le sujet, des travaux que l'on consulte toujours avec fruit. De nos jours (et pour suivre l'ordre des Etats indiqués au programme de cette conférence) en Hollande VAN DER GOOT, en Belgique SCHOUTEDEN, en Allemagne NÜSSLIN et CARL BÖRNER, en France le Dr. MARCHAL, en Grande-Bretagne DAVIDSON, en Hongrie HORVATH, en Italie GRASSI et DEL GUERCIO, en Russie MORDWILKO et CHOLODKOVSKY, en Suède TULLGREN, aux Etats-Unis BACKER se sont consacrés à l'étude de ces malfaisants Hémiptères. Mais une lutte rationnelle entreprise contre-eux, ne peut être menée à bonne fin qu' à la condition d'en bien connaître la biologie, et tout le monde sait que, par leur polymorphisme, et par les migrations que la plupart d'entre-eux effectuent, beaucoup de particularités de leurs diverses manières de vivre sont encore énigmatiques. D'ailleurs, la nomenclature elle-même est loin d'être parfaitement établie; c'est pourquoi il serait si désirable que, dans les Conférences comme celle-ci, si magnifiquement organisée par le Gouvernement Hollandais, les Aphidiologues se réunissent en grand nombre de tous les points du globe, présentent à leurs collègues des échantillons et des préparations des espèces qu'ils jugent nouvelles ou qui offrent une particuliarité biologique intéressante, ainsi s'établiraient entre eux, des liens de bonne collaboration qui faciliteraient le travail de chacun pour le grand bien de la science et de l'humanité.

Voici, maintenant pour ma part, en quoi consiste ma contribution à l'étude de la famille *Aphididae* Pass.

M'aidant de travaux publiés par les auteurs qui m'ont précédé, j'ai d'abord cherché à reconnaître et à rassembler les espèces par eux indiquées; les échantillons que j'ai recueillis ont été conservés en alcool ou ont servi à monter des préparations au baume de canada, entre lame et lamelle, suivant la méthode classique. J'ai pu ainsi composer une collection durable de plus de 2.000 préparations concernant le plus grand nombre des espèces indiquées par les auteurs européens. J'ai pour cela adopté une classification qui diffère fort peu de celle indiquée par M. BACKER en 1921. J'ai fait en outre les remarques ou observations que je ne puis ici que résumer à grands traits:

Sous famille Phylloxerinae.

A l'automne 1922, j'ai pu constater, à l'entrée de la forêt de Montargis, l'existence de *Phylloxerina Salicis* Licht. sur les jeunes pousses de Saule Marsault (Salix Capreae), et suivre une partie de son cycle évolutif. En fin août, je remarquai tout d'abord, les femelles parthénogénétiques entrouées de leur enveloppe laineuse et fixées à l'aisselle des jeunes feuilles entre le bourgeon axillaire et le pétiole de la feuille. Ayant cherché au pied de l'arbrisseau, j'y découvris un certain nombre de femelles sexupares aptères ayant déjà déposé les deux sortes d'oeufs: les plus petits ou oeufs mâles, et ceux de taille normale ou oeufs femelles. Je n'ai donc pas pu fixer la durée de leur incubation; quoiqu'il en soit, à part quelques rares éclosions plus précoces, ce fut le 7 Septembre que la plupart des sexués sortirent des oeufs, la déchirure de l'enveloppe commençant entre les yeux de l'embryon et se continuant suivant le plan de symétrie de son corps; mais déjà dès les 4, 5 et 6 Septembre, on pouvait apercevoir à l'un des pôles de l'oeuf, un sillon noir marquant la ligne de rupture de la coque ovarienne. Les individus de la génération bisexuée restèrent alors inertes au voisinage de celles-ci pendant environ 2 semaines et sauf quelques rares individus plus précoces ou plus tardifs, ce fut le 24 et le 25 que les femelles, *sans avoir subi aucune mue,* prirent position sur leurs membres, tandis que les mâles, également sans mue, peu agiles, et condamnés à rester à l'intérieur de la bourre laineuse, fécondèrent les femelles. Ces dernières effectuèrent leur ponte du 27 au 29, chacune d'elles ne donnant qu'un seul oeuf, puis périssant à son voisinage (Pl. XVI, fig. 1, 2).

Sous famille Hormaphidinae (Pl. XV).

Dans cette sous famille, je n'ai eu connaissance que de deux espèces: *Hamamelistes Betulae* Mordw. et *Cerataphis lataneae* Boisduval, encore cette dernière m'a-t-elle été communiquée en préparation montée au baume par mon Collègue, M. Vayssière qui la tenait de Schouteden. *Hamamelistes betulae* vit sur quelques bouleaux (*Betula alba*) du jardin attenant à la mairie de Montargis et j'ai pu pendant plusieurs années, en suivre le développement qui présente trois curieuses particularités:

1e. Le cycle évolutif annuel ne semble comporter que trois générations: une forme hiémalis durant de juin à avril de l'année suivante, une forme estivalis aptère et une autre forme estivalis ailée, ces deux dernières évoluant du 15 avril au 15 juin, et l'espèce semblant se perpétuer par parthénogénèse indéfinie. Pendant deux années consécutives, j'ai pu, en effet, élever les individus hiémalis issus des ailés de la deuxième génération estivale; cependant, comme l'espèce reste cantonnée au voisinage des serres dans le jardin de la mairie et ne s'étend pas au loin, il y a lieu de se demander si, après des périodes plus ou moins longues, il n'y a pas nécessairement retour à une plante de serre; on sait d'ailleurs que l'espèce, de provenance américaine, migre dans son pays d'origine de l'Hamamelis au Bouleau, et que les sexués, l'oeuf d'hiver et les fondatrices se rencontrent sur les premier de ces deux végétaux.

2e. Les individus de la génération hiémalis ont une conformation spéciale qui rappelle de très près la famille des *Coccididae*.

3e. La période de vie active ne s'étend, dans cette espèce, que d'avril à fin juin, les larves hiémalis étant fixées et à l'état de vie latente pendant tout le reste de l'année (9 mois).

Sous famille Mindarinae. La seule espèce qui appartient à cette sous famille est elle-même très curieuse par sa biologie; j'ai suivi, plusieurs années durant, son cycle évolutif qui ne comprend que trois générations: (fondatrices, séxupares, sexués nains, mais pourvus de rostre) qui évoluent sur les Abies en l'espace de deux mois: (15 avril au 15 juin), et pendant 10 mois de l'année, l'espèce reste à l'état d'oeufs. Mais la biologie de cette curieuse espèce a déjà été mise en évidence par défunt le Professeur NÜSSLIN.

Sous famille Eriosomatinae.

Cette sous famille comprend des types très différents que l'on peut ranger en cinq groupes a. *Eriosomatini*, b. *Pemphigini*, c. *Aploneurini*, d. *Prociphilini*, e. *Fordini*.

Du premier groupe, j'ai recueilli les formes connues des genres: *Eriosoma* ou *Schizoneura*, *Colopha*, *Tetraneura*, *Byrsocrypta* mais j'ai en outre observé sur les racines de Sedum reflexum, de nombreuses colonies d'aptères et d'ailés que j'ai rapportés à l'espèce *Schizoneura ulmi* L., dont les exules vivent habituellement, comme on sait, sur les racines de Ribes — (R. grossulariae, R. nigrum).

Du second groupe, j'ai rassemblé les diverses formes mentionnées par les auteurs; j'ai en outre observé deux espèces, nouvelles ou peu connues l'une dont je n'ai vu que les aptères disséminés sur le tronc de Populus nigra var. pyramidalis, et vivant sous de petites bourres laineuses secrétés par eux. Ne connaissant pas la forme ailée, je ne puis ni affirmer ni infirmer s'il s'agit du genre *Löwia* signalé par certains auteurs. L'autre espèce me semble n'avoir jamais été décrite; les aptères et les ailés vivent sur les racines superficielles de Populus alba. Par la forme de leurs glandes cirières, toutes deux doivent être nettement rattachées au groupe *Pemphigini*.

Au troisième groupe appartiennent les genres *Asiphum*, *Prociphilus* et *Thecabius*. Jusqu'ici ce genre *Asiphum* n'était représenté que par l'espèce *A. tremulae* D.G., or, j'ai observé sur les rameaux de Populus alba, une autre espèce qui a bien les caractères du genre (fondatrices dépourvues de glandes cirières et dont les antennes sont à cinq articles) mais je n'ai pu déterminer sur quelle plante ou hôte intermédiaire, vivent les exules de cette espèce dont j'ai pu observer et préparer les fondatrices, les émigrantes, les sexupares et les sexués.

Du groupe *Fordini*, j'ai recueilli: une espèce du genre *Forda* (*Pentaphis*), l'unique espèce du genre *Paracletus*, et deux espèces du genre *Tychea*, dont l'une: *Tychea phaseoli* se rencontre en automne sur les racines de haricots (Phaseolus vulgaris) et accessoirement sur les tiges souterraines de Pommes de terre (Solanum tuberosum) (Pl. XVI, fig. 5, 6).

Sous famille Aphidinae. Les espèces européennes de cette sous famille peuvent etre rangées en 4 groupes:

a. groupe *Lachnini*, b. groupe *Vacunini*, c. groupe *Callipterini*, d. groupe *Aphidini*.

a. *groupe Lachnini*. Ce groupe renferme des espèces le plus souvent strictement monophages qui peuvent être réparties en 4 sous-groupes: Sous-groupe *Tramina*, sous-groupe *Anoecina*, sous groupe *Pterochlorina*, sous groupe *Lachnini*.

Sous groupe Tramina. L'auteur qui, à ma connaissance, a le mieux étudié le genre *Trama*, Del Guercio dans „Contribuzione alla Conoscenza dei Lachnidi italiane" décrit les espèces: *T. Troglodytes* Heyd., *T. caudata* Del Guercio, *T. longitarsa* (Ferrari) Del Guerc., *T. ranunculi* Del Guerc., *T. Horwathi* Del Guerc. Or, j'ai observé les formes aptères et ailées de deux espèces de ce genre que je ne puis identifier avec aucune de celles qu'a décrites le savant auteur italien. L'une d'elles vit sur les racines d'Artichauts (Cynara Cardunculus), et de diverses autres composées: Scorzonera hispanica, Cichorium intibus, Lactuca sativa, etc.; cette espèce dont je donnerai incessamment la description est un véritable fléau dans les jardins; en raison de leur grand nombre, ces Aphides épuisent rapidement les plantes attaquées qui ne tardent pas à périr; j'ai essayé de combattre ces redoutables Pucerons en injectant dans le sol au pied de chaque plante attaquée de 7 à 8 gr. de sulfure de carbone; une grande partie des *Tramas* ont été tués, mais chaque fois il en est resté cependant une quantité suffisante pour une nouvelle réinfection; de sorte, le mieux est encore de refaire une nouvelle plantation et de détruire artichauts et Pucerons en injectant à chaque pied une dose de 15 à 20 gr. de sulfure. L'autre espèce vit sur les racines et les stolons de Ranunculus repens, elle est nettement différente de *Trama ranunculi* décrite par Del Guercio.

Sous groupe Pterochlorina. Genre Stomaphis. Les *Stomaphis* vivent dans les fissures des écorces de Quercus, Betula, Acer, Thuya; deux espèces sont communes dans le centre de la France:

St. Quercus L. et. *St. longirostris* Fabr.; j'ai suivi d'une année à l'autre c'est-à-dire de la fondatrice à l'oeuf, le cyle évolutif de chacune d'elles, j'ai obtenu *d'élevage* les mâles dans ces deux espèces, tous sont aptères, pigmés par rapport à la grosse taille de la femelle, *totalement dépourvus de rostre,* et très semblables aux mâles de *Paracletus cimiciformis* décrits par DEL GUERCIO.

Genre Dryaphis. Je n'ai trouvé sur nos chênes du centre de la France que deux espèces mais très distinctes l'une de l'autre: la plus petite à le tégument brillant, le mâle est aptère et la femelle pond ses oeufs isolément sous les écorces des chênes à côté de ceux de *Stomaphis quercus;* la plus grande est de couleur mate, le mâle est ailé et la femelle fait sa ponte, les oeufs groupés sur une branche à l'abri de quelques feuilles jaunies à l'automne. La première espèce peut être identifiée à *Dr. roboris* L. et la seconde me semble être une variété de *Dr. longipes* Dufour.

Genre Lachnus. Ce genre a été divisé par DEL GUERCIO en *Lachnus* (*sensu stricta*) avec les espèces *viminalis* et *tomentosus, Lachniella* comprenant: *fasciata, cilicica, hyalina, juniperi,* et *Eulachnus* renfermant: *agilis, Macchiati* et *pineti.* J'ai retrouvé dans le centre et l'est de la France toutes ces espèces; cependant celle que DEL GUERCIO désigne sous le nom de *E. agilis* a le rostre arrondi et devrait à cause de ce caractère être classé dans le genre *Lachnus* (*sensu stricta*).

b. groupe Vacunini. Je ne connais dans ce groupe que les deux espèces *Vacuna Dryophyla* Schranke et *Glyphina Betulae* Kalt., dont les formes sexuées ont été inconnues jusqu'ici. J'ai pu élever celles de *Vacuna* jusqu'à leur deuxième mue à la fin du mois de juin; elles sont alors fixées aux feuilles; mais après cette mue, elles quittent toujours les extrémités des rameaux pour se réfugier dans la mousse qui couvre la partie inférieure des gros troncs où j'en ai perdu la trace. Par contre j'ai pu obtenir les mâles et les femelles de *Glyphina betulae* qui sont pourvues d'un rostre comme les femelles vivipares et chaque femelle dépose plusieurs oeufs dans les fines desquamations de liège qui se roulent généralement en forme de tubes. Ce caractère, joint à la présence du rostre chez les sexués suffit à séparer le groupe des *Pemphigini* dans lequel il a été classé (Pl. XVI, fig. 3, 4).

c. groupe Callipterini. Ce groupe qui ne renferme que des espèces strictement monophages, la plupart vivant sur des végétaux ligneux, est assez embrouillé, précisément à cause de la synonymie compliquée des noms d'espèces, c'est pourquoi il serait de première urgence de s'entendre pour établir une nomenclature conventionnelle définitive. A l'exception de deux seulement, j'ai pu suivre le développement annuel des espèces mentionnées par VAN DER GOOT dans l'ouvrage „Beiträge zur Kenntniss der Pflanzenlaüse".

d. groupe Aphidinae. En raison de leurs migrations et de leur polyphagie et faute d'en connaître bien la biologie, on a multiplié considérablement le nombre des espèces; les auteurs européens le divisent ordinairement en deux sous-groupes, sous-groupe *Aphidinae*, et sous-groupe *Macrosiphonina;* BACKER en ajoute deux autres *Cervaphidinae* et *Pentalonina* qui, à ma connaissance, ne sont pas représentés en France. Certains genres, notamment *Aphis* et *Myzus* qui renfermant les espèces les plus prolifiques, sont les plus nombreux en individus, s'attaquent aux végétaux de la culture et sont les mieux connus des agriculteurs; ils constituent les fléaux contre lesquels ils ont le plus souvent à lutter. Je pense qu'il y a lieu de réduire considérablement le nombre des espèces et de ne conserver comme véritables que celles dont on peut suivre au printemps à l'automne et dont on peut trouver l'oeuf en hiver, et la fondatrice au printemps; la plupart devant entrer dans celles-ci, comme il a déjà été fait avec *Aphis evonymi, rumicis, papaveris,* etc.

Préparations à projeter :

Phylloxerina salicis — sexupare.
Hamamelistes betulae — estivalis, aptère, ailé, hiemalis.
Mindarus Abietinus.
Löwia ?
Pemphigina sur racines de Populus Alba.
Asiphum populi — fondatrice, émigrante, femelle ovipare.
Tychea phaseoli.
Trama sur racines de Lactuca sativa.
„ „ racines de Ranunculus repens.
Stomaphis quercus, mâle.
„ longirostris, mâle.
Dryobius roboris, mâle.
„ longipes, femelle ovipare.
Vacuna, jeune sexué.
Glyphina, mâle et femelle.

LES PUCERONS DE LA POMME DE TERRE

PAR

L. GAUMONT

Dans le Centre de la France quatre espèces d'Aphides s'attaquent à la pomme de terre:

Macrosiphum solani Kalt.
Myzus (Myzoïdes) persicae Pass.
Aphis evonymi Fabr.

qui vivent à la face inférieure des feuilles.
et: *Tychea (Tullgreenia) phaseoli* Pass., puceron hypogée qui se fixe aux tiges souterraines et aux tubercules.

1e. *Macrosiphum solani* est une espèce migrante dont l'hôte principal est le Cognassier (Cydonia vulgaris); l'oeuf hiverne en effet à l'aisselle des bourgeons de cet arbre et éclot au printemps; la fondatrice et la génération suivante s'y développent; cette dernière migre sur les solanées, la pomme de terre en particulier. Les ailés d'automne font retour au Cognassier, et la génération bissexuée aboutit à l'oeuf.

Mais l'espèce continue souvent à se multiplier par parthénogénese sur des plantes de serre pendant l'hiver et au premier printemps les ailés s'étendent dans le voisinage à la recherche des germes de pommes de terre sur lesquels ils se multiplient abondamment:

Echantillons présentés: Fondatrices sur cognassier (préparation).
ailée migrante d°
aptères et ailés sur germes de p. d. terre (en alcool).
dessins.

2e *Myzus* (*Myzoïdes*) *persicae Pass.* est également une espèce migrante qui a pour hôte principal le Pêcher (Persica vulgaris). Au printemps la fondatrice et la génération ailée qui suit vivent sur le Pêcher; les ailés s'étendent sur les cultures de pommes de terre et y déposent leur descendance. Comme pour l'espèce précédente, il y a à l'automne retour à l'hôte principal sur lequel est dépose l'oeuf issu de la génération bisexuée.

Echantillons présentés: Fondatrices sur pêcher, (preparation);
ailés sur pêcher d°
dessins

3e. *Aphis evonymi* est une espèce extrêmement polyphage dont l'oeuf se rencontre en hiver sur divers arbrisseaux: Evonymus europeus, Evonymus japonicus, Viburnum Opulus, et même sur les plantes herbacées et qui s'étend pendant la bonne saison sur un très grand nombre de plantes ligneuses ou herbacées, Asparagus, Beta, Capsella, Carduus, Chenopodium, Papaver, Phaseolus, Pisum, Rheum,

Rubia, Rumex, Trifolium, Tropaeolum, Tulipa, Vicia, Solanum etc.[1])
Echantillons présentés: Fondatrices sur Evonymus
émigrantes „ „
exulés sur pomme de terre
sexués ♂ ♁ sur Evonymus
oeufs (photographies)
dessins.

4e. *Tychea* (*Tullgreenia*) *phaseoli* Pass. se rencontre à l'automne fréquemment sur les racines de haricots, et quelquefois sur les tiges souterraines de pommes de terre. On ne connaît que les formes parthénogénétiques aptères et ailées de ce puceron.
Echantillons présentés: aptères (préparation).
ailés d°
dessins.

DIE BEKÄMPFUNG DER „SCHWARZEN BLATTLÄUSE"

VON

C. BÖRNER

Für die Bekämpfung der schwarzen Blattläuse spielt die Frage der Überwinterung eine entscheidende Rolle. Deshalb setzten nach Wiederentdeckung der von HIGHHURST zum ersten Male beobachteten Wirtswechsels einer schwarzen Blattlausart zwischen Evonymus und Krautpflanzen (Rumex, Vicia faba, Beta) durch MORDWILKO zahlreiche Untersuchungen in England, Dänemark, Frankreich und Deutschland ein, um festzustellen, ob die „schwarze Blattlaus" ausser auf Evonymus etwa auch auf Krautpflanzen zu überwintern imstande sei.

THEOBALD gelang es als Erstem, die schwarze Blattlaus von Rumex conglomeratus an dieser Pflanze im Stadium des Wintereies zu überwintern. Seine Untersuchungen fanden Bestätigung in England, Dänemark und Deutschland. THEOBALD's Annahme, dass seine Rumex-Laus der Schädling von Beta und Vicia faba sei, erwies sich indessen bei den in Naumburg angestellten Untersuchungen der letzten Jahre als nicht richtig.

Berichterstatter wurde bereits 1920 darauf aufmerksam, dass an Evonymus im Frühling eine schwarze Blattlaus Blattrollungen hervorruft, die sich *nicht* auf die letztgenannten Krautpflanzen übertragen lässt, während sie Rumex, einige Umbelliferen und vor allem Solanum nigrum willig annimmt. Im Sommer desselben

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[1]) See also Dr. BÖRNER's paper. (Ed.).

Jahres beobachtete Berichterstatter auf Helgoland Kolonien schwarzer Blattläuse an Evonymus japonica, die sich auf Papaver, Beta und Vicia faba übertragen liessen. Durch diese letzteren Beobachtungen waren frühere gleichsinnige Feststellungen des Berichterstatters in Lotharingen sowie die Entdeckungen von MORDWILKO und HIGHHURST bestätigt, gleichzeitig aber nachgewiesen, *dass die „schwarze Blattlaus" auf Evonymus nicht einer, sondern zwei verschiedenen Arten angehört.* In den folgenden Jahren wurden diese Feststellungen bestätigt und erweitert; *es gelang die Erstgenerationen beider Arten im Fruhjahr auf Evonymus aufzufinden und mit ihnen kreuzweise Infektionsversuche auszufuhren, die die Bestätigung des Mitgeteilten ergaben.*

Die Trennung beider Blattlausarten nach der Wahl der Sommerpflanzen ist eine sehr scharfe, obwohl es auch Pflanzenarten gibt, die von beiden Arten besiedelt werden (Cirsium arvense, Galium aparine, Rheum, Umbelliferen u. a.). Diese biologische Trennung wurde wesentlich ergänzt durch morphologische Unterschiede, welche vor allem die *Länge der Haare* an den Fühlern, Beinen und den Seiten des Körpers betreffen. Die *kurzhaarige Art erhielt den Namen Aphis evonymi F.*, die *langhaarige den Namen Aphis fabae Scop.* der synonym ist mit *Aphis papaveris* F.

Aphis evonymi kommt als Schädling krautartiger Pflanzen nicht in Frage; man findet sie nie im Freilande auf Beta, Chenopodium Atriplex, Vicia faba, Phaseolus, Papaver. *Der Schädling der genannten Krautpflanzen ist ausschlieszlich Aphis fabae.* [1])

Die schwarzen Blattläuse auf anderen Holz- und Krautpflanzen gehören nur zum Teil den beiden vorgenannten Blattlausarten an. Durch umfassende Vergleichszuchten wurde festgestellt, dass auf folgenden Pflanzen selbständige schwarze Blattlausarten leben, von denen nur die eine der beiden Arten von Viburnum opulus einen obligatorischen Wirtswechsel ausführt:

1. Viburnum opulus. a. *Aphis mordwilkoi* B. u. J. Die Laus lebt vornehmlich in den Blütendolden oder an den Blättern unterseits und bewirkt im allgemeinen *keine* Blattrollung. Der Fundatrix folgen meist nur ein bis zwei fundatrigene Generationen. Abwanderung auf *Lappa*, seltener auf Rumex-Arten (z. B. conglomeratus), auch an den Sommerpflanzen keine Blattrollungen.

b. *Aphis viburni* Scop. vom Frühling bis Herbst an Viburnum opulus (nicht Lantana), an Triebenden starke Blattrollung bewirkend. Kein obligatorischer Wirtswechsel.

2. Philadelphus. *Aphis philadelphi* C. B. wie *Aphis viburni* vom Frühling bis Herbst an Philadelphus-Arten, ebenfalls an Trieb-

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[1]) See also Dr. GAUMONT's paper, p. 65 (Ed.).

enden und starke Blattrollung bewirkend. Kein obligatorischer Wirtswechsel.

3. Hedera. *Aphis hederae* K. Wie *Aphis viburni* und *philadelphi* vom Frühling bis Herbst an Hedera. Blattrollung nur bei starkem Befall ganz junger Blätter. Kein Wirtswechsel.

4. Ilex. *Aphis ilicis* K. Biologie noch nicht näher erforscht. Vermutlich eine seltenere aber selbständige Schwesterart von philadelphi. Übertragung von *Aphis fabae,* die ihr morphologisch ähnlich ist, auf Ilex ist nicht gelungen.

5. Aegopodium podagraria. *Aphis podagrariae* Schrank. Vom Frühling bis Herbst auf genannter Pflanze starke Blattrollung bewirkend, besonders an schattigen, feuchteren Orten. Kein Wirtswechsel.

6. Rumex conglomeratus. *Aphis rumicis* L. Vom Frühling bis Herbst ausschlieszlich an dieser Ampferart, die Blätter eng einrollend. Kein Wirtswechsel.

Aus dieser Zusammenstellung ergibt sich, *dass die an Aegopodium und Rumex überwinternden beiden schwarzen Blattlausarten nicht in den Formenkreis von Aphis fabae gehören.* Sie sind nicht nur biologisch, sondern auch morphologisch und durch die Farbe der Wintereier spezifisch abweichend. Diese artliche Selbständigkeit gilt auch für die anderen aufgezählten Arten, von denen bisher keine einzige, auch nicht zwangsweise, an Krautpflanzen, auf die sie sich gelegentlich über Sommer übertragen liessen, überwintert werden konnte. Letzteres trifft auch für die beiden schwarzen Blattläuse von Evonymus zu, die im Herbst an ihren Krautpflanzen regelmässig die geflügelten Sexuparen und Männchen zwecks Rückwanderung zum Evonymus erzeugen und deren etwa an Krautpflanzen zurückgebliebenen Ungeflügelten nach den bisherigen Erfahrungen durch Frost abgetötet werden. *Eine Ueberwinterung dieser Läuse, insbesondere von Aphis fabae, an Beta dürfte nur bei geeigneter Zucht im Warmhause oder in südlichen Ländern möglich sein. Für Mittel- und Nordeuropa kann es als ausgeschlossen gelten.*

Die Bekämpfung von *Aphis fabae* kann sich danach auf die Bekämpfung an Evonymus konzentrieren. Hier kommt sowohl eine Winter- oder Frühjahrsbehandlung der Evonymus-Sträucher mit Blattlausgiften in Frage, wie andererseits Ausrottung oder zeitweises Niederschlagen der Sträucher, besonders an ihren Wildstandorten. Die Behandlung am Strauch mit Giften ist nach Beginn der Blattrollung sehr erschwert, sie müsste bei Austreiben der Knospen, oder früher zur Zeit des Eistadiums der Blattläuse stattfinden. Das Niederschlagen oder Kappen der Evonymussträucher erfordert vorherige Organisation des Vernichtungskampfes, damit in einem einzigen Winter sämtliche Winterwirte des Schädlings beseitigt werden können. Angesichts der Schwierigkeit eines solchen Vorgehens erscheint die radikale Ausrottung des Evonymus leichter, da sie successive von Gebiet zu Gebiet ausgedehnt werden kann.

Die Bekämpfung von *Aphis fabae* durch Zucht und Anbau *resistenter oder immuner Nutzpflanzen* (Beta, Vicia, Papaver) erscheint nach den in Naumburg bisher angestellten Beobachtungen *nicht* aussichtsreich. Es besteht die Befürchtung, dass die Angaben von DAVIDSON, der immune oder schwachanfällige Sorten der genannten Pflanzengattungen festgestellt zu haben glaubt, auf Benutzung verschiedenartigen Infektionsmateriales von Evonymus, *mit anderen Worten auf eine Verwechslung der beiden Evonymus-Blattläuse Aphis fabae und evonymi zurückzuführen sind.*

DAS PROBLEM DER REBLAUSRASSEN

VON

C. BÖRNER

Ältere, bei Vergleich lokal getrennter Seuchengebiete, teilweise widersprechende Angaben über die Anfälligkeit verschiedener Rebensorten gegen die Reblaus, die man auf örtliche klimatische Einwirkungen zurückzuführen geneigt war, fanden im Jahre 1910 und 1913 durch den Referenten eine neue Erklärung dahingehend, dass es sich um biologische Abweichungen im Verhalten zweier verschiedener Reblausrassen handele. Es war durch vergleichende Infektionsversuche nachgewiesen worden, dass bestimmte Unterlagsreben, welche sich der lothringischen Reblaus gegenüber fast oder vollständig immun gezeigt hatten, sich bei Metz durch Rebläuse aus Südfrankreich an Blättern und Wurzeln vergallen lassen. Dadurch war die Annahme widerlegt, dass die verschiedenartige Anfälligkeit der Reben gegen Rebläuse verschiedener Seuchengebiete auf einem klimatisch wechselnden Verhalten der Reben beruhe. Der biologisch abweichenden Reblaus Lothringens wurde der Rassename *Pervastatrix* beigelegt. Morphologische Unterschiede der beiden Reblausrassen blieben noch unbekannt.

Während des Krieges blieben die Untersuchungen in Deutschland, in der Schweiz und in Italien darauf beschränkt, durch Vergleichszuchten mit Material aus verschiedenen Seuchengebieten nachzuprüfen, ob es sich jeweils um das lothringische oder das südfranzösische Verhalten der Laus handele. SCHNEIDER-ORELLI ermittelte für die Seuchengebiete der Nordschweiz ein demjenigen der lothringischen Rebläuse sehr ähnliches biologisches Verhalten. GRASSI und TOPI fanden im Seuchengebiet am Lago Maggiore bei

Arizzano eine Blattgallenreblaus, welche der lothringischen *Pervastatrix* sogut wie ganz entspricht, während die von ihnen vergleichsweise in Zucht genommenen Rebläuse von der Riviera (Ventimiglia) das südfranzösische Verhalten zeigten. Die von RATHAY im Klosterneuburger Versuchsweingarten in den 80er und 90er Jahren des vorigen Jahrhunderts beobachteten Blattgallenrebläuse sind auf Grund seiner Infektionsversuche als solche des lothringischen Typus aufzufassen. RATHAY war auch bereits das im Vergleich zu Südfrankreich abweichende Verhalten seiner Versuchsreben aufgefallen, auf Unterschiede im Verhalten der Reblaus bezog er seine Beobachtungen indessen nicht.

Den ersten Nachweis über das *gleichzeitige Vorkommen* beider Reblausrassen im selben Seuchengebiet erbrachte im vergangenem Sommer THIEM, indem es ihm gelang, das Verhalten der Läuse im Klosterneuburger Rebgarten in Gegensatz zu bringen zum Verhalten anderer Blatt- und Wurzelrebläuse aus der Umgebung von Wien, Herzogenburg und Graz.

Eine wichtige Erweiterung der bisherigen Ergebnisse der biologischen Forschung brachte das Studium der morphologischen Details. Es gelang gewisse Unterschiede *im Verhalten der Rückentuberkel der Wurzelläuse* zwischen den Vertretern beider Rassen nachzuweisen. Der wichtigste Unterschied betrifft den Bau der Marginalhöcker der Hinterbrust, welche bei den Wurzelläusen der lothringischen Form fast immer zwei getrennte Knöpfchen bilden, während sie in der ungeflügelten Serie der Wurzelläuse der südfranzösischen Form bei normal chitinisierten Tieren zu einem einheitlichen Tuberkel verschmolzen sind. In der Nymphenserie unterscheiden sich die beiden Reblausformen in dieser Hinsicht nicht, jedoch sind die Tuberkel bei der südfranzösischen Form in der Regel erheblich grösser als bei der lothringischen. Das Letztere gilt auch für die ungeflügelten Wurzelläuse. Es gibt jedoch Individuen beider Formenreihen, die sich hinsichtlich der Grösse der Tuberkel nicht unterscheiden. Bei Untersuchung ganzer Kolonien gibt das Verhalten der Marginalhöcker der Hinterbrust bei den Ungeflügelten, soweit sich bis jetzt beurteilen lässt, sicheren Aufschluss über die Zugehörigkeit zu der einen oder anderen Reblausform.

Die morphologischen Eigentümlichkeiten der lothringischen Reblaus wurden auch an Material aus den übrigen deutschen Seuchengebieten (Süd-, West-, Mitteldeutschland) festgestellt. Ferner zeigen die Rebläuse in der Nordschweiz grossenteils dasselbe Verhalten; allerdings war in dem Material SCHEIDER-ORELLI'S nicht selten eine Wurzelreblausform mit verschmolzenen Marginalhöckern der Hinterbrust vorhanden, immer jedoch in Gemeinschaft mit zweihöckrigen Wurzelrebläusen und besonders an Tuberositäten der verholzten Wurzelteile. Ich halte daher diese besondere Form für eine Variation der lothringischen Rebläuse.

Die morphologischen Merkmale der in biologischer Hinsicht mit der südfranzösischen übereinstimmenden Reblaus wurden an Material aus Österreich entdeckt und an entsprechendem Material aus Südfrankreich bestätigt. Ob sie auch für das biologisch gleiche Material anderer Orte gelten, bleibt abzuwarten.

Da nun in den Reblauswerken von CORNU sowohl wie von GRASSI nur die zweihöckrige Reblaus abgebildet ist, muss geschlossen werden dass in Südfrankreich und Italien neben der einhöckrigen auch die zweihöckrige, d. h. neben der „südfranzösischen" auch die „lothringische" Reblaus vorkommt.

Dies wird noch wahrscheinlicher auf Grund biologischer Eigentümlichkeiten im Verhalten der Wurzelrebläuse. Es hat sich nämlich herausgestellt, dass die südliche Reblaus sich nicht nur an den Amerikanerreben, welche gegen die nördliche Reblaus immun sind, sondern auch an denjenigen Rebsorten *auf die Jungwurzeln beschränkt*, welche von der nördlichen Reblaus auch an den verholzten, ein- und mehrjährigen Wurzeln unter Tuberositätenbildung ansiedelt. Es erhob sich danach die Frage, ob diese südliche auf die Jungwurzeln sich beschränkende Wurzellaus etwa auch an der Europäerrebe nur die jüngeren Wurzeln befällt, und ob die Reblaus der verholtzten Europäerwurzeln auch in den südlichen Ländern „der nördlichen" Reblaus angehört. Die diesbezüglichen Infektionsversuche sind noch nicht zum Abschluss gelangt; vorerst ist eine Tuberositätenbildung an verholzten Wurzeln *nicht* eingetreten.

(Dies verschiedene Verhalten der Wurzelrebläuse erinnert sehr an ähnliche Unterschiede zwischen anderen unter sich verwandten Blattläusen, indem diese nicht selten an der Besiedelung bestimmter Teile derselben Wirtspflanze unterschieden werden können.)

Für die Praxis ist hieraus der wichtige Schluss zu ziehen. dass die südliche" Reblaus, trotzdem sie die weitaus grössere zahl der Rebensorten befällt, der weniger gefährliche Schädling ist und dass als Würger des europäischen Edelweinbaues in erster Linie wohl nur die sogenannte nördliche Reblaus in ihrer Tuberositätenbildenden Wurzellausform in Betracht kommt.

Nach diesen Feststellungen wurde der vom Referenten 1910 für die lothringische Reblaus aufgestellte Rassename *Pervastatrix* wieder eingezogen und durch die Artbezeichnung PLANCHONS „*Vastatrix*" wieder ersetzt. Die „südliche" Reblaus erhielt dagegen den der amerikanischen Reblaus von ASA FITCH 1854 gegebenen Namen „*Vitifolii*", obwohl nicht mit Sicherheit feststeht, ob FITCH Blattgallen der nördlichen oder der südlichen Reblaus vor sich gehabt hat. Sollte ersteres der Fall sein, so müsste eine Neubenennung der „südlichen" Reblaus erfolgen. Als Heimatpflanze der Letzteren wurde *Vitis riparia*, die Uferrebe im Missouristromgebiet, angenommen, während in Ersterer die Reblaus der *Labruscarebe* aus dem Alleghanygebiet erblickt wird. Daher erhielt diese den deutschen Namen *Fuchsreblaus*, jene den Namen *Uferreblaus*.

Es erscheint ausserordentlich wichtig, die mitgeteilten Beobachtungen durch solche im amerikanischen Heimatgebiete der Reblaus zu ergänzen und zu bestätigen. Sie sind für die Züchtung der Unterlagsreben richtung-gebend; denn im Falle ihrer Bestätigung erscheint es gerechtfertigt, die Selektion der Unterlagsreben nach ihrem Verhalten gegenüber der schädlicheren *Vastatrix*reblaus vorzunehmen. In diesem Sinne wird bereits seit Jahren an der Biologischen Reichsanstalt in Deutschland die Rebenselektion praktisch ausgeführt.

Nun gibt es aber auch Rebensorten (z. B. Aramon × Rupestris Ganzin I, Mourvèdre × Rupestris 1202, Cabernet × Rupestris 33a und 33a 1), an denen auch die *Vitifolii*-Reblaus in der Regel unter Bildung von Stichflecken an den Blättern und Wurzeln abstirbt, ohne zur Fortpflanzung zu schreiten. Es macht den Eindruck, als gäbe es Rassen der Sandrebe *Vitis rupestris*, die fast oder vollständig immun gegen *Vitifolii* sind, während sie die *Vastatrix*-Reblaus noch zumteil annehmen. Da nun aber die genannten Rupestris-Kreuzungen sich auch gegen die *Vastatrix*reblaus fast oder vollständig immun gezeigt haben, besteht die Hoffnung, durch planmässige Rebenzüchtung die Zahl der *gegen beide Reblausarten* praktisch immunen Rebensorten wesentlich zu vermehren und sie insbesondere hinsichtlich ihrer Eignung für die verschiedensten Boden- und Klimaverhältnisse zu verbessern. Zu diesem Zwecke müssen getrennte Zuchtstationen eingerichtet werden, in denen jeweils nur mit der einen Reblausart gearbeitet wird, deren Leitung aber in derselben Hand liegt. Es ist zu wünschen, dass an dieser für den Weinbau der Welt ausserordentlich wichtigen Aufgabe alle beteiligten Länder in kollegialer Arbeitsgemeinschaft beteiligt werden.

THE PENETRATION OF PLANT TISSUES AND THE SOURCE OF THE FOOD SUPPLY OF APHIDS [1]

BY

DR. J. DAVIDSON

The manner in which the food of aphids is obtained from the

[1] For a detailed and illustrated account of these investigations see DAVIDSON J, (1923) Ann. Appl. Biology, X, No. 1, pp. 35—54.

plant host is an aspect of the biology of these insects which has been very little studied.

[1]) BUSGEN (1891), PETRI (1908—1911) and ZWEIGELT (1914) have investigated the subject.

The following conclusions have been arrived at as a result of a detailed study of these problems by the writer in the case of *Aphis rumicis* L., *Macrosiphum rosarum* Walk., and *Myzus cerasi* F.

The food of aphids is the cell sap of plants, which they obtain by penetrating the tissues by means of a flexible chitinous piercing organ.

The piercing organ is composed of the maxillary stylets and the mandibles. The maxillary stylets have two grooves along their internal faces and are closely apposed, thus forming two canals which extend to the extremity of the compound maxillary stylet thus formed. The dorsal canal is the suction canal, along which the plant juices are conducted into the pharynx. The ventral canal is the ejector salivary canal down which the saliva is pumped into the plant.

The penetration of the piercing organ into the tissues is brought about by the retraction of the labium and the forward prolongation of the „forehead". The labium grips the piercing organ in a pincer-like manner at its distal end, thus supporting that structure, and at the same time assisting in forcing it into the plant tissues.

The course of the piercing organ in the plant tissues is evidently associated with the search after nutritive cell sap. With *Aphis rumicis* it passes between the epidermal cells, intracellularly through the cortex to the phloem elements of the vascular bundles. The richly branching tracks frequently seen in the phloem shows that this tissue affords an important source of the food supply. The cells of other tissues are however often drawn upon for food, such as the cortical cells and the mesophyll cells of the leaf. This is especially noted when the food plant is heavily infected. PETRI has shown in *Phylloxera* that the piercing organ passes through the cortical cells.

During the passage of the piercing organ through the tissues, saliva is secreted by the aphid and coagulated masses of saliva and cell sap are frequently seen in sections inside cells or intercellular spaces. The saliva destroys the middle lamella of the cell wall and thereby aids the penetration of the piercing organ. It also causes plasmolysis of the cells with which it comes in contact, and also disorganisation of the cell contents. Owing to the action of the saliva

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[1]) BUSGEN, M. (1891) Jena Zeitschr. f. Naturwiss. XXV, 340—428.

L. PETRI (1908) Centralbl. f. Bakt. II, XXI, 375—379; Id., (1909) Zeitschr. f. Pflanzenkr. XIX, 18—48; Id., (1910) Rendic. Accad. d. Lincei, XIX, 28—34; Id., (1911) Rendic. Accad. d. Lincei, XX, 57—65.

ZWEIGELT, F. (1914). Centralbl. f. Bakt. Abt. II, XLII, 265—335.

during the passage of the piercing organ a precipitation of substances is produced which forms round the piercing organ a thin walled tube or sheath the wall of which becomes irregularly thickened by secondary deposits.

Occasionally certain cells may react under the influence of the saliva, resulting in a cellulose thickening of the cell walls as may be sometimes seen in the case of *Macrosiphum rosarum* on the rose.

The sucking out process is chiefly intracellular, although intercellular suction also takes place, in which case the cells immediately surrounding the intercellular space concerned may be destroyed by the action of the saliva, the cell sap thus passing into the intercellular space.

It would appear therefore that the varying constitution and concentration of cell sap in different plants is an important consideration in connection with the biology of aphids.

„INTERNAL RUST SPOT" DISEASE OF THE POTATO TUBER. (SYNONYMS: SPRAIN, NET NECROSIS, EISENFLECKIGKEIT, KRINGERIGHEID, BUNTWERDEN AND MALADIE DES TACHES EN COURONNE).

BY

SYDNEY G. PAINE.

(Pl. VII)

There seems no doubt that the disease as we know it in England is the same as has been described under the various names given above.[1]) One distinguishes two separate types of this disease. In type „A", previously known in England and Ireland as „Sprain", the storage tissue of the tuber is spotted with islands of corky tissue of a reddish-brown colour (Fig. 1); these may be quite small or as large as half a centimetre in diameter, and may break at the centre to form cavities. In type „B" known in England and America (3) as „Net Necrosis" fine strands of corky tissue of a dark brown or chocolate colour run for considerable distances through the tissue; frequently these radiate from the pith to the vascular ring and appear to follow the lines of tne internal phloëm, in which case the disease exactly resembles the „Frost Necrosis" shown by JONES, MILLER

[1]) Dr. QUANJER (5) has urged a plea for uniformity in the nomenclature of this disease and has suggested the name „Suberosis". One is entirely in sympathy with Dr. QUANJER in this plea and the name certainly described the main feature of the disease but it might equally be applied also to other diseases of the potato, such as Corky Scab, and Common Scab, and for this reason I have not seen fit to adopt it. The question of nomenclature is one which might well be referred for the decision of this conference.

and BAILEY (2) to be the result of freezing (Fig. 2). The brown strands are not necessarily confined to the phloëm however, as they often occur in the cortex where such elements are not likely to be present. Other types of disease such as „Bruise" and „Streak" described by HORNE (1) and the concentric rings described by SWELLENGREBEL (6) and QUANJER (5) are in all probability produced by the same organism though at present the author has failed to isolate it in these cases.

Many investigators being unable to find any causal organism and not succeeding in reproducing the disease by inoculation of diseased tissue upon healthy tubers have believed this disease to be due to some physiological disturbance. QUANJER (5) and HORNE (1) have expressed their belief in a bacterial origin though they have failed to isolate any organism capable of producing the disease. SWELLENGREBEL (6) in a lengthy paper claims to have succeeded in infecting tubers and reproducing symptoms of the disease, the figures in this paper however are not convincing and the claim that common soil organisms such as *Bacillus mesentericus* and *Bacillus megatherium* may produce the disease is difficult of acceptance. It seems probable that SWELLENGREBEL had the real causal organism but failed to free it from others with which it was associated. One of the organisms, that which he describes as giving the best results, may have been the same as the one described below but its action in producing disease can only have been slight and the description of the organism given by SWELLENGREBEL is not sufficient to establish its identity.

The Isolation of Pseudomonas solaniolens n.sp.

This organism was first isolated by the author in 1917 as stated in a preliminary communication in 1918 (4). The infection experiments made at that time, though on the whole positive, were not strikingly successful. It is now five years since the appearance of this preliminary communication and during this period the same organism has been isolated time after time; the results of inoculation however were somewhat capricious; clear indications of typical disease being followed by failures in later attempts which suggested that the organism rapidly lost its virulence. It is only within the last two years that more satisfactory evidence of disease has been obtained experimentally.

The organism occurs in two strains, variations or perhaps mutants; as usually isolated it is not characterised by any particular odour; but two years ago and four times since then a strain was obtained which possessed a very penetrating earthy-potato smell resembling closely that which we associate with a potato cellar. This was very striking and encouraged one to think that virulence of the organism might be correlated with this phenomenon; this, however, has not been established in later experiments, almost identical symptoms of disease having resulted from inoculation with both the smelling and the non-smelling strains. The inoculation experiments during the past two years have been considerably more successful than earlier ones, due mainly to an improved method of inoculation. These experiments, it must be stated, have not yet given the same general infection as is met with in the naturally diseased tuber but the local infection produced at the point of inoculation shows symptoms of disease which cannot be distinguished macroscopically or microscopically from those of the original disease and lead one to the opinion that further extension of the disease is only a matter of striking the right conditions.

The Method of Inoculation.

In order to introduce the inoculation material into the potato tuber with as little disturbance of the internal conditions as possible the following method was devised. In the tuber, sterilised on the outside with mercuric chloride, a hole some two or three centimetres deep and half a centimetre wide was made with a sterile carpenter's twist drill or augur. The bacterial slime used for inoculation was inserted and the hole plugged with a core of potato cut with a sterile cork-borer from another tuber of the same variety. The core was forced into the hole by a glass rod sliding in the cork-borer; in this way the hole was completely plugged all the air being driven out and the bacteria lying between the walls of the hole and the plug. The inoculated tuber was either planted in soil or kept in a waxed cardboard box.

The Results of Inoculation.

The earliest experiments seemed to show that the disease progressed slowly and this is borne out by observations of the disease as it occurs in stored tubers. These early experiments were made by inoculating the organism on the surface of sterile slices of potato in moist chambers. As these vessels were kept for a long time and were opened periodically for replenishing the water they often became contaminated with the common sporing organisms which produced a wet rot, the result being a rotted mass with a margin of corky tissue of a typical reddish-brown colour. Where contamination has been avoided the cork formation has been limited to a depth of one or two millimetres and the disease produced has usually been of type „A" (Sprain) but occasionally the inoculated surface has shown a stippling with brown spots which can then be traced as threads running into the tissue for two or three millimetres;

we thus have a surface infection of type „B" (Net Necrosis). It is difficult to understand why the same organism should act on the tissue in these different ways but the fact has now been definitely established by numerous observations. Once or twice there has been observed a patch of corky tissue of type „A" on the under side of the slice and on critical examination fine brown threads have been traced to it from the upper inoculated surface. These results with surface infection of potato slices were obtained six years ago. By the later method of „plug" inoculation contaminations have been very rare and the results have been more consistant. After three or four weeks incubation of material inoculated in this way one finds the core reduced to a hard shrivelled corky mass, the hole usually widened towards the bottom and the walls thickly suberised with a brown mass of cork having finger-like projections running out into the surrounding tissue; the suberised walls of the cavity are usually about two to three millimetres thick. This suberisation is exactly characteristic of the corky masses in the disease type „A" and when sectioned and stained is indistinguishable from it, the fingerlike projections appear to be attempts at further invasion of the tissue which have been frustrated by the formation of a barrier of wound cork. In two or three experiments threads of cork have been traced running into the tuber for more than a centimetre and these exactly resemble those of Net Necrosis. We thus have both types „A" and „B" arising from the same inoculation (Fig. 3).

In order to observe the extent of the penetration of the tissue use was made of the soft-rotting organism *Bacillus atrosepticus* and the whole of the unattacked tissue was rotted away leaving a cylinder of suberised tissue. The walls of these cylinders are thick and roughened on the outside by the numerous projections. (Fig. 4 , A).

Control experiments wherein the process of inoculation is imitated exactly as far as the cutting and plugging is concerned show the following features. The plug remains intact and sometimes becomes grafted to the tuber tissue; usually, however, a wound cork forms at the surface of contact between the plug and the surrounding tissue. On removal of this cork by rotting, as described above, the cylinder of cork is seen to be very thin and quite smooth. (Fig. 4, B.)

Brief Description of the Organism causing the Disease.

The organism is a small oval non-sporing rod, motile by a single very long polar flagellum and possessed of a penetrating smell of earthy potato. These features suggest for it the name *Pseudomonas solaniolens*. It grows readily on all the ordinary culture media and produces on gelatine a very striking irredescence when viewed by transmitted light. Gelatine is not liquified and the colonies are round. Colonies on potato-mush agar and on potato plugs are of a pale buff colour (Ridgway's Tilleul Buff) and the potato plug is not discoloured. Glucose in broth is fermented with the production of acid but no gas, no acid is produced from lactose, sucrose, mannite, and glycerine; nitrates are not reduced; the action on potato starch is feebly diastatic; litmus-milk changes slowly becoming a firm pink curd without gas and without any sign of casein digestion.

As stated above, the organism exists in two strains, a smelling and a non-smelling variety; the non-smelling strain is the one usually isolated from diseased potatoes, but the smelling strain has now been obtained on four separate occasions. After prolonged culture specially in the sugar broths the smelling strain has passed into the non-smelling one. The latter differs from the former in certain other features also; morphologically it is slightly larger and more coccoid, it is moreover non-motile; culturally it grows rather faster than the smelling strain and produces spreading colonies on the surface of agar and gelatine; physiologically, it behaves in exactly the same way and could not be distinguished from the smelling strain. Both forms of the organism seem to be equally virulent in the laboratory.

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THE SUPPOSED RELATION OF POTATO SKIN SPOT TO CORKY SCAB [1]

BY

W. A. MILLARD AND SYDNEY BURR

Skin spot (Oospora pustulans). This disease was worked out in

[1]) A complete illustrated account of this work will appear in the „Bulletin of Miscellaneous Information", Royal Botanic Gardens, Kew.

England by OWEN (1919) who stated the causative organism to be *Oospora pustulans*. Inoculation experiments carried out by this worker were not, however, entirely conclusive.

Corky Scab (Spongospora subterranea) is known in America as Powdery Scab.

In a recent paper by SHAPOVALOV (1923) on the „Relation of Potato Skin spot to Powdery Scab" the conclusion is drawn that Skin spot in itself is not a definite disease, but that the pustules commonly known by that name are the immature sori of Corky Scab, i. e. the two diseases are synonymous.

The importance of this statement lies in the fact that Skin spot is extremely common in England on seed potatoes of certain varieties, e. g. „King Edward" and „Ally".

One of the principal points of evidence adduced by SHAPOVALOV in support of his theory is that he failed to reproduce Skin spot with pure cultures of *Oospora pustulans*.

The present writers have succeeded in reproducing typical Skin spot pustules in abundance in their inoculation experiments with *Oospora pustulans*, and they are also able to show that the structure of these pustules is extremely characteristic and essentially different from that of Corky scab sori.

They are thus confident that there is no relation between the diseases of Corky Scab and Skin spot, and that the causative agent of the latter may now be considered as definitely established as *Oospora pustulans*.

The experiments also show that the most susceptible points of infection in Skin spot disease are the „eyes" of the tubers, which are injured and sometimes destroyed by the fungus.

DIE ANATOMISCHEN UND MIKROCHEMISCHEN VERÄNDERUNGEN DES KARTOFFELLEPTOMS

VON

DR. VON BREHMER

(Tafel V en VI)

Die verschiedene Auffassung über die Korrelation der Leptomnekrose QUANJER's zur Blattrollkrankheit veranlasste meine Studien über die Entwicklungsgeschichte der Leptomnekrose in der Kartoffelpflanze. Meine Arbeiten erstreckten sich über mehrere Jahre und wurden an deutschem, amerikanischem und holländischem Untersuchungsmaterial durchgeführt. Das von mir selbst gesammelte holländische Material entstammte den Versuchsfeldern Prof. QUANJER's. Als Ergebnis der Untersuchungen konnte ich feststellen, dass drei in ihrer Erscheinung nicht erkannte und von einander unabhängige pathologische Vorgänge im Kartoffelleptom bisher unter den einen Begriff Leptomnekrose zusammengefasst worden waren und dass daraus sich die verschiedenartige Beurteilung, teilweise Ablehnung der Korrelation zwischen Leptomnekrose und Blattrollkrankheit erklärte.

Die drei Veränderungen, welche im Kartoffelleptom vorkommen können, sind: Nekrobiose, Nekrose, und Obliteration.

I. Die Nekrobiose des Kartoffelleptoms.

Die Nekrobiose ist allen Kartoffelpflanzen, ob gesund oder krank, eigen. Sie ist ein Verquellungsvorgang, der in den Zwickeln der älteren Leptomteile, gewöhnlich nahe den Bastfasern beginnt und sich allmählich auf die jüngeren nachwachsenden Leptomgewebe erstreckt. (Tafel V, Fig. 1—5.) Die Zwickel erweitern sich zunächst, bekommen ein knolliges Aussehen und die Wandlamellen verlieren ihre dichte Anlagerung. Nach Uebergreifen der Aufquellungen auf umliegende Zellwände tritt infolge Aufquellens derselben die knollige Zwickelverquellung zurück. Das ganze Gewebe erhält ein gleichmässig verquollenes Aussehen. Der Zwickelraum und das Lumen der anliegenden Zellen verschwinden durch fortgesetzte Verquellung, nicht durch Zusammendrücken infolge turgeszenter Nachbarzellen. Befallen werden Siebröhren, Geleitzellen und Parenchymzellen. Die der Mittellamelle anliegenden Wandpartieen sind stärker verquollen als die der Mittellamelle abgekehrten. Optisch erscheinen die mittleren Wandpartien hellglänzender als die äusseren. Den Fortgang der Verquellung zeigt Fig. 5, Tafel V. Die Lumina älterer Zellen sind verschwunden (Fig. 5 ×), die jüngerer rundlich verengert, die junge Zellen unverändert. Gelbverfärbungen der Wände und Gewebezerrungen treten nicht auf. Im Endstadium verquellen ganze Zellkomplexe einschliesslich der äusseren Wandlamellen. Der Zusammenhalt der Zellen ist gestört. Gelatinöse Zellulosemassen erfüllen eine ursprünglich viele Zellen umfassende Lücke. Im Längsschnitt (Tafel V, Fig. 6) sind die Wandverquellungen durch * gekennzeichnet. Die Siebröhren enthalten einen Kern (Tafel V, Fig. 7—9), sind also als normale Zellen aufzufassen, die aus Protoplasma und Zellkern bestehen. Die nekrobiotischen Zellen werden nicht zusammengedrückt, sondern ihr Lumen verkleinert sich allmählich dem Grade der Verquellung entsprechend. Die innere Oberfläche der verquellenden Zellen ist rundlich. Sie behalten ihre Turgeszenz bis kurz vorm Verschwinden des Zelllumens, d. h. bis dasselbe sich mehr als $^2/_3$ seiner ursprünglichen Ausdehnung verengert hat. Dann stirbt die Zelle ab (Tafel V, Fig. 9). Das abgestorbene Protoplasma liegt als dichter Belag der Wand an. Später wird die nekrobiotische Zelle zusammengedrückt, ihr Lumen verschwindet und hinterlässt einen geraden bis schwach bogigen Spalt (Tafel V, Fig. 9a), der nicht bleibend ist, sondern in der Quellmasse verschwindet. Die Quellmasse besteht aus einer Mischung von Zellulose, Wasser und Schleim (Nachweis: Mazerationsverfahren mit Salzsäure in Alkohol). Sie bildet sich in Zellkomplexen, welche infolge Neubildung von Leptomgewebe nicht mehr für den Leitungsprozess benötigt werden. Die verquollenen Zellen werden ihrer ursprünglichen physiologischen Bestimmung enthoben und übernehmen die sekundäre Funktion des Wasserspeichers für nachwachsende jüngere Leitungsgewebe. Da die alten Gewebe aus dem Lebensbereich der Kartoffelpflanze nicht endgültig ausscheiden, sondern, obwohl sie an und für sich abgestorben sind, einen Funktionswechsel vornehmen, habe ich sie mit nekrobiotisch bezeichnet. Menge und Grad der nekrobiotischen Verquellungen sind für ein und dieselbe Kartoffelsorte verschieden. Sie finden sich besonders dort, wo das Leptom mächtig ausgebildet ist, wie unter den Stengelflügeln, an den Blattknoten, in den Blattmittelnerven, auch im markständigen Siebgewebe. In den Knollen sind nur nekrobiotische Anfänge zu finden. Frühsorten haben mehr Nekrobiose als Spätsorten. Anhaltende Trockenheit besonders in der zweiten Hälfte der Vegetationsperiode begünstigt die Nekrobiosebildung. Knollen aus Ernten feuchter Jahre haben mehr Nekrobiose wie solche normaler Jahre. Im allgemeinen lässt sich sagen, dass in günstigen Jahren die Leptomveränderungen nur älteren, in ungünstigen Jahren fast allen Teilen der Kartoffelpflanze eigen sind, ferner dass je geringer die Assimilationsenergie, also je geringer die Beanspruchung der Siebelemente für die Leitung der gebildeten Kohlehydrate ist, desto stärker die Verquellung der Leptomwände und desto zahlreicher die der Nekrobiose verfallenen Leptompartien. Diese Korrelation tritt bei der Pflanze selbst insofern ein, als bei geringerer Leitungsbeanspruchung erst die markständigen Siebbündel, dann die der Rinde ausser Funktion gesetzt werden.

Im polarisierten Lichte bleibt nekrobiotisches Gewebe sichtbar. Die verquollenen Zellwände erscheinen homogen leuchtend, die Zelle an sich etwas vergrössert (Tafel VI, Fig. 10a).

Mikrochemisch verhält sich nekrobiotisches Gewebe wie die gesunden Zellulosewände. (Tafel VI, Fig. 11—13, Tafel V, Fig. 16—17.)

II. Die Leptomnekrose Quanjer's.

Untersucht wurden u. a. besonders von QUANJER als einwandfrei krank bezeichnete Kartoffelstauden. Die Leptomnekrose beginnt nicht mit Zwickelaufquellung, sondern an willkürlichen Stellen des Leptoms. (Tafel VI, Fig. 2). Sie steht mit der Zwickelverquellung in keinen ursächlichem Zusammenhang, obschon bei fortschreitender Nekrose verquollene nekrobiotische Zwickel in Mitleidenschaft gezogen werden können. In diesem Falle erweitert sich der Zwickelraum nicht, sondern sinkt in sich zusammen. Eine Verfärbung des Gewebes ist im Anfangsstadium nicht zu beobachten. Bei Ausbreitung der Nekrose (Tafel V, Fig. 10—12; Tafel VI, Fig. 6) sinken die befallenen Zellen schnell zusammen, sterben endgültig ab, ihr Kern korrodiert, das Plasma schrumpft. Die nekrotischen Zellen hinterlassen je nach dem Grade der Erkrankung entweder ein Lumen, dessen Innenoberfläche stark zerrissen oder effiguriert ist (Tafel V, Fig. 10 und 13) oder infolge des Drucks der umliegenden turgeszenten Zellen nur noch einen dunklen, deutlich hervortretenden unsymmetrischen, vielzackigen, aber bleibenden Spalt. Die Gewebe strecken sich mehr oder weniger stark und verfärben sich gelb bis bräunlichgelb. Bei Beginn der Nekrose tritt Wandverdickung ein, die in vorgeschrittenerem Stadium wieder abnimmt. Die Verdickungen selbst sind verschieden stark, jedoch bedeutend geringer und von anderer Natur als die der Nekrobiose. Gewöhnlich sind die Wandaufquellungen unbedeutend, seltener stärker. Der Grad der Wandaufquellung ist abhängig von der Schnelligkeit des Absterbens der Zelle. Treten Nekrosenester in sehr stark verquollenem Gewebe auf, dann ist ursprüngliches nekrobiotisches Gewebe später von Nekrose befallen. (Tafel VI, Fig. 3, 4, 5, 7.) In solchen Fällen tritt Gelbverfärbung der Gewebe von vornherein auf. Tafel VI, Fig. 5 zeigt einen extremen Fall, in dem die nekrobiotische Entwicklung durch Nekrose unterbrochen wurde. Die ursprünglich homogen verquollenen Zellen effigurieren, die Wände beginnen zu zerfasern (Erregertätigkeit?). Es scheint, als ob Nekrose mit Vorliebe im nekrobiotischen Gewebe auftritt. Sind Erreger die Ursache der Nekrose, dann scheinen sie in der Quellsubstanz einen günstigeren Nährboden zu haben, als im Inhalt der Zelle. Besondere Kennzeichen der nekrotischen Zelle sind ihre zerrissene innere Oberfläche oder der zackige Spalt, Gewebezerrungen und Gelbverfärbungen. Bei nicht nekrobiotischen also normalem Gewebe tritt Gelbverfärbung der Zellwände durch Nekrose erst im vorgeschrittenen Stadium ein, im Endeffekt ist sie immer vorhanden. Bei nekrobiotischem Gewebe erscheint die Gelbverfärbung durch Nekrose schon im ersten Anfangsstadium und ist im Endeffekt an Intensität gesteigert. Eine Sorteigentümlichkeit ist die Gelbverfärbung nicht. Die gelben Einschlüsse in Interzellularen, die bekanntlich bei den meisten Pflanzen vorhanden sind, dürfen mit den Gelbverfärbungen verursacht durch Nekrose nicht verwechselt werden. Die nekrotischen Siebröhren (Tafel VI, Fig. 1) erscheinen im Längsschnitt teilweise oder völlig zusammengesunken. Die teilweise zusammengesunkene Zelle zeigt im Querschnitt ein zerrissenes Lumen; die zusammengedrückte, den dunklen unregelmässigen Spalt. Die Siebplatten leisten dem Druck der umliegenden turgeszenten Zellen Widerstand. Sie sind meist plan oder infolge des Drucks schwach gebogen. Die auf den Siebplatten lagernden rundlichen Kalluspolster (Tafel V, Fig. 6) werden bei nekrotischen Zellen in das Innere der Siebröhre hineingepresst (Tafel VI, Fig. 1.). Der Inhalt kranker Siebröhren ist stärker gekörnelt als der gesunder. Tafel VI, Fig. 6 veranschaulicht nekrotisches Gewebe zwischen nekrobiotischem und gesundem. Dasselbe Bild polarisiert (Tafel VI, Fig. 10a) lässt zwischen gekreuzten Nikols den gelbgefärbten nekrotischen Gewebestrich ohne Zelldifferenzierung schwach leuchtend oder ausgelöscht erscheinen. Holz und Bast dagegen treten hellleuchtend hervor (Tafel VI, Fig. 10b). Die Gelbverfärbung des Nekrosegewebes ist daher nicht auf Verholzung zurückzuführen.

Brauchbare mikrochemische Reaktionen zur Erkennung der Nekrose sind:

1. Millon's Reagenz: Bei gleichzeitiger schwacher Erweiterung der zusammengesunkenen Siebröhren, treten dieselben infolge des rotbraungefärbten Inhaltes deutlich hervor.
2. Reaktion von Mäule (Tafel VI, Fig. 11—12) färbt das nekrotische Gewebe durch die oxydierende Wirkung des Mangans als Folge des säureren Charakters zunächst schwarzbraun, ebenso den Inhalt gesunder Zellen und Holzgewebe. Zellulose und Nekrobiose werden schwach rötlichgelb. Nach Zusatz von Salzsäure und Ammoniak entfärbt sich das nichtverholzte Gewebe einschliesslich der nekrotischen Teile. Nur die Zellinhalte behalten eine Zeitlang eine schwach grünlich-gelbe Färbung. Der ursprüngliche Gelbstoff des nekrotischen Gewebes ist zerstört. Holz und Bast färben sich dunkelweinrot. Auch diese Reaktion beweist das Fehlen von Holzbestandteilen im Nekrosegewebe.
3. Jodjodkalilösung mit anschliessendem Zusatz von Schwefelsäure (Tafel V, Fig. 14—15) verursacht starke Jodablagerung im nekrotischen Gewebe. Dass keine Holzablagerungen in diesem, trotz der fast gleichen Färbung des Holzes (Tafel V, Fig. 14a) sind, beweist der Jodumschlag in blau nach Zusatz von Schwefelsäure (Tafel V, Fig. 15—15a). Beim Ablauf der Reaktion verzögert sich der Farbumschlag des Nekrosegewebes in blau, im Gegensatz zur gesunden Zellulose und Nekrobiose. Der Grund ist, dass vorher infiltrierte Kallose erst gelöst werden musste.
4. Die Phloroglucin-Salzsäure-Reaktion (Tafel V, Fig. 16—16a)

weist ebenfalls auf Abwesenheit von Holzbestandteilen im nekrotischen Gewebe hin. Eine gewisse Farbähnlichkeit besteht zwischen dem Inhalt der nekrotischen Zellen und Holz. Ersterer verfärbt sich braunrot, letzteres violettrot. Die Zellulosemassen bleiben gelb. Bräunlich-rote Schattierungen in der Umgebung der nekrotischen Zellen sind auf in ihre Zellwände infiltrierte Zellinhaltsbestandteile, nicht aber auf Holzeinlagerungen zurückführen.

5. Chlorzinkjod zeigt: dass je grösser der Wassergehalt der Wände, desto geringer ihre Reaktionsintensität ist und dass die Quellung, also der Wassergehalt in der Mitte der Wände und in den Zwickeln stärker ist als in den Randpartien. Die Verquellung nicht nekrotischer Gewebe beginnt also von innen. Die nekrotischen gelben Wände sind von feinen blauen Linien durchzogen. Die Zellulose ist also an sich nicht völlig zerstört, nur bestimmte Teile von ihr müssen sich geändert haben, weil allein durch intermolekulare Einlagerung von irgendwelchen Stoffen der Zellulosecharakter nicht so stark herabgedrückt werden kann.

Bei den vielen von mir untersuchten Kartoffelstauden ob gesund oder mit irgendeiner Staudenkrankheit behaftet habe ich die Leptomnekrose nur bei blattrollkranken Pflanzen finden können. Fand ich dieselben auch bei anderen Staudenkrankheiten. dann waren diese ausserdem noch blattrollkrank. Die Untersuchungen haben gezeigt, dass in ein und derselben Kartoffelstaude verschiedene Krankheiten gleichzeitig auftreten können, und dass die Ansicht QUANJER's, dass zwischen Leptomnekrose und Blattrollkrankheit eine Korrelation besteht, also die Leptomnekrose für Blattrollkrankheit typisch sei, zu Recht besteht.

III. Die Obliterationen des Kartoffelleptoms.

Die auf Tafel VI, Fig. 8—9 wiedergegebenen Veränderungen des Kartoffelleptoms treten niemals bei noch wachsenden Pflanzenteilen auf, sondern nur bei solchen, die kurz vor der Ernte gesammelt, deren Blätter und Stengel mehr oder weniger stark vergilbt, deren Zellen also im Absterben begriffen sind. Diese Veränderungen sind typische Alterserscheinungen. Das ganze Phloemgewebe ist mehr oder weniger gleichmässig und stark verdickt, tangential oder radial zusammengedrückt und gestreckt. Gelbverfärbungen treten nicht auf. Die Siebelemente speziell sind zusammengesunken, ihr Lumen ist noch sichtbar, die charakteristischen Spalten der Nekrose fehlen. (Fig. 8 ist ein Schnitt durch das rindenständige Leptom eines unterirdischen Stengelteiles der Sorte Beseler.) Ziemlich gleichmässige Wandverdickungen verlaufen in tangentialer Streichrichtung. Nekrobiose verfällt ebenfalls diesem Altersprozess, Nekrose nicht. Altes verzerrtes, teilweise zerrissenes nekrobiotisches Gewebe liegt unter den Bastfasern der Fig. 9. Diese Gewebeveränderungen haben mit Nekrose und Nekrobiose nichts gemeinsam. Sie sind „Obliterationen der Siebröhren", weil die befallenen Zellen ihres Inhalts entleert sind, d. h. für die Leitung der plastischen Reservestoffe nicht mehr benötigt werden wenn auch bei den Obliterationen der dicotylen Hölzer die einzelnen Zellen stärker zusammengesunken und die Zerrungen der Gewebe ausgesprochener sind. Bei den Kartoffelstauden sind diese Gewebeveränderungen Anfangsstadien der Obliterationen, die deswegen nicht so typisch sind, weil die Kartoffel einjährig ist und die Gewebespannungen nicht zo weit durchgeführt werden konnten, wie bei Hölzern. Die Obliterationen beginnen nicht an einem Punkte, um sich auf das ganze Phloem auszudehnen, sondern dort, wo zur Zeit gerade die Gewebe ihres Inhaltes entleert sind und nicht mehr für die Leitung von Stoffen in Frage kommen. Neben Siebröhren und Geleitzellen verfällt auch das Rindenparenchym der Obliterationen. Die Veränderung der einzelnen Zellen ist nicht Ursache der Gewebezerrung, sondern radialer Druck und tangentialer Zug.

Zusammenfassung:

Bei einwandfrei gesunden Pflanzen tritt Nekrose nicht auf, sondern nur Nekrobiose und Obliterationen.

Bei einwandfrei nur blattrollkranken Pflanzen sind nekrotische und nekrobiotische Leptomveränderungen immer vorhanden, Obliterationen seltener.

Die anderen bisher bekannten Staudenkrankheiten stehen mit der Blattrollkrankheit in keinem ursächlichen Zusammenhang.

Im Gegensatz zur Nekrose sind Nekrobiose und Obliteration Alterserscheinungen. Letztere sind voneinander verschieden.

Die nekrotischen Veränderungen des Siebgewebes nehmen in den Siebröhren ihren Anfang und verbreiten sich von dort auf die umliegenden Gewebe.

Der Inhalt der nekrotischen Zellen hat säureren Charakter als der benachbarter gesunder Zellen.

Die Siebröhren der Kartoffelpflanze enthalten einen Kern.

SESSION ON TUESDAY JUNE 26, 9 A.M.
IN THE GREAT HALL

ORGANISATION AND METHODS OF THE PHYTOPATHOLOGICAL SERVICE OF HOLLAND

BY

N. VAN POETEREN

Holland has been in the possession of high-standing cultures for a long time. The bulb-culture was started even before the year 1600. Cabbage-growing in our cabbage-district of North-Holland was in 1619 already of considerable extent, and the production per Acre is so high, that foreigners are frequently reluctant to believe it. And this is scarcely to be wondered at, when I relate that two big cabbage yields of the same field is the rule there in *one* year. The potato-culture with us is highly intensive and produces very large crops. The average yield for the Netherlands is 241 Hectolitres per Hectare; in the province of Groningen it amounts to 329 Hectolitres per Hectare. And I could mention various similar examples.

While the high standing of the culture, and the large crops of fine healthy produce may be largely due to our peculiar soil and climate, it is in no slight measure the reward of proper tillage, heavy, but judicious manuring, skilful husbandry, and vigorous weeding, and last, but not least, the fighting of diseases has played a great part in it all. And naturally, for after making the most of the circumstances, but conducting a less intensive fight against diseases, the one thing in one's power to improve upon the quantity and quality must finally lie in a better fight against diseases.

This indeed we have taken in hand since early days. I will not go into the details of the history of the development of our labours in this respect, suffice it to say that already in 1869 RITZEMA BOS began his information work. And it is above all the information work, which has made such progress in our country.

First RITZEMA BOS alone, then from 1896 in the „Willie Commelin Scholten" Phytopathological Laboratory of Amsterdam, to be followed up by the more extensive Institute for Phytopathology at

Wageningen, and finally the still far more comprehensive Phytopathological Service were especially engaged with the application of the phytopathological science. You are all aware of what has been done as regards investigation in our country, amongst others by QUANJER and OORTWIJN BOTJES to counteract the potato-diseases, but for years already we too have been very intensively engaged, and our entire Service is so arranged, that the knowledge acquired can immediately be put into practice.

This is the primary business of the P. S. The result is that a general movement to combat diseases has arisen, and all the horticulturists and agriculturists have been roused to the sense of the desirability to co-operate in this great work. And by this means again we have been enabled to carry on our second great work, the controlling of the plants and produce destined for export, on such an extensive scale, and at the same time so intensively.

I will first give you a brief outline of what our Phytopathological Service is doing to further a general fight against diseases.

I would here point out the great advantage we have, in possessing so small a country and consequent easy survey, rendering one central management for this entire branch possible, nay even desirable. But at the same time I would remark upon the highly intensive cultivation, and the extensive horticultural centres which we possess, and which necessitate our having a large staff of assistants in our employ.

The work here indicated is divided over the following sections:

1. Section for investigation and information.
2. Section for propaganda for fighting diseases in horticulture.
3. Section for propaganda for fighting diseases in agriculture.
4. Section for Ornithology.
5. Section for the execution of legal measures.
6. Section for Exhibitions, Museums and Collections.

1. The section for investigation and information creates the opportunity for all those in the country who desire such, to obtain advice with regard to diseases and insects infesting their plants, and how to combat them. In the first place this occurs at Wageningen, where the laboratories are situated and the scientific staff is established. The unknown cases, which our employés stationed outside Wageningen discover on their rounds of inspection, are examined at Wageningen as well, forasmuch as they do not present a subject for closer investigation by the two other institutions in Holland which are exclusively engaged in such investigations.

Much information, however, is given by our assistants established outside Wageningen to the growers direct, of course in cases where there is no call for a special investigation as to the nature of the disease.

The centralization of this advice-work has led to the section in question occupying itself both with the animal and the vegetable or atmospheric causes, while advice is even given upon domestic stores which have not kept well.

2 and 3. This advice work has undergone considerable development in a particular way since 1912 by special propaganda for the combating of a smaller, but more generally occurring, number of diseases and insect-pests.

During the activities of the former Institute for Phytopathology it had been found, that the giving of advice alone to those who sought it, was insufficient to attain the object in view. As a matter of fact there will always be persons everywhere, who take too little account of the cause of a decrease in their crops, or attribute it rather to something against which, in their opinion, there is no remedy, while in many cases it is quite the contrary. Consequently, especially in a small country like ours, the opportunity for obtaining advice on application had to be supplemented with the giving of advice to those who had not solicited it but yet were in no less need.

With this work two sections of our Service are engaged, the one on behalf of the horticulture, and the other on behalf of agriculture. As subject for propaganda, the diseases and insects are taken which are of common occurrence, and for which a good remedy had been found, but is yet more or less neglected.

The propaganda is conducted most intensively, through personal calls at the nurseries, through lectures, reports in the papers, propaganda-pamphlets and field-demonstrations. A properly conducted propaganda may lead to the plague being practically stamped out.

A striking illustration of this kind is afforded in the history of the campaign against the cabbage-fly *(Chortophila Brassicae)*, which can inflict considerable injury in different places, above all to early cauliflowers, particularly in dry spring seasons. As a protection against this insect, we knew, in common with yourselves, of the cabbage-collars, but in spite of their being regularly recommended by us, very little headway was made until the year 1918. Now in a few short years the Ph. S. have succeeded in making the cabbage-collar a universal and popular means of fighting the cabbage-fly. In the first year of our propaganda 5.000 cabbage-collars were laid round the plants; the second year 40.000, next 200.000 and then 800.000, while in 1922 the number increased to 1.800.000.

What this means for the cabbage-growers will be patent to all, but the amount of labour involved in getting a sufficient supply of the collars, and ensuring that they found purchasers and were properly put on, can only be fully appreciated by those employed in our Service, who put the work through. Similar work has also been carried on with regard to other disesases affecting horticultural plants (Lampronia rubiella on raspberries, Incurvaria capitella on currants, winter moth, and others) and with divers agricultural crops (smut of grain, stripe disease of barley, seedling-blight of beet).

In different cases the efforts are concentrated on demonstration at the field, for instance when the characteristics of the symptoms of the disease are best observed from an inspection of the growing crops. This is particularly the case with the potato-diseases, so that special practical lessons in phytopathology were held in different parts of the country, for the growers on their own land.

This work goes hand in hand with what is being done by the Phytopathological Service in order to get the proper attention given to plant-diseases at the field-inspection of crops, held by different agricultural and horticultural associations in our country. These field-inspections have as object, and actually do assist in a very great degree, the trade in genuine sowing-seed and setting-material free from disease. To produce these, the controllers of the agricultural and horticultural associations test the crops while still afield (and afterwards also when parcelled). It is clear that the investigation as to plant-diseases which could be transmitted with the sowing-seed or setting-material plays an important rôle here. The two sections for horticultural and agricultural propaganda as a matter of fact occupy themselves very intensively with these testings.

4. Of peculiar interest is our ornithological section. The protection of insect-eating birds is the most important form of biological attack which we apply in our country, and this takes place principally in our woods, parks and country-estates; and partly also in orchards. This protection of insect-eating birds, by providing nesting-opportunity (nest-boxes) has developed remarkably. On many large country-estates hundreds of those boxes are hanging, at the „Oranje Nassau's Oord", one of our observation-grounds, there are no fewer than 320 hanging on an area of 140 H.A.

The results obtained from this bird-culture at the same time furnish a portion of the material for the investigation as to the factors determining the increase or decrease in the number of birds and their habits, their dependence upon their surroundings, their mode of life, and phaenology.

Both the horticultural and the agricultural, as well as the ornithological section, avail themselves in their work not only of the services of our technical officers spread all over the country (see map) but at the same time have some hundred correspondents at their command, that is to say mostly practical agriculturalists or horticulturists, and teachers, who give their services gratuitously in desseminating knowledge, making propaganda for means of attack, and collecting information.

From this it may be seen how intensively our country is worked with regard to the fight against plant-diseases.

5. Against two diseases only do we possess a law which regulates the mode of attack, i. e. against the American gooseberry mildew and the potato wart-disease.

The danger from the former disease with which our gooseberry-culture seemed to be threatened a few years back, I consider to have been overcome. We have been able to counteract the injurious consequences of this disease by a systematic winter-pruning, so that we have every year a very large quantity of mildew-free gooseberries for export.

Now, however, that the attack is still simpler and more efficacious by the application of our alcalic Burgundy mixture whereby the entire gooseberry harvest can be kept free of mildew, this disease has lost all terror for us, and after an acquaintance with our remedy the same may apply to other countries as well.

The fight against the potato wart-disease is conducted by us as vigorously as might be expected from an exporting country, that spares itself neither expense nor trouble in order to give its consumers the assurance of the healthy condition of our export-produce. I will revert to these measures later on.

6. Special attention is also paid to exhibiting at exhibitions, and the formation of collections for use at schools, and agricultural and horticultural courses.

We not only send an exhibit to most of the annual agricultural and horticultural exhibitions, but our Service of late has made a speciality of organizing small winter-exhibitions. Here exclusively material of diseased and injured plants is on view, while one of our experts is on the spot to give the necessary verbal information. These special exhibitions are a great assistance in spreading the knowledge of plant-diseases. A specimen of a larger exhibition can be seen here in the hall (see p. 135).

We also make up collections on a large scale to be used in schools and classes.

Our publications will also be known to you, the larger of which, the so-called „Mededeelingen" or „Communications", deal with a subject in detail, while the pamphlets fulfil the same purpose in a more popular form. Although our publications are obtainable at cost-price only, many thousands of copies are sold annually.

I must not leave the subject of what is being done in our country towards promoting the most intensive possible mode of fighting plant diseases, before touching upon a subject of peculiar interest, i. e. the combatting of the injurious consequences of diseases by means of immune varieties.

This is particularly the case with regard to the potato-wart-disease. Not that this disease is of special significance for our country, for even if we took no steps to decrease its injurious consequences, it would not diminish our potato-harvest even by 100 H.L. Nevertheless the culture in grounds where the disease has once been detected is absolutely under our control, all potatoes coming from land where even a single wart-diseased potato has been found, are rendered innoxious.

These measures are thus stricter than those of any other country in Europe, and are adopted, because as an exporting country, we are anxious to give our consumers the greatest possible security. But it appears to us, that the solution of the wart-disease problem is very simple, and that it lies in making use of the factor of immunity, which occurs in the potato-varieties. The efficacy of the fight against the wart-disease does not lie in import-prohibitions, control of the import and control of the culture, as is the custom in every country at present, but in promoting the cultivation of good unsusceptible varieties. These being available, which they are already, it will be a great deal more economical to leave the trade free, as far as potatoes are concerned, and the culture need have no fear of further losses.

And even as the medical world may speak of a triumph when such measures have been taken, as will render a disease no longer a menace to mankind, as in the case of unsusceptibility to the small-pox disease after vaccination, so it would be a veritable triumph for the phytopathological science, if it could declare that there is no more danger to be feared from the wart-disease, for the simple reason that the cultivated potatoes have been rendered immune or practically so, and that the governments of the different countries might therefore be advised to repeal all the obstructive regulations to trade, relative to that disease. There is so much work for us to do, that in the cases where the plant itself presents the complete and natural solution of the problem of attack, we need not assist it artificially, and we may safely add inadequately, by economic measures.

The example given by other countries, namely, of paying strict attention not only to the investigation of the existing potato-varieties as to their wart-resistance, but also to the propagation of the resistant varieties and especially to the use of these varieties in practice, we have gladly followed, and so we would contribute towards the complete, practical and simple solution of the seemingly complicated wart-disease problem.

So far I have outlined to you what the Phytopathological Service in Holland is doing to make the attack against plant-diseases and pests as general as possible, and thus have our crops increase in quantity and quality. I shall now proceed to indicate what we do in order to increase as much as possible, the healthy condition of the products, which we intend to export, to satisfy all reasonable demands. I will first, however, make a few general remarks, from which it may be judged what standpoint we take in respect to the spreading of plant-parasites through the trade in plants and plant-produce.

Seeing that organisms may be present on living plants, which have an injurious effect upon those plants, it is clear that such organisms can be imported with living plants and so introduced into other countries. It is well that the phytopathologists take this fact into account, but it would not be wise on their part, if they allowed it to blind them, and so were to take measures which would defeat their own ends.

If indeed, for the sake of protecting the home-cultures, recourse is had to the means of exclusion of plants, two points should not be forgotten and these are:

a. that this policy can only be satisfactory with absolute exclusion which by a reciprocal and consistent application must inevitably lead to a total cessation of the international trade in horticultural products, and which might also put serious obstacles in the way of the trade in the most essential agricultural products;

b. that the exclusion of plants will never lead to the complete prevention of the importation of plant-parasites.

As regards the first point under discussion it will be interesting and very instructive to note that, if once one starts making demands as to the healthy conditions of the imported living plants and plant-produce, one becomes more and more inclined towards the system of exclusion of whole groups of plants or of all living plants. This is the result of the consequent application of the theoretical consideration that each organism that feeds upon plants *must* be injurious to cultivated plants, and the idea that each organism that has not shown signs of inflicting injury is ready to become so, if placed in new surroundings.

Theoretically there is not much to be said against these arguments;

but I consider it unfair to look upon this question from a theoretical point of view alone. If one had to recount in writing all the dangers to which a wheat-plant or fruit-tree is exposed from the moment that it starts growing, till the seed or fruit has been gathered in, we should have sufficient material to prove that neither a single plant nor a single tree would even succeed in bearing fruit. Certainly it costs an effort at times to get them so far, and special precautions are frequently necessary, but one does meet nevertheless with a tolerable amount of success. And herein lies, in my opinion, the chief task of the phytopathological science. That it should also serve to diminish the chance of transmitting parasites is no more than it should do, and the Netherlands Plant Disease Service is surely the best proof that we consider this work most important, but science should at least impose upon itself the task of rendering a normal exchange of produce possible. Otherwise plants will be subjected to more restrictions than human beings in international traffic, and this in the long run would inevitably lead to a conflict, considering that plants and plant-produce belong to the most indispensable exchange-products in the world.

The Phytopathologists must thus seek after a practical basis for international trade, since with ever-increasing restrictions a conflict is bound to arise between science and the consumer, which will be highly detrimental to the popularity of that science and will finally have to be settled to the advantage of the consumer.

Here I by no means lose sight of the fact that the international trade has been the cause of transmitting serious plant enemies, but I will at once state that it is by no means always due to the plant-trade that enemies have crept in. The recent case of the Colorado-beetle in Europe is a good proof thereof, as well as former importations of this insect.

Plant parasites may be transmitted in all manner of ways, and it does not seem possible to stop these channels effectually. No doubt in some, but only very few cases one has to take refuge to limitation or even prohibition of import, but now-a-days in several countries the measures concerning plants are much more rigid than those concerning men.

Quarantine-measures concerning removal of men from one country into another have only been relative to a few determinate diseases, and even in those cases one is content with a medical inspection; nobody has ever thought of entirely prohibiting the traffic of men from one country into another, in consideration of the fact, that in one of those countries e. g. inflammations and colds occur, which might, although nothing thereof is known, take a more serious character in another country.

In my opinion it is not at all necessary to take more rigid measures against diseases of plants than against diseases of men.

With due control of the plants, both during the growing-time and at the time of export, the danger of transmitting organisms which may inflict injury in the country importing them, need not be greater than that associated with the importation of other articles of trade. The essential point is the manner in which the exporting country has handled the culture and whether due control was exercised in securing the utmost limit of practical certainty.

We believe now, as far as Holland is concerned, that if the good condition in which plants grown in our nurseries are, and were, by reason of the care bestowed upon them with intensive culture and for which they were also known in foreign countries before a regular inspection-service existed, if this good condition can be still supplemented and improved upon by a special propaganda for, and supervision of, the handling of nursery-plants and other products with all the means by which the healthy condition can still be increased, and further if it be adopted as a hard and fast rule that no declaration be given with exports, unless the entire shipment has been previously examined and approved by a competent authority, all this jointly forms a guarantee for the absence of dangerous plant-parasites, which is equally as great as the chance of importing such parasites to which we are exposed with the uncontrolled importation of all manner of other products.

These considerations represent the guiding line in what the Phytopathological Service in the Netherlands has done on behalf of the export-trade. In the first place thus, we are engaged in spreading widely a knowledge of plant-diseases and injurious pests in every way in which this may be desirable. If this propaganda may have made the impression upon some persons that the Netherlands must be overwhelmed with diseases and insect plagues, it may here be stated that this impression is wholly false. It is not because our country is the victim of diseases and plagues that the propaganda was conducted, but because we strove after *absolute* purity, and to attain this called for the most extensive application of the means of control, even though the parasite might be scarcely apparent. On your visit to our nurseries I hope that you will be able to convince yourselves of the purity of the plants.

This propaganda and spreading of knowledge is conducted by our assistants who already number twenty-eight, exclusive of those at Wageningen. The constant presence of these inspectors in the culture-centres adds greatly to the effect, as will be evident. A great part of the information-work takes place at the nurseries and at the fields. Our so-called demonstrations at field attract many spectators and form indeed a very considerable subdivision of our labours during the growing period. And the practical Hollander knows-too how to apply the knowledge he acquires and our work has the hearty co-operation of the agricultural and horticultural associations.

And after the sowing-seed and the growing-plant have had every possible attention paid to them, that part of our production which is destined for countries which make special demands for imports, are still subjected to a final inspection. In many cases this is carried out at the place of production, in the culture-centres, such as the bulb-district, Boskoop and other centres of horticulture.

Our inspectors are constantly engaged, and not a case or parcel may be closed without the permission of our authority in charge. The staff appointed for this task have no other duties to fulfil, and can thus devote themselves wholly to the work. In important centres we have more than one inspector, and those are always concentrated wherever the shipment requires their extra presence. In other cases the testing takes place at the staples, at a railway-station or port. In no case, however, may a certificate be awarded unless the entire shipment has first been submitted to one of our inspectors. The inspection is performed most carefully. Oftentimes the detection of one organism in a whole lot leads to the whole lot being condemned. In certain cases the diseased plants or bulbs are carefully removed and the parcel submitted anew to inspection. Woody plants, even though no parasites may be found, are a short time before packing treated with a 5 $^0/_0$ solution of carbolineum, in order to have an extra assurance that these plants were sent off absolutely pure.

Our organisation is thus as follows: In the large centres of culture we have our inspectors established, who are in constant touch with the nurserymen. In the growing period attention is continually directed to the application of every means whereby the healthy condition of the plants might be increased. Of peculiar significance is our regular winter-treatment with carbolineum, which represents a veritable sterilization of the plants so treated.

During the shipping season these inspectors are constantly going the rounds of the plants, previous to packing. For important places several inspectors are stationed. So, for instance. in Boskoop, where there are three stationed during the whole year. In the bulb-district, situated between Haarlem and Leiden, there are five permanently stationed, but during the shipping-period of the bulbs this number is increased to fifteen. No shipment takes place which is not first subjected to the scrutiny of our inspectors, and I can assure you that the exporter, who would dare to evade our control by some underhand means, will have received his last Certificate if proved actually guilty of fraud.

This inspection-service is also regulated by Head-quarters, at Wageningen. Here the administration of the certificates takes place, and the work is regulated, the inspectors are distributed over the places of shipment, and a control is exercised.

I believe in this sketch to have shown you, that Holland fully realises the obligations which the international exchange of agricultural and horticultural products entail, for as much as the healthy condition of those products is concerned. Holland as exporting-country, has always regarded her task from a broad point of view, and has gone every length to create an organisation which may pass through the mesh of the critic. The earnestness and the energy with which all our assistants fulfil their task, and the ample supervision of our country by inspectors who have no other task to fulfil than the spreading of knowledge concerning plant-diseases, the promotion of the production of disease-free plants and plant-products and, in so far as the special regulations enforced by the importing countries are concerned, the inspection of the products for exportation, prove that our organisation is fully competent to comply with all reasonable demands.

I hope that our efforts may meet with the approbation of the phytopathologists of all countries, and serve as an example of the way in which a healthy international exchange of plants and plant-produce may at length be possible for all countries.

INTERNATIONAL PLANT DISEASE LEGISLATION AS VIEWED BY A SCIENTIFIC OFFICER OF AN IMPORTING COUNTRY

BY

H. T. GÜSSOW

Mr. Chairman, Ladies and Gentlemen,

In addressing you on this subject may I express myself at the commencement as wholly in favour of international co-operation and community of action against the spread of insect pests and plant diseases? In the year 1914, we may recall, the Phytopathological Conference, held at the International Institute of Agriculture in Rome, took steps towards formulating a policy of wider application and while the articles of the international convention drawn up on that occasion afforded, internationally speaking, a decided advance over the conditions previously existing, it is hoped that fresh consideration of certain of the articles may still further promote the objects in view.

International co-operation against the spread and distribution of insect pests and plant diseases is recognized as one of the most interesting as well as the most difficult and important of problems.

It would seem to a student of the various laws of nations in force, all directed towards one and the same end, that the viewpoints as to what should constitute a practical basis for co-operation are as divergent as are the problems themselves. This applies specially to questions affecting international trade, because the particular requirements of each country claim consideration; and it may be argued that international co-operation against the spread of pests and diseases ought not to be regarded solely from a phytopathological aspect. The spread of plant diseases and insect pests bears a very close relation to the economic position of any country; and it is important that each country should not only pay attention to its own needs and position, but should also bear in mind the requirements of the countries to which its exports may be consigned. Unless careful attention be given to this phase of international co-operation, a country may not succeed in establishing or maintaining trade relations.

Uniformity of laws governing the importation of plants and plant products seems to be the aim of many conferences nowadays: yet any law is promulgated in the interest of the country enacting it, and there should be no difficulty in making uniform world laws, providing that the world's requirements are uniform. There would be no difficulty in establishing fairly uniform laws in phytopathology, providing the conditions requiring laws are similar. But this is the point upon which opinions differ seriously.

Let us consider the Continent of America as a whole, with an area of nearly eight million square miles, with its few countries (British North America, United States of America and Mexico), with its immensely valuable natural resources, its vast original forests, its extensive agricultural and horticultural interests and its population of say, one hundred and twenty millions, and compare it with the Continent of Europe, with but half the area, with its many political subdivisions, its well developed and intensive rather than extensive agriculture, and possessing four times the number of inhabitants.

On the Continent of America there are but three responsible governments; in Europe there are perhaps six times as many.

It will be seen that so far as continental co-operation is concerned in America, it would be a simp'e matter for three governments to take common action against the introduction of foreign pests and diseases in order to protect a whole continent, and incidentally each its own country. But it would be a very difficult matter to devise laws acceptable to all European countries, even though such laws might afford sufficient protection for the Continent of Europe as a whole. So far as Canada and the United States are concerned, very close co-operation in this respect is aimed at in the common interests of both countries.

The only point we have to regret is the fact that the authorities of the Continent of America did not conceive of the plan of co-operative action at a considerably earlier date; had this been the case many millions of dollars would have been saved. Only those familiar with our experience of foreign diseases and pests on the Continent of America can adequately realize the necessity for very careful protective measures.

It has often occurred to me that useful information might have been gathered on the Continent of America if there had been no importation from Europe many years ago of the common barberry. This now constitutes one of the most serious obstacles to the control of black stem rust, which as recently as 1916 caused in Canada alone a loss of some $ 200.000.000. This is said in view of the apparent justice of the claim of European observers that where there is no barberry, black stem rust does not amount to anything. We are now trying — an almost impossible task — to eradicate this shrub from at least the grain-producing regions of America.

Incidentally, this leads to the description of another aspect of international co-operation designed to effect the control of a very destructive plant disease.

It was not until 1911 that co-operative action as regards plant diseases and insect pests legislation was considered by Canada and the United States. At that time conditions arose which called urgently for protective measures. The discovery in Newfoundland of black wart disease of potatoes, indicating that the disease had actually crossed the Atlantic from Europe, and the entry of white pine blister rust, perhaps more than anything else gave rise to the promulgation of certain orders prohibiting unrestricted importation from abroad. May I here direct attention to article No. 4 of the Rome convention, which states that „The provisions of the present convention shall not apply to vines, grain and seeds, *edible tubers,* bulbs, rhizomes and roots, fruits and vegetables, *or to any crops grown on a large scale*". (The italics are mine).

Such an article cannot possibly be subscribed to in its present form by all the countries of the world. The individual rights or requirements of any country to take measures for the protection of its own interests must not be prejudiced by any such provision.

Those of us who were able to observe the colossal damage brought about by blister rust of white pines in Eastern America, the almost hopeless situation as regards eradication, and the gigantic and costly efforts that have been made in the New England States, and which have now become necessary in Canada, will not find it difficult to comprehend the frame of mind which supported enforcement of the severest measures for the protection of our combined resources from any further similar invasion.

I am not an entomologist, but even a layman's disgust is aroused by observing the ravages of the gipsy and browntail moths along what may be termed one of the world's most picturesque highways, passing through the Adirondacks and especially the White Mountains of New Hampshire. It is examples like these that arouse public sentiment against the unrestricted importation of nursery stock by which these pests and diseases were brought to the Continent of America.

The white pine blister rust has now reached the valuable western white pine areas of the Pacific coast, where all five-leaved pines are seriously threatened. As far as British Columbia is concerned, this rust has found conditions so favourable to its development that control seems to be entirely out of the question. Just contemplate the danger to what we term the natural reproduction of all our most valuable timber trees on the Continent of America.

It would seem unnecessary to discuss in detail the results brought about by the introduction of many other pests which might be mentioned. It was obvious that something had to be done and be done quickly, before it was too late. The question arose and received very careful consideration. Should each country on the Continent of America undertake a joint effort to protect the entire continent, or should each act independently?

In the case of contiguous countries with a borderline of about 3.000 miles in length, with climatic and economic conditions so similar, it was logical to proceed with as close a measure of co-operation as possible; excepting a number of special circumstances it it would have been necessary for contiguous countries to impose reciprocally restrictions similar to those they imposed upon the countries of other continents. It is clear that under the conditions described, the wisest plan was that of closest co-operation, simply because biological agents do not respect an imaginary line such as that which is constituted by our political border.

Thus were developed the lines of defence which now protect the Continent of North America in its entirety.

Naturally, the close inspection of every consignment of nursery stock from abroad which has been made since our present laws came into operation, has revealed more and more the dangers to which horticultural as well as agricultural industries had been and were being exposed. The cases of intercepted insects and plant diseases have been so numerous, that gradually the restrictions have had to be made more severe.

The lessons learned from previous experience made the responsible officers very cautious. Nobody could foretell whether a pest or a disease — insignificant perhaps in the country of origin — might not develop into a serious menace in any part of this great continent. Though frequently challenged, this attitude is not unreasonable, if we take into consideration the diversity of our climatic and other conditions. There are so many and such vast natural resources in existence, with the remote possibility of practising anything like effective measures of control, because of the enormous extent of territory to be covered, that prevention under all circumstances must be considered more advantageous than any attempt at cure.

For instance, there has recently been described a canker of Douglas fir (*Phomopsis*) discovered in Europe. Strange as it may seem, the home of the Douglas fir on the Pacific coast of America is exposed to infection through the importation of infected nursery stock from Europe. Would one be prepared to recommend under such circumstances importation subject to certification and inspection, or would one consider it wiser to prohibit the importation altogether of any host plants likely or known to carry this disease?

We have such immensely valuable tracts of Douglas fir to protect at all costs, that we took the „safety first" course and prohibited the importation of all such nursery stock, preferring to grow it ourselves, as indeed we could easily do.

This raises additional important points in which our viewpoint may differ from that of our European colleagues.

Owing to cheaper production — no doubt due to more intense development of the nursery business of Europe — importers on the Continent of America were offered seedlings of a good many of their native trees and shrubs at a cheaper rate than could be obtained in America. The result was that a very considerable trade developed with Europe in such stock. It seemed almost like carrying coals to Newcastle to import white pine seedlings from Europe into the home of the white pine in America. To-day, owing to the introduction of the blister rust, we have ample cause to regret the practice. Would it not be simple wisdom to prohibit altogether any and all such classes of nursery stock native to the Continent of America? It takes a year or two longer to produce strong seedlings of white pine in America than it does in Europe; yet is it not a sound biological action to call a halt to all such importations in future? One must bear in mind the vast tracts of virgin woods which must be protected.

While we, in Canada, are in favour of the closest possible co-operation, we are also aware of the objections raised in some European quarters towards our general attitude. Can one be really blamed for adopting the safest measure possible, viz., the closing of our ports to all nursery stock from other countries in view of the experiences which we have had on the Continent of America?

Have our European colleagues ever given careful thought to the fundamental cause of the American attitude, which lies in the simple fact that the Continent of America is essentially composed of importing countries, and that our exports of nursery stock or plants, especially to Europe, are practically negligible?

European nurseries are very numerous, and there exist a good many firms largely dependent upon the export trade. In the days of unrestricted exports, that is, before 1911, the ports of the Continent of America were open. If one consults the figures of importations made of all classes of nursery stock for ten years previous to 1911, one finds a very considerable balance in favour of the European exporter, as compared with the twelve years following 1911. Naturally, the war interfered seriously during the latter period. Yet, it seems to be a fact that after the war, when business firms in Europe were anxious to dispose of their products to America, they found that during the years of war Americans had not been idle, but had considered the time opportune to begin raising many of the materials formerly obtained from Europe. As a result of this economic condition, together with the more restrictive measures in force, European exporters found it increasingly difficult to dispose of their wares to America. Complaints were made of the severity of the regulations, and strong representations were made by the experts of various countries to the effect that the regulations in force were unfair; that they no longer were exclusively on a strictly biological basis; that, in fact, such measures amounted practically to tariffs of protection and that the increased vigilance was exercised for purposes other than protection from insect pests and diseases.

We have been aware for some considerable time of this interpretation, which is not exactly just and fair, since such rumours often emanated from the disappointed exporter, wholly unfamiliar with the true state of affairs on the Continent of America.

Meanwhile in America there existed a very similar attitude, entertained by concerns other than established nurseries, which formerly derived their main income by acting as large importers. In these quarters too, the technical experts of America were severely criticized. To them it was merely loss of trade affecting their pockets and not the question of guarding the country against destructive diseases or pests; and, in consequence, representations were made occasionally within our own country, demanding the modification of existing regulations.

On the other hand, those concerns which during the years of war had established the nucleus of a nursery business, possible because of the exclusion of serious competition from Europe, made strong representations to the effect that imported vegetation from Europe was reeking with disease, that bulbs from Holland were inferior, and that nursery stock grown in Europe did not prove as hardy as stock raised under our own conditions. There were many other similar complaints. We confess that it was often enough possible to see that an endeavour was being made by united action and pressure exerted or attempted in political quarters, to induce us to promulgate still severer measures, which would bring the desired protection to our own newly-established industries.

It will be realized, therefore, that the position of the government officer charged with the duties of safeguarding his country's true resources and interests, is not an enviable one. He would often find himself between the devil and the deep sea were it not that in every case he is guided as well as protected by the maintenance of a concise biological basis for his actions.

It is clear that there exists in every country enough harmony among the producers of any commodity to try the effects of a sober amount of political pressure on their respective governments, when they believe themselves to be injured in respect of the free commercial interchange formerly enjoyed. All governments cannot permanently ignore such persistent representations. We could have taken action in Canada against the Dutch bulb growers, had we not at our disposal through the inspection of Dutch bulbs, data which did not fully support the claim that they are generally inferior. Of course, some Dutch bulbs are inferior; the practice no doubt prevails that cheap bulbs are purchased in bulk for export to chain or retail stores, in America, and this class of goods does not tend to establish uniform satisfaction amongst customers. As far, however, as the importers of the Dominion of Canada are concerned, we are generally supported in our endeavours to protect Canadian resources. The great difficulty, which is incident to all countries alike, arises from delays at points of inspection and from minor regulatory requirements which formerly were not in existence, but which are now necessary in order to keep a proper check upon all importations. It is incumbent upon every country, of course, to arrange its service in such a manner that it may interfere as little as possible with the volume of a trade which is necessarily compressed into a brief importing period.

Owing to these conditions, criticism has been frequent. That much of this criticism is based is indeed manifest by the attitude in some European quarters in favour of retaliation by endeavouring to exclude American produce, such as fruits, from European markets. Is it common knowledge that a good many European countries subject to a very close scrutiny every fruit consignment reaching Europe from America?

Would a retaliatory action such as is indicated above be based on truly biological principles? May I ask if the European countries are prepared for instance to admit American potatoes? Are they not just as afraid of the introduction of the Colorado beetle as we are of the introduction of black wart disease from Europe?

Serious consideration has been given in America at all times to the certification systems offered us by Europe. Such systems may have their merits as far as contiguous countries are concerned, but as far as the trade between continents is concerned, we fear that certification cannot possibly be a real and permanent protection.

I may again ask, would Europe be prepared to accept our potatoes on a health certificate basis, and if not — why not?

Another question may be referred to here. We in America are accused of a one-sided conception of phytopathology, which sees an economic danger in every insect and every fungus likely to be imported.

Ladies and Gentlemen, we have no other alternative, for the simple reason that we have to protect our side of the ocean and that for many years we have imported from Europe, in one year, more than we have exported to Europe of similar classes of materials. This is our side of the question, and if the tables should be reversed, what conscientious European plant pathologist or entomologist could take any different view?

It has been stated that the object of international phytopathology is the protection of the agricultural and related resources of every country from foreign and domestic enemies, and that any measures must take into consideration all the claims of international trade. Without wishing to appear selfish, may I ask if such efforts, like charity, should not begin at home?

We have in each and every country a threefold reason: first, as applied to America, the protection of natural resources. It should be possible to calculate the comparative values of established trade with other nations versus the wealth of natural resources, and to decide on a truly economic basis the action that should be taken to safeguard effectively the more valuable asset of the national wealth. Secondly, and perhaps equally important, the productive industries of a country, including agriculture, horticulture, and related interests, claim protection. Thirdly, there are the interests of the producers of nursery, florists' and related stock, which may suffer through infection from imported pests or diseases. There is always the serious danger of distributing diseased vegetation from such sources unless protection commences with home industries. The basis of international trade in living plants and plant materials used for propagation is freedom from disease and insect pests. Is it reasonable to appropriate sums of money for the doubtful control of a newly introduced disease, or is it more reasonable and more economically sound gradually to restrict importation to such classes of vegetation as are reasonably safe when imported from abroad? Who would be prepared to furnish such a list in advance? This would be a more difficult undertaking than that suggested by article ten of the Rome convention, which invites the contracting states to send a list of the plant enemies against which they desire protection; such lists to be drawn up according to the following principles:

a. Common enemies of plants which have long since spread to nearly all countries to be excluded, as well as parasites whose usual host plants do not exist in the importing countries.

b. In specifying plant enemies which are to appear on the lists, the choice will be limited to
   1. Those of an epidemic character.
   2. Parasites which are destructive or at least harmful to crops.
   3. Those which are easily propagated by live plants or by living parts of plants.

Such provisions may suit the case of contiguous countries having similar floral conditions. It does not meet the requirements of the countries of other continents. In America, for instance, with its widely varying climatic and floral conditions, the danger exists that parasites may find native plants related to the original host, suitable to their mode of life.

Who can foresee what fungus or insect may not assume an epidemic character under new environmental conditions, or what parasite may not become destructive? Why should there be any limit as to the length of the list? Indeed, how could one possibly attempt the preparation of any satisfactory list? If such an attempt were made I contend that the conditions would become hopelessly involved.

I understand that this conference has been called to attempt once more the solution of the problem of rational international action in this regard. In order to do this all points of view must be given free representation. The exporter cannot well make demands of the importer, and the importer must recognize above all that for biological reasons the free interchange of living plants between countries situated in different continents is attended by serious risks and must be governed by a policy different from that which relates to contiguous countries. We have frequently considered this question, but think it humanly impossible to evolve any plan that will allow of the free and unrestricted interchange of living plants. This principle must apply to every country, but it does so more emphatically to countries that are largely importing, or have been largely importing. We must always be prepared to deal with sudden contingencies, but may fail in our efforts when serious risks are involved if the laws of importing countries are not sufficiently inclusive. It must be remembered that confidence begets confidence, and confidence in the scientific staffs of the various countries interested is essential to a solution of the questions at issue.

We have thus frankly explained our position, and we ought not to be accused of failure of duty, because though our conditions may seem to be similar to your own, they are in reality essentially different. Ours are those of importing, whilst yours are those of exporting countr es, and the two interests necessarily clash.

I have thus attempted to describe the conditions which prevail within the Dominion of Canada especially, and which doubtless apply to the Continent of North America generally. Our next question for consideration is, what internationally acceptable arrangement is possible to cover the essential points and most of the requirements of all the nations? This is an extremely difficult problem, because of the very divergent conditions existing within the various countries.

Let me clearly define our own attitude:

We imported from Europe all classes of nursery stock, bulbs, etc., etc., in the year 1919, to the value of $ 214.608. Our exports in that year were nothing. In 1920 our imports were $ 220,724 and exports nothing. In 1921 our imports were $ 513.341 and exports $ 50.00. In 1922 our imports were $ 556.224 and exports $ 400.00. From these figures it may easily be gathered that we have as yet little financial interest in exportations of nursery stock. We do not in this connection include fruit exports for consumption and not for propagation.

Our duty is to protect, to the fullest extent possible, from the ravages of foreign pests and diseases our varied interests; national, natura resources, agricultural, horticultural and forestry, as well as our established nursery businesses, knowing the serious consequences of our having imported disastrous enemies into the Continent of America. You as professional colleagues must realize our viewpoint more quickly than can the representatives of concerns eager to trade with us, and our viewpoint inclines towards the adoption of such measures which will guarantee us against future exposure to similar risks.

We are ready to-day to import from any country — and see no reason to depart from our present position — any living plant required for our purposes, provided that such living plants or nursery stock in its widest application are essentially free not only from any specified pests, but preferably, of course, from any pest or disease whatsoever. Indeed, we cannot see why we should import any vegetation that is infested by pests or diseases already widely prevalent in Canada, although so far we have not taken serious exception to any such instance.

What suggestions, therefore, has this conference to offer that would cover all reasonable requirements?

It is true that every country must consider — apart from the question of protection from diseases and pests — the development of agriculture and horticulture, and must endeavour to promote same by the introduction of any living plants, etc., that are likely to prove of value; but provision for such importations will always be made by a special clause in our act empowering us to import anything by ministerial warrant. Such a practice may be further developed by the establishment of nurseries under government supervision, in which any new plant may be tested and propagated free from disease or pests and certified as suitable to our economic and general conditions.

International co-operation for the control of diseases at the least could only cover fundamental factors; the requirements of individual nations would always have to receive special treatment. What may suit your requirements may not in any way solve our problems or come anywhere near solving them. We do not contend for the exclusion of all types of vegetation. We are glad to supply our needs in this regard at any time, but we must safeguard our interests at all cost.

If not total prohibition of importation, what is the next best measure that would protect the Continent of America from the recurrence of such serious menaces as those we have already experienced? Are the European contries able to solve the problem, organize and carry out to the satisfaction of all importing countries a system whereby the exportation of any diseased vegetation, including all nursery stock in its widest sense, is prevented?

And are they able to arrange for the imposition of severe fines for attempts to evade the law? Is such a plan possible of practical execution? It may be possible to issue licenses to exporters whose products satisfy the requirements of a plant exportation service. But it is open to doubt that any such arrangement is practically possible. Any country willing to assume full responsibility for its plant exports in this connection, and able to convince the importing country of the efficacy of its service, whilst ready also to risk the consequences of having shipments rejected on unbiased biological inspection at the port of entry, will contribute materially to the solution of the problem and thereby ensure the free international exchange of living plants.

Such an arrangement would have far reaching beneficial effects, for by its operation diseases within the exporting country would be gradually eliminated in so far as may be practically possible.

The issue of certificates of freedom from diseases and insect pests as at present required and practised is not wholly safe, because of the difficulty of recognizing diseases or pests on inspection of the shipments. It is a safeguard though, in as much as without a certificate no guaranty whatever is afforded as to whether vegetation be reasonably free from disease.

As far as Canada's present regulations are concerned, they have been devised by taking first into consideration our own requirements, and they are an attempt to protect ourselves from the invasion of foreign pests and diseases so far as we are able to do so under the present circumstances of international trade. We shall be only too glad to consider carefully any proposal intended to simplify our work, provided that we obtain at least the same degree of security that we at present enjoy.

The Dominion Entomologist, Dr. Arthur Gibson, the chairman of the Dectructive Insect and Pest Act Advisory Board of Canada is present and, I feel sure, would be glad to make a brief statement of our present regulations governing the importation of living plants etc. into Canada in so far as they relate to European countries.

REMARKS ON PLANT DISEASE LEGISLATION IN CANADA

BY

A. GIBSON

May I first of all express my pleasure at being thus able to meet the officials of the Dutch Phytopathological service, who are responsible for the calling of this conference, as well as the delegates here assembled from other countries. It is my privilege, also, to extend to the entomologists and others present, very warm greetings from their friends in the Dominion of Canada. It is my pleasure not only to represent in my official capacity as Dominion Entomologist and Head of the Entomological Branch of our federal Department of Agriculture, but also with Dr. L. O. HOWARD, Chief of the United States Bureau of Entomology, the organisation known as the American Association of Economic Entomologists, which organization is proud to have among its members many of the leading entomologists of Europe.

Mr. GÜSSOW, Dominion Botanist and plant pathologist, has addressed you on the subject of „International Plant Disease Legislation as viewed by a scientific officer of an importing country." This address has emphasized the necessity of an importing country doing everything it reasonably can to prevent the introduction of foreign insect pests or plant diseases. The Dominion of Canada Destructive Insect and Pest Act Advisory Board was created on April 21st, 1922, with the following members: Mr. ARTHUR GIBSON, Dominion Entomologist and Head of the Entomological Branch, Chairman; Mr. E. S. ARCHIBALD, Director, Experimental Farms, Vice-Chairman; Dr. J. H. GRISDALE, Deputy Minister; Mr. H. T. GÜSSOW, Dominion Botanist, Experimental Farms Branch; Mr. L. S. MCLAINE, Chief, Division of Foreign Pests Suppression, Entomological Branch, Secretary.

The chief function of this Board is to advise our Department of Agriculture in all matters relating to the Destructive Insect and Pest Act of Canada. Recently the Department approved of new and revised regulations which we expect will go into effect about September 1st. I have pleasure in presenting to this conference a copy of the proposed regulations. The important requirements of these regulations in so far as they relate to European exporters are:

a. That shipments of nursery stock must be accompanied by a certificate of inspection, issued and signed by an authorized officer of the country of origin, which certificate must state that the nursery stock covered by the certificate has been examined by the official and has been found to be apparently free from any pest or disease;

b. That each container of nursery stock, in addition to bearing a copy of the certificate of inspection, must be clearly marked with the name and address of the consignor and consignee, the port of entry and also a declaration showing the quality, kind and value of the nursery stock contained therein;

c. That potatoes from Europe are prohibited entry into Canada;

d. That all five-leaved species of the genus *Pinus* from Europe are prohibited entry into Canada;

e. That alle species and varieties of currants and gooseberries (*Ribes* and *Grossularia*) but not including the fruits of the latter, from all foreign countries are prohibited entry into Canada;

f. That European Blackthorn (*Rhamnus cathartica L.*) and common or Rust Barberry (*Berberis vulgaris L.*) and their hybrids and horticultural varieties: all species and varieties of *Berberis* and *Odostemon* (*Mahonia*) susceptible to Crown Rust of Oats and Blackstem Rust of wheat respectively; including:

B. Amurensis Rupr.	*B. aristata D. C.*
B. Canadensis Pursh.	*B. ilicifolia Forst.*
B. Lycium Royle.	*B. Nepalensis Spreng.*
B. Sibirica Pall.	*O. aquifolium Rydb.*

from all foreign countries are prohibited entry into Canada;

g. That all species and varieties of the genera *Pseudotsuga*, *Tsuga* and *Larix*, from countries other than the United States, are prohibited entry into Canada.

In addition to the regulations which I have indicated, all nursery stock entering Canada from Europe will continue to be examined by our inspectors either at the port of entry or at the destination of the shipment. The Department, too, will be empowered to examine any or all plant products entering Canada which are suspected to be infested with serious pests or diseases.

It will be noted from what I have said that with comparatively few exceptions the Government of Canada has not placed an embargo on nursery stock in general. The term „nursery stock" under our proposed regulations includes all plants for ornamental purposes or propagation.

Canada has in the past suffered very seriously from the introduction of foreign pests and diseases. A recent introduction and one which is causing our entomologists much concern at the present time is the European Corn Borer. Unfortunately, Canada has in the province of Ontario, probably one of the most active, serious outbreaks of this insect in field corn, which can be found anywhere and we have good reason to believe that the pest was introduced about ten years ago in broom corn imported from Europe. During recent years, too, we have intercepted on nursery stock from Europe other insect pests, such as the Apple Sucker, the Azalea Leaf-Miner, the Narcissus Bulb Fly, the Small Narcissus Bulb Fly, the Brown Tail Moth, the Satin Moth, the Lackey moth, the Apple and Cherry Ermine Moths, the Sorrel Cutworm, various scale insects, etc.

Surely, gentlemen, our Government cannot be criticized if it first of all considers the welfare of its own agriculture and allied interests. This is only what would be expected. I would take the liberty of urging that European countries which export nursery stock as defined in our regulations to Canada, impress upon their shippers the necessity of only exporting stock which is absolutely clean and free from disease or insects, in so far as your inspectors may be able to determine. In general, too, it would be a wise practice to only allow to be exported from your countries such stock as is considered to be normal and in a good state of health. We have noted with regret that shipments of nursery stock have in the past been frequently made to Canada, which one might term as culled stock or „left-overs", which have been forwarded for selling purposes, either by public auction or in stores known as chain stores.

DIE VERSCHLEPPUNG VON INSEKTEN UND EINFUHRVERBOTE

VON

DR. L. REH

Die Verschleppung von Insekten ist so alt, wie Handel und Verkehr. In den letzten Jahren nimmt sie, aus unbekannten Gründen, in rasch steigendem Masse zu. Der Gedanke liegt nahe, sich durch Ein- bzw. Ausfuhr-Verbote gegen die Einschleppung fremder Schadinsekten zu sichern. So werden denn auch von fast allen Staaten solche erlassen, immer mehr, immer strengere und umfassendere.

Erreichen diese Verbote ihren Zweck, wird durch sie die Einschleppung von Schadinsekten verhindert? Die Frage ist objektiv kaum zu beantworten. Wenn wir aber die trotz Allem zunehmende Ver schleppung sehen, müssen wir wohl mit Nein antworten. Man könnte sogar fast sagen: je mehr Verbote, umso mehr Einschleppung.

Ich habe die ganze Frage im Jahre 1917 einer sorgfältigen Untersuchung unterzogen. Auf diese Arbeit darf ich wohl betr. der Einzelheiten verweisen und mich hier auf das Allgemeine beschränken.

Wir müssen bei der Verschleppung 3 *Stufen* unterscheiden: den *Transport* durch die Verkehrsmittel, die *Einschleppung* in das fremde Land, und die *Einbürgerung* in diesem. Jede spätere Stufe betrifft immer nur einen verschwindend kleinen Bruchteil der früheren.

Wenn man sich das Alter und den ungeheueren Umfang des Weltverkehrs vorstellt, die Berichte der Quarantäne-Stationen liest, bedenkt, dass in ihnen immer nur ein Bruchteil der wirklich auf den Sendungen vorhandenen Insekten-Arten aufgeführt wird, und dass viele von diesen in sehr grossen, oft ungeheueren Mengen vorhanden sind, so muss man immer nur darüber staunen, welch' unendlich kleiner Bruchteil der verschleppten Insekten schliess ich irgendwo eingebürgert wird.

Wenn man die Verschleppung als Masstab für die Einbürgerung nehmen wollte, so müssten schon längst die Faunen aller Handelsländer derart durcheinander gewürfelt sein, dass keines mehr eine besondere eigene Fauna hätte.

Die tatsächlichen Einbürgerungen sind gewöhnlich nur *Einzel-Vorgänge*; wenn also ein Insekt in ein Land eingeschleppt und darin eingebürgert ist, so können unzählige weitere Einschleppungen derselben Art folgen, ohne dass sie zu Einbürgerungen führen; diese bleiben immer seltenste Ausnahmen. Die Eroberung der neuen Heimat findet fast stets von der ersten Einbruchstelle aus statt; die Nachschübe sind dafür belanglos.

Die Länder und Erdteile verhalten sich gegenüber den Einschleppungen ganz verschieden. Europa hat wohl aus dem Osten eine Reihe von Tierarten erhalten, aus dem Westen, von Uebersee, aber nur ganz vereinzelte. Nordamerika degegen erhält ständig unerbetene Gäste aus allen Teilen der Erde, sehr viel mehr aber vom Osten als vom Westen. Indien hat ganz wenige eingeschleppte Insekten, Australien eine sehr grosse Zahl, Hawaii wird fast überschwemmt von ihnen. Aber auch in diesen Ländern beträgt die Zahl der eingebürgerten nur einen Bruchteil der dorthin verschleppten. *Dass Insekten also bei der Quarantäne gefunden werden,* sagt gar nichts über ihre Gefährlichkeit.

Alle Einfuhr-Verbote beruhen auf der Annahme, dass die Verschleppung vorwiegend mit den *Nährpflanzen* stattfände. Aber schon HAMILTON hat festgestellt, dass von 156 in die United States eingeschleppten Käfern nur 60 mit ihren Nährpflanzen, 96 in Verpackung gekommen sind. Die *Wege* der Einschleppung sind oft derart merkwürdig und unvorherzusehen, dass wir sie nur verschliessen können, wenn wir den ganzen Handel verbieten. Selbst ein so auffälliges Insekt wie der Koloradokäfer konnte $^1/_2$ Dutzend mal nach Europa gelangen, ohne dass man auch nur ein einziges Mals mit Sicherheit weiss, wie. Beispiele für die merkwürdigsten, unvorher zu sehenden Wege gibt es die Hülle und Fülle.

Es sind nicht immer die *schädlichsten* Insekten oder überhaupt Schadinsekten, die eingeschleppt und schädlich werden. Ja, man sieht als Heimat eines weit verbreiteten Schadinsektes das Land an, in dem es den wenigsten Schaden tut. Von unseren 3 Pieris-Arten der Kohlpflanzen ist die schädlichste, *P. brassicae,* noch nicht verschleppt, die viel weniger schädliche *P. napi* nach Nordamerika. Denken Sie an die *San José-Laus* in ihrer Heimat China und in

Nordamerika. Weder *Nonne*, noch *Malacosoma neustria*, noch *Cheimatobia brumata*, noch *Anthonomus pomorum*, noch die *Chlorops*-Arten haben Eurasien verlassen, trotzdem ihre Biologie sie zur Verschleppung geradezu vorherbestimmt.

Häufig *wechseln* Insekten nach ihrer Verschleppung die *Nährpflanze*. So macht Herr Dr. LINDINGER mich darauf aufmerksam, dass die Schildläuse von Citrus und Phoenix aus dem Mittelmeergebiete bei uns nur in Warmhäusern und nur an tropischen Orchideen vorkommen.

Wir sehen also: wo wir die Frage der Einschleppung biologisch anfassen, stehen wir vor Rätseln; wir wissen einfach nichts über die Wege, die Ursachen, die Bedingungen. Wir wissen weder, warum ein Insekt sich zur Verschleppung eignet, und wie sich diese vollzieht, noch warum bei einem anderen Insekte das Gegenteil der Fall ist.

Wir haben also kaum Aussicht, die Einschleppung und Einbürgerung dazu geeigneter Insekten zu verhindern.

Es gelten heute noch die 4 Sätze RITZEMA BOS' (1907): Einfuhr-Verbote sind lästig und nachteilig für den Handel, können die Feinde nicht abhalten, kommen immer zu spät, und richten sich nur gegen notorisch schädliche Insekten, die aber nicht immer die gefährlichen sind.

Aus den seitherigen Erfahrungen können wir sagen: Einfuhrverbote sind zwecklos, weil sie entweder sich gegen Insekten richten, deren Einschleppung dennoch erfolgt, oder gegen solche, die auch ohne sie nicht eingeschleppt würden.

Wirklich verhindern können wir Einschleppungen nur, wenn wir den gesamten Handel und Verkehr verbieten. Selbstverständlich, je strenger und umfassender die Einfuhr-Verbote sind, umso mehr werden sie erreichen. Ihr Schutz ist aber immer nur bedingt, und es fragt sich, ob ihre Ergebnisse den damit verbundenen Erschwerungen von Handel und Verkehr entsprechen. Vorausgesetzt natürlich, dass sie überhaupt biologischen und nicht wirtschaftlich-politischen Erwägungen entspringen.

Es ist eine bekannte Erfahrung, dass *neu eingebürgerte Insekten Schädlinge ersten Grades* bilden. Aber stets lässt ihre Schädlichkeit allmählich nach, bis sie nicht grösser ist, als die der einheimischen Arten. Die Ursache hierzu sind eines Teiles gegenseitige Anpassungen mit der einheimischen Lebenwelt, ihren Tieren und Pflanzen, andererseits Zunahme der Parasiten und Feinde. Und darin liegt m. E. ein Haupt-Nachteil der Einfuhr-Verbote; sie verhindern auch die Einschleppung der Parasiten der bereits eingebürgerten Arten; die ganzen Ausgaben und Mühen zur späteren künstlichen Einführung von Parasiten würden sich ohne die Verbote erübrigen.

Viel wichtiger als Einfuhr-Verbote scheint mir die *Ueberwachung des eigenen Landes*. Wenn ein Herd eines eingeschleppten Insektes rechtzeitig entdeckt wird, so wird es in den meisten Fällen gelingen, ihn restlos zu beseitigen. Siehe Koloradokäfer in Deutschland, England und Frankreich.

Ich hoffe, Sie davon überzeugt zu haben, dass die Frage der Verschleppung in ihren Ursachen und Wegen noch durchaus ungelöst ist, dass wir vor lauter Rätseln stehen, und dass die heute herrschende Manie, Einfuhr-Verbote zu erlassen, wissenschaftlich keinerlei Berechtigung hat, dass aber die für ihre Durchführung nötigen Mittel und Arbeiten besser bei der Durchforschung des eigenen Landes Verwendung finden könnten.

DISCUSSION.

J. C. KIELSTRA: *Remarks on the economical questions connected with plant disease legislation.*

Not being a phytopathologist I am of course not able to judge of the technical value of the measures treated in the extremely important paper of Mr. H. T. GÜSSOW. I am not able to form an opinion about the question whether a security of one hundred percent, which he hopes will be the result of the measures he wants to be taken, really can be obtained. Consequently my remarks will not have any reference to this side of the subject, but I will restrict myself to the economical questions, which this very important paper give rise to.

If I understand his considerations well, the basis of the opinion of Mr. GÜSSOW is, that, in trade between two countries, of which the one exports and the other imports, there are always two interests that necessarily clash.

It is against this basis that I think I must impugn. For a transaction, whatever it may be, can only be accomplished, if there are two parties, who agree, and these parties only agree, if they expect any profit out of it. Whether these parties are individuals or countries it does not make any difference as far as regards this principle. One country only buys goods produced in another so long as it expects to profit by the purchase, and on the other hand one country only sells goods to another if it expects to find advantage in the sale.

Mr. GÜSSOW, if I understand him well, denies, that America, forming a continent by itself, obtains such advantage by importing. So many sources of such abundance are found, he adds, that America is able to produce all the goods now obtained from abroad. His opinion is therefore that America can do without the products of other countries, and still have all it desires by producing those goods itself.

In my opinion this assumption cannot be sustained. And this is evident, when we keep in view that only self-interest induces a country to exchange its own products for those of another country. If after all America imports certain goods, although it would be possible to produce those goods in the country itself, thanks to American resources, then the explanation of this fact can only be found in American selfinterest. Suppose it was expected to be more advantageous to produce the goods in America instead of procuring them by exchanging American-made goods, why should such goods not have been produced directly?

Let us see now, what is the interest that induces America to exchange? It seems to me that this is the explanation: in exchanging, a quantity of goods is parted with, the production of which of course required a certain quantity of effort in labour and capital from the American producer, but, that in exchange he receives another quantity of goods, the production of which would have cost him greater effort. The same is the case with the producer of such goods in the other country. To produce the goods, now *imported from America would cost him greater effort than the* production of the goods he now sends across the Ocean.

For the sake of simplicity the influence of payment in money or by draft, has not been taken into consideration, as it does not really cause any difference in the course of things. The process may then show a more complicated character, its nature is the same.

If the above is taken into consideration it will be clear that the inhabitant of America is harmed, if he is prevented from obtaining the goods he wants to import from another country. For in this case he is forced, if he really wants them, to apply such effort as is needed for producing them. But this means that he will have to make a greater effort for the obtaining of the same goods than if he was able to get them by exchange, because he could produce, with less effort, the goods he would have parted with in exchanging; this being for him the reason for the exchange.

Consequently the result of an exchange, as free as possible, is the production of goods where it is possible to produce them with the least effort. For mankind as a whole, for each nation in particular, this means the obtaining of goods wanted, at the smallest sacrifice. To put it in another way: the greatest wealth at the least cost.

Now it is possible that by free import the risk of transmitting diseases or pests is so great that the possible disadvantage far surpasses the possible profits of the exchange. But, in any case, it is *certain*, that, if on account of this risk the import is impeded or prevented, the importing country which obviously wanted the imported goods, is at a disadvantage.

Therefore it is my conviction, that the task of a phytopathologist, from the point of view of public welfare never can be any other than to make his science subservient to the discovery of means, by which he is able to diminish the perils connected with import, to the lowest attainable minimum. If he goes further and impedes imports into his country, it is *certain* that he will cause loss to it. If he disires to foster the prosperity of his country, he will on the contrary, as far as necessary, and if possible in co-operation with students of the same science in other countries, have to look for the means of impeding, as little as possible, imports from other countries into his own.

Such a co-operation may lead to the acceptance of similar methods, and to mutual confidence in each other's methods, and thereby, eventually, in the value of each other's certificates. On such mutual confidence all international commercial relations, for the greater part, are founded. As far as trade in living plants is concerned, this is also the only possible basis.

Prof. RITZEMA BOS, whose appearance on the platform was greeted with unanimous, long-drawn applause, stated as his opinion that measures to prevent the import of plant diseases and noxious insects did often more harm than the pests themselves; in most cases the prohibition of import of plants, which might carry insects or diseases, is issued too late. A well equipped Phytopathological Service with a sharp competent staff in the importing as well as in the exporting country, gives in his opinion the best prospect for preventing dangerous importations.

Mr. VAN POETEREN states that the problem in discussion is a very difficult one, which cannot be solved in a few words during a short conference. He had pointed out the standing-point of an exporting country, which possesses a rather extensive organisation; the work being done very carefully, he thinks that our guarantees go as far as can be expected from any country.

As Mr. GÜSSOW has said, he does not like restrictions; he wishes to accept the plants, which his country needs, but yet he has to make some restrictions to make sure that the immense forests and cultures of his country are not threatened by foreign pests or diseases.

Mr. v. POETEREN believes that on thoses principles trade with Canada will be possible for countries which look very carefully after plant-diseases, as well during the growing period as at time of packing. He hopes that this plan will be followed by other countries also, and that quarantine will be restricted to such cases, in which it is absolutely impossible to rely on other measures.

An animated discussion now arose; on account of the importance of the subject it was resolved on the proposal of Dr. VAN SLOGTEREN to renew the discourse on Saturday June 30 at Baarn, when there would be a larger amount of time available; also in the meantime everybody would have occasion to think the matter over, which might tend to more sharply defined remarks. See page 216.

It had now become too late to visit the experimental fields of the Phytopathological Service. Therefore some of the members of its staff gave a very short „exposé" of some experiments made, and results obtained.

Mr. T. A. C. SCHOEVERS, before saying something about some flax-seed, treated with chemicals and exhibited on the stands of the Service in the Hall, wanted to illustrate by a simple instance the great use of a conference like the one now in progress. Several years ago, in 1915, he discovered in diseased spinach- and bean-roots small corpuscules of unknown nature (described and figured in Mededeelingen Landbouwhoogeschool, vol. XV, p. 75; referate in English p. 83). Although it seemed probable that the corpuscules were protozoans, up till now this had not been proved. He had asked the advice of several Dutch and foreign microbiologists, but none of them had been able to point out with certainty the true nature of the unknown small bodies. Now he used the opportunity of the presence of Dr. J. FRANCHINI, of the „Institut Pasteur" at Paris and showed him his photos and slides. Dr. FRANCHINI at once produced a photograph of an organism, recently studied by him which was exactly like the so-called x-organisms of the spinach-roots. He was quite sure that they were indeed protozoans. Dr. FRANCHINI expressed his readiness to examine SCHOEVERS' material; so there is now a good chance that in the near future this matter will be cleared up, thanks to the fact, that Dr. FRANCHINI attended the Conference. One of Mr. SCHOEVERS' lides and Dr. FRANCHINI's photograph were exposed for comparison.

Some preliminary experiments for disinfecting flax-seed, carrying Botrytis-disease.

In 1922 and 1923 ample evidence was secured that the *Botrytis*-disease of young flax-plants originated from infected seed. For further investigation small plots had been sown with flax-seed grown on diseased fields, and treated as follows:

I. Untreated; II. Slightly moistened and then powdered with

Germisan-powder; III. id. id. with *Uspulun*-powder [1]); IV. id. id. with powder for Burgundy mixture; V. Moistened, but immediately afterwards quickly dried, with *Germisan*-solution 1 + 30; VI. id. id. with *Uspulun*-solution 1 + 30; VII. id. id. with water only; VIII. id. id. with 2 % solution of calcium bisulphite; IX. id. id. with $^1/_5$% solution of mercury-chlorid.

For examination by the members of the Conference 100 seeds of each treatment had been put in large Petri-dishes and placed on the stands. Results as follows:

I. Most young seedlings badly attacked by *Botrytis*; 81 % germinated.
II. 99 % of seeds killled.
III. No *Botrytis*, but only 63 % germinated.
IV. Less *Botrytis* than in I, but yet about 50 % diseased; 82 % germinated.
V. No *Botrytis*, 84 % germinated.
VI. About 7 % *Botrytis*, 84 % germinated.
VII. 100 % *Botrytis*, 81 % germinated.
VIII. 80 % *Botrytis*, 83 % germinated.
IX. 10 % *Botrytis*, 81 % germinated.

These results agree with those obtained in the experimental plots, as regards germination; the flax suffered severely from the extreme heat in the first weeks of July; several plants died, but *Botrytis* could not be found. Experiments will be repeated in 1924; it must be stated that disinfection of flax seed on a large scale will be difficult owing to the trouble which arises from the mucilaginous layer of the seed-coat. The mucilage causes the seeds to cake together and, what is worse, reduces the percentage of germination quite considerably.

Mr. v. POETEREN: I should like to say something about the other demonstrations, which cannot all be shown owing to lack of time. First of all I want to say a few words about the furrowing wheel devised for destroying leather-jackets which will be shown out of doors.

The damage to young pasture-land by these larvae is often so extensive that the prevention of this injury has been a very important subject for investigation for the P. S. One of our officers Mr. W. H. DE JONG has studied the life habits of the leather-jackets and has worked out some methods of combating them. For destruction

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[1]) Germisan and Uspulun are products of German origin; both materials have proved their value as seed-disinfectants; the former is especially valuable against stripe-disease of barley; see p. 120—121.

on arable land, it suffices to make use of poisonous bran mash, especially when there are only very young plants on the land (e. g. young sugar beets).

On meadows however there is always so much food, that there the larvae must be killed in another way. Mr. DE JONG who has studied the life habits of the leather-jackets, has found, that they move in a distinct period of their development (i.e. March, April and sometimes also the first part of May) over rather large distances on the surface of the soil. This applies anyhow to the most important species *Tipula paludosa* Meig. This moving is the basis for a method of control by means of small trenches or furrows which are dug in the meadow and in which the leather-jackets fall and ultimately perish.

Now it turned out to be troublesome to have the furrows *dug out* in the meadow and therefore the engineer Mr. POLAK has constructed his furrowing-wheel, which *presses* a small furrow in the ground. The walls of this furrow are vertical and smooth so that the leather-jackets cannot creep upwards and must perish in a few days.

Mr. DE JONG and Mr. POLAK will be glad to give you on the meadow next to this hall all further information you desire in connection with the life habits etc. of the leather-jackets and the technical details of the wheel.

I will also call your attention to the fact, that previously we have tried another method of killing leather-jackets in the ground, i. e. by means of needles, which are pushed into the ground. Mr. POLAK has drawn up and constructed a machine, which is, I believe, very ingenious, but which turned out to be not strong enough to be used in practice.

I suppose however, that the principle features of this machine will interest you.

It pushes a large number of needles at the same time vertically into the ground, and lifts them, while proceeding, also vertically again. The machine is not exposed here, but Mr. POLAK will surely give information about it, to all, who are interested in it. [1])

The other demonstrations would have taken place on one of our experimental fields on the Wageningsche berg, fifteen minutes from here.

I regret, that not only time, but other circumstances too do not allow us to show you what we intended to show. For instance the American gooseberry mildew, of which we had a rather large ex-

[1]) For particulars about leather jackets and their control see: Plantenziektenkundige waarnemingen, IV, „Over Emelten", by W. H. DE JONG en D. L. ELZE (Verslagen en Mededeelingen van den Plantenziektenkundigen Dienst te Wageningen, n°. 28).

perimental plot, has not appeared even on the unsprayed bushes. Therefore we are not able to show the results of our alcaline Burgundy mixtures but Mr. MAARSCHALK will be so kind as to explain this new spray against this disease; during four years this mixture has given fully satisfactory results.

The very particular weather we have had during the last months is also cause of the not-succeeding of other experiments, arranged for this Conference, but Miss SPIERENBURG, Mr. HUS and Mr. VERHOEVEN will be glad to give any information to those interested in the experiments and investigations under their care.

Control of American gooseberry Mildew by alcaline Burgundy mixture. Mr. H. MAARSCHALK, Phytopathologist in the Phytopathological Service of the Netherlands, gives an explanation to persons interested in the way how American Gooseberry Mildew is combated in Holland. He said, that he had found that spraying in spring with Burgundy mixture with an excess of carbonate of natrium, is an excellent remedy. Carbonate of natrium must be taken in excess because this material is able to kill the mildew, when it has still a white colour. As soon as the blossoms have dropped, in Holland about the 5th or 15th of May, the gooseberries are sprayed with Burgundy mixture containing $1\frac{1}{2}$ % coppersulfate and $1\frac{1}{2}$ % carbonate of natrium. The coppersulfate and carbonate of natrium are first separately soluted in about 4 à 5 L. hot water and after the solutions are quite cooled off, mixed with the necessary quantity of water. It makes no difference which solution is first put into the water. Experiments taken in the last four years have shown that every gooseberry field which was sprayed with Burgundy mixture, showed hardly any diseased berries. Even some large gooseberry plantations, which the owners wanted to eradicate, as during several following years the crop was not worth picking, have given already after two years treatment in spring abundant yields, in which hardly any mildewed berries were to be found. No pruning was done in wintertime. It is impossible to kill the mildew with Burgundy mixture, when it has taken a brown color and also it is hardly possible to keep the bushes free from mildew with this spray. The principal thing, i. e. to pick healthy berries, can be obtained with one spray only executed in the beginning of May, at which time the mildew generally appears.

In summer time on sunny days, it is dangerous to use this spray on gooseberries, as after some days the leaves will drop; young leaves stand the mixture better than old ones; therefore spraying in spring can be done without damage, although a little scorching of a few berries may occur.

Another subject was discussed by Mr. MAARSCHALK, i.e. the *use of soft soap*. Having seen in some cases scorching of the leaves after the use of ordinary soft soaps, he had tried to make a soft soap, which could be used in a strong solution without any harm for the plants. He found that a good soft soap could be made by every one, by boiling together one part of resin and ½ part carbonate of potash in 1½ part of water. A soft soap is then obtained, which can easily be soluted in any quantity of water. A smaller amount of water can be taken, but for the practical man, the formula given above is preferable. Sprays mixed with this soap spread readily over the leaves and stick well to them; especially for spraying onions, cabbage, etc., the addition of resin soap can be highly recommended.

Mr. W. B. L. VERHOEVEN, agricultural engineer, attached to the Phytopathological Service, had prepared some experimental-plots to show the *results obtained with some new seed-disinfectants* of German origin. He had experimented with stripe disease of barley *(Helmintho-sporium gramineum)*, stinking smut of wheat *(Tilletia tritici)*, loose smut of oats *(Ustilago avenae)* and covered smut of barley *(Ustilago tecta-hordei)*. The last two failed, as the disease did occur neither in the treated nor in the untreated plots. Each plot had a square area of 7½ $M.^2$. 750 seeds were sown on each plot.

STRIPE DISEASE

Treatment (by moistening and thoroughly shovelling) [1]					*Diseased plants*
1. Germisan	25 gr.	soluted in	4 L.	water per H.L.	8
2. „	50 „	„ „	4 L.	„ „ „	2
3. „	75 „	„ „	4 L.	„ „ „	1
4. „	100 „	„ „	4 L.	„ „ „	0
5. „	25 „	„ „	3 L.	„ „ „	6
6. „	50 „	„ „	3 L.	„ „ „	2
7. „	75 „	„ „	3 L.	„ „ „	1
8. „	100 „	„ „	3 L.	„ „ „	0
9. „	¼ %	„ „	15 L.	„ „ 100 K.G.	5
10. „	½ %	„ „	15 L.	„ „ 100 „	0
11. Untreated.					66
12. Coppersulphate	250 gr.	„ „	3 L.	„ „ H.L.	6
13. Uspulun	¼ %	„ „	15 L.	„ „ 100 K.G.	24
14. „	½ %	„ „	15 L.	„ „ 100 „	15

[1]) See for particulars about this method „Verslagen en Mededeelingen van den Plantenziektenkundigen Dienst", n⁰. 4 or n⁰. 23.

15. Uspulun	100 gr. soluted in 3 L. water per H.L.	3
16. Segetan	2 % „ „ 6 L. „ „ „	124
17. „	4 % „ „ 3 L. „ „ „	95

The nrs. 16 and 17 had been sown at a later date, which causes the large difference with the untreated plot.

STINKING SMUT OF WHEAT
(artificially infected seed)

	Treatment	*Smutted ears*
1. Germisan	25 gr. soluted in 4 L. water per H.L.	0
2. „	50 „ „ „ 4 L. „ „ „	1
3. „	75 „ „ „ 4 L. „ „ „	0
4. „	100 „ „ „ 4 L. „ „ „	1
5. „	25 „ „ „ 3 L. „ „ „	4
6. „	50 „ „ „ 3 L. „ „ „	4
7. „	75 „ „ „ 3 L. „ „ „	1
8. „	100 „ „ „ 3 L. „ „ „	0
9. „	¼ % „ „ 15 L. „ „ 100 K.G.	0
10. „	½ % „ „ 15 L. „ „ 100 „	0
11. Untreated		605
12. Coppersulphate	200 gr. „ „ 2½ L. „ „ H.L.	0
13. Uspulun	¼ % „ „ 15 L. „ „ 100 K.G.	0
14. „	½ % „ „ 15 L. „ „ 100 „	0
15. „	100 gr. „ „ 4 L. „ „ H.L.	2
16. „	100 „ „ „ 3 L. „ „ „	3
17. Tillantin B	0.5 % „ „ 10 L. „ „ 100 K.G.	60
18. „ B	1 % „ „ 3 L. „ „ H. L.	61
19. „ B	2 % „ „ 3 L. „ „ „	47
20. „ C	0.5 % „ „ 10 L. „ „ 100 K.G.	1
21. „ C	1 % „ „ 3 L. „ „ H.L.	8
22. „ C	2 % „ „ 3 L. „ „ „	2

It follows that against stripe disease *Uspulun* is second to *Germisan,* which has given the best results; *Segetan* has done no good in this case. Against stinking smut *Germisan* proved to be as good as coppersulphate and also the most suitable for practical use. The Service advises to use a solution of 100 gram Germisan in 3 L. water per H.L.

Mr. P. HUS, agricultural engineer, attached to the Phytopathological Service:

It was the intention of the Phytopathological Service to demonstrate some methods of combating plant diseases. As we give such demonstrations usually in agricultural and horticultural regions, the members of the Conference would have got on impression of the Service's practical work.

One of the demonstrations regarded *the use of tarred felt disks* invented by Dr. SLINGERLAND to prevent the damage caused by the cabbage-fly, *Chortophila (Anthomyia) brassicae.*

To day these disks are used on a large scale in Holland, nearly 1.000.000 yearly are fastened to the cabbage-plants.

In the beginning it was not easy to get the growers to use the disks. A lot of difficulties were enumerated, and it seemed to be impossible to convince the growers.

However the results of the demonstrating fields worked as an incitement.

Losses of 90—95 % were reduced to 5—8 %. The differences between the rows of „collared" (in Holland the disk is called a „collar" and the „uncollared" plants were so clear that nobody could doubt the value of the disks.

The price of the disks (nearly 1 sh. p. 100) was no objecction to the application, only the manner of use and the time for fastening the disks caused some trouble.

Our officers helped the growers everywhere, showed them how to fasten the disks to secure a good result and now the „collar" has become popular in Holland.

The secret for obtaining a good result is a good fastening of the collar. The main point is that the collar must lie flat on the ground and that the peaks of the star (the collar has a star-formed incision) are close to the stem of the cabbage-plant.

Fastened in this way it is impossible for the fly to lay the eggs at the foot of the plant.

Sometimes the fly succeeds in creeping under the collar, then the eggs are laid at the nether side of the disk. It in curious that those eggs soon die, they become brownish, and shrivel. Probably this is due to the tar, which for that reason is a good ingredient of the disk.

The disks are hexagonally formed. This is the most economic form; from one roll of tarred paper nearly 2300 disks can be made. —

For some years the disks were made by hand. By means of a punch the collars were cut out of the sheet of paper. One person could make 3000—3500 disks daily. At present the disks are machine-made.

The *big buds of black currants,* a disease, which is caused by the mite *Eriophyes ribis,* has become of great importance. In some of our fruit-growing districts the attack is so bad, that the culture of black currants has strongly decreased; in some places even the black currant has disappeared entirely.

In connection with the very high prices paid for black currants during last years, there is a great desire to grow black currant bushes free of big buds.

For many years sprays have been tried, however without success. The course of life of the *Eriophyes ribis* offers a lot of obstacles to effectual combating. During nearly the whole year all stages of life, eggs, larvae and imagines are present. It seems impossible to kill at once the mites in all these stages of life; it has been proved that an often repeated spray is not sufficient; we have no remedy to prevent the buds from the penetration of the mite.

So we were obliged to look for other methods. It was presumed that the mite hibernated in the buds. For this reason one would imagine that the cutting away in winter of all infected shoots, even of the whole bush, would free the plantation of this insect. But it has now become clear that this supposition is not true.

The young shoots, grown in the spring, following on the cutting in winter, show immediately the big buds badly. It is not known in which way these shoots are attacked, nor where the mites come from.

We believed from the trunk or from the surrounding ground. We sprayed the trunk with 10% carbolineum, drenched the surrounding ground with the same liquid and still the shoots were attacked.

So cutting-away combined with winter spray (10 % carb.) is not the proper method to get rid of big buds.

Some results can be obtained by picking and gathering continually the infected buds. When we do so for many years, the plantation becomes at least rather healthy.

Our hope, however, is fixed on the cultivating of immune or resistant varieties. Some people believe they have already got such varieties. In several places we have planted a lot of them for control. They are in the midst of badly infected bushes, big buds are thrown all around, twigs with infected buds are fastened to them to make the chance of infection as great as possible. The results of the first year are encouraging. We have not found an absolute immunity: there were big buds, but only a few of them.

If in the next years the infection remains as small as in the past, we have without doubt a variety, which will be grown in those regions where the black currant has now disappeared.

Miss DINA SPIERENBURG, phytopathologist in the Phytopathological Service, gave at a private interview with several members the following exposé of the new elm-tree disease [1]:

[1]) DINA SPIERENBURG. Een onbekende ziekte in de Iepen I. Mededeelingen en Verslagen van den Plantenziektenkundigen Dienst nr. 18 (1921). Idem II. nr. 24 (1922).

During the last few years a bad elmtree-disease has been very prevalent in our country. We hear more and more, that the disease has also made its victims in the surrounding countries.

The disease discloses itself by a mass of dry leaves in the top of the trees, those dry leaves come lower and lower, till the whole mass of leaves has become brown and the tree dies right off.

In some cases, mostly young trees from 15—30 years old, the process takes only a few weeks time, older trees of 60 a 80 years, pine away more slowly for some years. Up to this year (1923) several of those old trees look bad, they bud again every year, but we soon see that the leaf-mass is thin and very soon the leaves begin to fall.

Many of those trees are cut down on account of their looking so bad, but they are rarely quite dead as the young trees are when felled. The inner wood shows rings of brown spots in the xylem of the last annual circles. In a severely diseased tree every branch from the thickest to the smallest shows the discolouring of the xylem. In many cases the discolouring is also to be seen in the stem and in the roots.

From the discoloured wood a fungus of the genus *Graphium* can be cultivated. Miss Dr. M. B. SCHWARZ has called this fungus *Graphium ulmi.* [1])

Many infections have been done with *Graphium ulmi,* but up to now we have not yet succeeded in creating the symptoms of the disease as they appear in the living tree. Infections with *Graphium* give discolouring of the wood, but elmtree-wood discolours very soon, so that discolouring is also the result of infections with other fungi or with bacteria. So it is not yet sure, if the fungus is the cause of the disease, for, as you know, in plant pathology as a result of the infection the symptoms of the disease must show themselves, and so far I have not yet succeeded in obtaining these results. No one of my many infected trees and twigs showed wilting or browning of leaves, only colouring of the xylem. Of course the investigations are being continued, but we can certainly say that even if the fungus should prove to be the cause of the disease, climatological influences, especially drought, have a great influence on the outbreak and on the course of the disease.

M. W. POLAK (Lecturer in Mechanics in the Agricultural University, Wageningen). *The furrowing-wheel for destroying leather-jackets* (Pl. VIII). It is well known that there exists a method for

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[1]) M. B. SCHWARZ. Das Zweigsterben der Ulmen, Trauerweiden und Pfirsichbäume. — Thesis, accepted by the Utrecht University, 1922.

destroying leather-jackets in *pasture ground*, by making narrow trenches or furrows in which the leather-jackets are caught.[1])

It is probable that with this method satisfactory results will be obtained, provided the furrows can be made at a short distance from one another (say from $1^1/_2$ to 2 yards). This, however, is hardly practicable under present conditions when trenches are made with the help of the spade or the plough; this method meets with too many difficulties when the distance is very small.

With the *furrowing-wheel*, however, we are enabled to make furrows at small distances without meeting with the said difficulties. The trenches can be made exceedingly narrow, and no mould is thrown upon the field. The construction of the furrowing-wheel is a very simple one.

Under the cart a thin cast-iron wheel is contrived, which (by means of a lever) can be forced down into the ground, as far as the depth required. This wheel will drive a narrow rut or track into the ground, which constitutes the furrow which is wanted (Pl.VIII)[2]).

Furthermore I should like to draw your attention to an apparatus which we have recently fitted on to the furrowing-wheel; this contrivance is used foı strewing poisoned bran all along in the furrow which Mr. DE JONG wanted to try, as he had already booked very good results with that bran on arable land (method of PACKARD and THOMSON in California).

This sowing of poisoned bran can be done by throwing it by hand into a funnel from which it is conducted to the furrow by means of a tube. In our implement, however, we contrived a small mechanical sowing-apparatus. From a mechanical point of view it would be more practical to use a powder or a liquid instead of bran, because bran will pass with difficulty through a thin pipe. Perhaps a powder or liquid fit for the purpose may yet be found. — Finally I beg to note the following particulars:

1. We have not yet been able to make any experiments, as there were no leather-jackets this year. So the practicability of this implement has still to be proved.

2. The demonstration of the implement will here be made on heavy clay-ground, though it is intended for use on sandy-soil. I can, however, assure you that the furrows in sandy soil will prove quite as satisfactory and will remain undamaged for a considerable time.

3. The cart has to be so heavy, or so heavily loaded, that the

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[1]) See page 117.

[2]) For particulars see „Mededeelingen Landbouwhoogeschool", Vol. XXIV, part. 2.

wheel will penetrate to a sufficient depth. Practical experiments must show which depth may be considered to suffice.

4. The tractive power required is a rather considerable one, and, of course, will depend on the nature of the soil. Practically, I think, two horses will be required to draw the cart.

I hope that this short explanation has been sufficiently clear and comprehensible, so that we may now proceed to the demonstration.

(The cart then drove over the field and the furrowing-wheel cut its sharp-edged furrows into the soil.)

SESSION ON TUESDAY JUNE 26, 2 P. M.

IRRTÜMER UND MISSBRÄUCHE BEI DER BEGUTACHTUNG DER BEKÄMPFUNGSMITTEL

VON

J. BERNÁTSKY

Erzeugung und Verkauf der Bekämpfungsmittel, d. i. der Mittel die zur Bekämpfung der Pflanzenkrankheiten dienen, ist mit Handelsinteressen verbunden. Der Absatz der Bekämpfungsmittel hängt oft von der Begutachtung seitens wissenschaftlicher Forscher und Beamten ab. Es liegt aber in der menschlichen Natur, dass manchmal weder Reichtum noch Armut, weder ämtliche noch wissenschaftliche Titel des Begutachters, vor Irrtümern und selbst vor Missbräuchen schützen. Das moralische Empfinden ist durchaus nicht überall gleich. Es kommt auch vor, dass die Begutachter unter ämtlichen Druck stehen.

Auf Grund meiner eigenen auf zwanzig Jahre zurückreichenden Erfahrungen könnte ich auffallende Beispiele mit sonst geachteten Namen aus verschiedener Herren Länder erwähnen, dies dürfte aber überflüssig sein. [1])

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1) Es sei mir bloss gestattet, ein einziges, fast unglaublich klingendes Beispiel zu erwähnen. Ein gänzlich neues Bekämpfungsmittel wurde einfach so untersucht, dass man mit demselben einen Obstgarten gegen eine gewisse Pilzkrankheit einmal bespritzte. Die Obsternte fiel gut aus und von dem Pilz war keine Spur vorhanden. Auf Grund dieses „Versuches" wurde das Bekämpfungsmittel ämtlich als vorzüglich begutachtet! Andere Forscher aber stellten fest, dass die betreffende Pilzkrankheit damals in jener Gegend überhaupt nicht zum Ausbruch kam, weil der Sommer dort ausserordentlich trocken war!

In manchen Fällen sind auch kleinliche psychologische Momente, wie z. B. wissenschaftliche Eifersucht massgebend.

Das Auftreten der Krankheitserreger hängt auch vom Klima, Standort und von der Witterung ab. Dieselbe Krankheit erscheint in manchen Jahren fast gar nicht oder nur schwach, in andern Jahren tritt sie äusserst heftig auf. In erstem Fälle erweisen sich auch schwach wirkende Bekämpfungsmittel als ausgezeichnet, oder es genügt ein einziges Bespritzen mit dünner Lösung; in letzterem Falle erweisen sich auch sehr wirksame Mittel, in konzentrierter Lösung und mehreremals angewandt, als zu schwach.

Sowohl aus praktischen Erfahrungen als auch aus Laboratoriumsversuchen weiss man, dass die fungicide oder insecticide Wirkung mancher Bekämpfungsmittel von der Temperatur, Feuchtigkeit, Nässe und Wind abhängt (Schwefelstaub, Schwefelkohlenstoff, Tetrachlorcarbon, Kupferhydroxid); manchmal ist die Bekämpfungsweise ausschlaggebend (Perozid).

Manche Kompositionen (Mischungen) erweisen sich bald entschieden besser, bald gar nicht besser, als einfachere Mittel. (Schwefelkupferstaub wirkt bei trockenem Wetter gar nicht besser als Schwefel, aber bei nassem Wetter bedeutend intensiver und rascher, weil dann die Wirkung des Kupfers zur Geltung gelangt, was sich in Laboratoriumsversuchen genau nachweisen lässt.)

Alldemgemäss können auch sonst einwandfreie Bekämpfungsversuche zu einander widersprechenden Ergebnissen führen.

Die Wirkung des Bekämpfungsmittels hängt manchmal auch sehr von dem Entwicklungsstadium des Krankheitserregers ab (indem z. B. Nikotin und auch Venetan gegen Conchylis ausgezeichnete Dienste leistet, solange die Raupe jung ist, aber im vorgeschrittenen Alter der Raupe beinahe versagt). Ebenso hängt der etwaige schädliche Einfluss des Bekämpfungsmittels auf die Wirtspflanze von verschiedenen Umständen, auch vom Zustand und Entwicklungsstadium der Wirtspflanze ab (indem z. B. schwach sauer wirkende Kupferkalkbrühe das junge Laub bedeutend stärker schädigt als altes Laub derselben Pflanze). [1])

Ferner kommt es oft vor, dass Zoologen blosz das vielleicht weniger wichtige Insekt, Botaniker blosz den vielleicht weniger wichtigen Pilz auf der Wirtspflanze warnehmen und dagegen Bekämpfungsversuche durchführen. Auch kommt es vor, dass der Forscher blosz irgend einen wenig wichtigen Parasiten oder gar Saprophyten auf der Wirtspflanze, aber nicht auch deren eigentliche Krankheits-

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1) Manche Bauern in Ungarn wissen aus Erfahrung ganz gut, dass der Kupferkalkbrühe im August nicht soviel Kalk zugesetzt werden muss wie im Mai und Juni.

ursache, die etwa physiologischer Natur ist (Frost, Boden, Klima, Lichtmangel), warnehmen. Wenn dann nicht die primäre, sondern die ganz unwesentliche sekundäre Krankheit versuchsweise bekämpft wird, so kann das Ergebnis keinen grossen Wert haben. Es sei auch daran erinnert, dass wissenschaftliche Forscher zuweilen keine Ahnung vom praktischen Pflanzenbau oder gar vom landwirtschaftlichen Betrieb haben; die Begutachtung solcher Forscher kann wissenschaftlich einwandfrei, aber vom praktischen Standpunkt undurchführbar und lächerlich erscheinen. Landwirtschaftlich gebildete Begutachter sind dagegen zuweilen geneigt, ohne wissenschaftliche Genauigkeit vorzugehen.

Es muss auch daran erinnert werden, dass in manchen landwirtschaftlichen und gärtnerischen Betrieben die elementärsten Forderungen der Pathologie (wie z. B. energisches Vernichten des Fallobstes, das mit der Obstmade oder mit Monilia behaftet ist), unbeachtet bleiben und infolgedessen die Versuche mit Bekämpfungsmittel fast illusorisch werden.

Es ist aber einerlei, aus was für Ursachen oft ganz falsche Begutachtungen selbst auch von wissenschaftlichen Autoritäten und Instituten herausgegeben werden; man kann jedenfalls den Grundsatz aufstellen, dass es *im Interesse der Wissenschaft, der praktischen Landwirtschaft und aller ackerbautreibenden Länder liegt, darauf hinzuwirken, dass Irrtümer und Missbräuche bei der Begutachtung der Bekämpfungsmittel möglichst vermieden werden.* Unsere Aufgabe ist es jedenfalls, solche Irrtümer und Missbräuche zu verhindern helfen.

Diesbezüglich wäre es vielleicht vorteilhaft, für die Art und Weise und für den ganzen Gang der Untersuchung der Bekämpfungsmittel gewisse Regeln festzustellen und den mit der ämtlichen Begutachtung betrauten Beamten anzuempfehlen, die Regeln möglichst zu befolgen.

Es mag zweifelhaft erscheinen, ob sich derartige Regeln überhaupt feststellen lassen und sollte dies dennoch geschehen, so bleibt es noch fraglich, ob die Beamten geneigt sein werden die Regeln zu befolgen. Um aber die Lösung der Frage nicht gänzlich unversucht zu lassen, sollte damit eine Kommission betraut werden, die entweder ihre abfällige Meinung oder aber ihre ausgearbeiteten Vorschläge einem berufenen Forum unterbreitet.

Als derartige Regeln dürften vielleicht folgende Berücksichtigung verdienen:

I. Studium der einschlägigen Literatur.

II. Biologisches und landwirtschaftliches Studium der Wirtspflanze.

III. Studium der Biologie des Krankheitserregers oder Schädlings, mit Rücksicht auf diesbezügliche praktische Erfahrungen.

IV. Orientierung über Einfluss der Witterung, des Bodens, der Lage und der Bewirtschaftung auf die Wirtspflanze und auf den Krankheitserreger.

V. Eigentliche Untersuchungen des Bekämpfungsmittels.

1. Chemische und physikalische Untersuchung: nicht nur chemische Analyse, sondern auch Prüfung z. B. auf Löslichkeit, Vermengbarkeit, Einfluss verschiedener Faktoren (z. B. Temperatur) auf das Bekämpfungsmittel.

2. Biologische Versuche im Laboratorium. Sie bieten den Vorteil, dass sie bedeutend billiger sind als praktische Versuche, ferner in verhältnismässig kurzer Zeit und mehr oder weniger unabhängig von Witterung und Vegetation über wesentliche Fragen sicher Aufschluss geben. Namentlich die fungicide oder insecticide Wirkung des Mittels lässt sich am raschesten, sichersten und billigsten im Laboratorium feststellen. Im Laboratorium kann man hundertfach variierte Versuche bedeutend leichter und schneller durchführen, als im Grossen in der Praxis.

Dabei hat man folgendes zu beachten:

a. Variierung. Der Versuch soll verschiedentlich und unter verschiedenen äussern Umständen variiert werden.

b. Kontrolle. Die Versuche sind immer vergleichsweise durchzuführen; in ganzen Versuchsreihen sollen sämtliche mitwirkende Faktoren vollkommen gleich sein, blosz ein einziger Faktor variiert; in Versuchsreihen soll nicht nur das fragliche Mittel, sondern auch gut bekannte Mittel vergleichsweise geprüft werden; zugleich ist das Verhalten des Krankheitserregers ohne Zugabe irgend eines Mittels vergleichsweise zu untersuchen.

c. Wiederholung. Derselbe Versuch soll öfters wiederholt werden.

d. Die Versuche sollen sich erstrecken auf die fungicide oder insecticide Wirkung im allgemeinen, sowie auf bestimmte Krankheitserreger, ferner auf die Wirkung des Mittels auf Wirtspflanzen, auf etwaige Wirkung auf Mensch und Haustiere, auf das Verhalten des Mittels z. B. in der Spritzmachine, richtige Aufbewahrung desselben, etc.

3. Kleinere praktische Versuche in landwirtschaftlich betriebenen Versuchsfeldern. Es sind dabei möglichst ähnliche Regeln zu befolgen wie im Laboratorium.

4. Grosze praktische Versuche.

Auf Grund der bisher erwähnten Untersuchungen wird man in der Regel ein endgültiges, über jedem Zweifel erhabenes Ergebnis erreichen. Aber es sollen auch noch verschiedene praktisch wichtige Fragen gelöst werden, wie z. B. über die richtigste und billigste Durchführung der Bekämpfung mit Rücksicht auf den landwirtschaftlichen Betrieb, Erziehung der mitwirkenden Arbeitskräfte, praktischen Gewinn, u. s. w.

Die grosszügigen praktischen Versuche bieten zugleich dem Forscher Gelegenheit, in den landwirtschaftlichen Betrieb einen Einblick, und über die physische und geistige Leistungsfähigkeit der landwirtschaftlichen Arbeitskräfte, sowie über die sich manchmal wiederstreitenden Forderungen des landwirtschaftlichen Betriebes und des Pathologen einen Überblick zu gewinnen.

VI. Wiederholung der Untersuchungen durch andere Forscher. Je mehr andere Forscher dasselbe Ergebnis erhalten wie wir selbst, desto sicherer kann man seiner Sache sein.

VII. Strenges Meiden all dessen, was an Geheimhaltung grenzt. Die Untersuchungen sollen durchwegs nicht im Geheimen stattfinden, sondern man lasse vielmehr einem Jeden zutritt, der nur einigermassen etwas von der Sache versteht. Besonders gelegentlich grösserer praktischer Versuche sollen Kollegen, verwandte wissenschaftliche Institute, Landwirte, Nachbarn zur Besichtigung von allem Anfang an eingeladen werden, Besichtigung des Ergebnisses allein genügt nicht immer.

Geheimhaltung der Untersuchungen kann in manchen Fällen sowohl aus praktischen als auch aus rein wissenschaftlichen Gründen, z. B. wenn es sich um Erwerbung eines Patentes oder um die wissenschaftliche Priorität handelt, erlaubt sein. Aber sonst kommt man durch Geheimhaltung der Untersuchungen mit vollem Recht in den Verdacht, ohne gehörige Objectivität vorgehen zu wollen.

VIII. Veröffentlichung nicht nur der Versuchsergebnisse, sondern auch der Untersuchungen (nicht gerade weitläufig). Einfache Begutachtung ohne beweiskräftige Veröffentlichung der Bezüglichen Untersuchungen ist immer verdächtig.

Mit dem Festsetzen und Anempfehlen dieser oder ähnlicher Regeln wird unsere Aufgabe noch nicht gelöst sein. Ausserdem wird man die Regeln auch beim besten Willen nicht immer genau befolgen können. Aber wenn man in strittigen oder verdächtigen Fällen erfahrt, ob sie gelegentlich der Untersuchung und Begutachtung irgend eines neuen Bekämpfungsmittels wenigstens einigermassen eingehalten oder gar nicht befolgt wurden, so kann man sich über den Wert der Begutachtung ein Urteil zurechtlegen. Zum Schluss möchte ich die Hoffnung aussprechen, dass es der in Vorschlag gebrachten Kommission und überhaupt den erfahrenen Vertretern der Phytopathologie sicherlich gelingen wird, auch noch andere Wege und Mittel zur Erreichung des Zieles ausfindig zu machen.

VORSCHLAG

im Interesse der Vermeidung von Irrtümern und Missbräuchen bei der Begutachtung von Bekämpfungsmitteln.

1. Der Kongress erkläre, dass es im Interesse aller ackerbautreibenden Länder liegt, darauf hinzuwirken, dass bei den wissenschaftlichen Begutachtungen von Bekämpfungsmitteln Irrtümer und Missbräuche möglichst vermieden oder beseitigt werden.

2. Der Kongress ernenne eine Kommission, die sich mit der angedeuteten Frage beschäftigen und diesbezügliche Vorschläge dem Kongress noch während seiner Tagung unterbreiten soll.

Wenn dies unmöglich ist, so ernenne der Kongress eine Kommission, die ihre Vorschläge erst dem nächsten intern. phytopathologischen Kongress unterbreitet.

Oder aber, um Zeit zu gewinnen, betraue man mit der Besprechung der Frage eine Kommission, die ihren Sitz in Wageningen hat und ihren Beschluss den Interessenten aller ackerbautreibenden Länder binnen einem Jahr mitteilt.

VORSCHLÄGE FÜR EINE EINWANDFREIE BEGUTACHTUNG VON PFLANZENSCHUTZMITTELN

VON

E. RIEHM [1]

I. Amtliche Begutachtung.

Eine Beseitigung der von dem Direktor der Station für Mykologie in Budapest, Herrn Dr. J. BERNATSKY, geschilderten „Irrtümer und Missbräuche bei der Begutachtung der Bekämpfungsmittel" ist dringend erwünscht. Es erscheint mir aber kaum möglich, durch Aufstellen von Richtlinien allein diese Missstände zu beseitigen, wenn man nicht in den einzelnen Ländern massgebende Stellen schafft, die in Zusammenarbeit mit den Vertretern der Phyto-

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[1]) Dr. E. RIEHM (Biol. Reichsanstalt, Berlin-Dahlem), did not attend the Conference; as his "Vorschläge" refer to Dr. BERNATSKY'S paper, the Editor inserts them here although there was no time to have them read at the Conference.

pathologie oder angewandte Entomologie eine Begutachtung von Pflanzenschutz-mitteln ausführen und am besten amtlichen Charakter erhalten. Zu erstreben wäre es, dass in den einzelnen Ländern Gesetze geschaffen würden, die alle von der massgebenden Stelle nicht für brauchbar befundenen Pflanzenschutsmittel vom Verkehr ausschliessen.

In den Ländern, in denen solche Gesetze nicht geschaffen werden, müssen die Verbraucher von Pflanzenschutzmitteln besonders eindringlich auf den Wert der Begutachtung durch diese Stellen hingewiesen werden. Haben die Verbraucherkreise den Wert der von diesen Stellen begutachteten Pflanzenschutzmittel erkannt, so werden sie nur von diesen Stellen begutachtete Pflanzenschutzmittel verlangen; infolgedessen werden dann die Hersteller von Pflanzenschutzmitteln sich in erster Linie an die massgebenden Stellen wenden.

II. Mitwirkung bei der amtlichen Begutachtung.

An der amtlichen Begutachtung können sich alle Phytopathologen bezw. Entomologen an Universitäten, Pflanzenstationen und anderen Anstalten beteiligen, sofern weder sie selbst, noch ihre Institute an dem Vertrieb von Pflanzenschutzmitteln pekuniär interessiert sind. Bei jeder einzelnen Begutachtung muss eine Mindestzahl von Begutachtern mitwirken, deren Versuchsfelder oder Versuchsgärten möglichst unter verschiedenartigen klimatischen Verhältnissen liegen müssen.

III. Vorbedingung für die amtliche Begutachtung.

Jede Begutachtung von Pflanzenschutzmitteln ist zwecklos, wenn man nicht die Gewähr hat, dass das betreffende Pflanzenschutz mittel stets in derselben Zusammensetzung in den Handel kommt, in der es geprüft worden ist. Deswegen ist es unbedingt notwendig, dass die Hersteller der massgebenden Stelle die Zusammensetzung der zu prüfenden Pflanzenschutzmittel vertraulich mitteilen. Noch besser wäre es, wenn die öffentliche Bekanntgabe der Zusammensetzung auf den Packungen der Pflanzenschutzmittel erreicht werden könnte. Bei der Angabe der Zusammensetzung genügt es nicht, wenn nur die chemischen Elemente angegeben werden, weil die Wirksamkeit der Stoffe von der Art und Weise abhängt, in der die Elemente chemisch gebunden sind. Der Hersteller des Pflanzenschutzmittels muss also genau angeben, in welcher chemischen Verbindung die wirksamen Substanzen in dem Pflanzenschutzmittel enthalten sind. Nur dann kann man durch gelegentliche chemische Kontrolle einzelner aus dem Handel entnommener Proben feststellen, ob das Pflanzenschutzmittel in derselben Zusammensetzung geliefert wird, in der es zur Begutachtung eingeschickt worden war.

IV. Aufstellung des Versuchsplanes.

Die Begutachtung eines Pflanzenschutzmittels kann nur auf Grund eingehender biologischer Prüfung erfolgen. Die hierfür erforderlichen gemeinsamen Versuche der massgebenden Stelle und der mit ihr zusammen arbeitenden Phytopathologen und Entomologen müssen nach einem einheitlichen Versuchsplan ausgeführt werden. Bei der Aufstellung dieses Versuchsplanes sind die von Herrn Dr. BERNATSKY aufgestellten Grundsätze zu beachten. Vielleicht wären ausserdem noch folgende Punkte zu berücksichtigen:

Die Zahl der Versuchspflanzen bezw. der Versuchsparzellen darf nicht zu klein sein, damit das Ergebnis nicht durch individuelle Verschiedenheiten oder Standortsunterschiede beeinträchtigt wird.

Die Versuche müssen mit einer gegen den in Frage kommenden Schädling besonders anfälligen Pflanzenart bezw. Sorte durchgeführt werden. Zu empfehlen ist, die Versuche gleichzeitig mit mehreren Pflanzensorten auszuführen. Wenn möglich, sollten alle Versuchsansteller die Prüfung des Pflanzenschutzmittels an denselben Pflanzensorten durchführen.

Um zu verhüten, dass das Ergebnis durch das Auftreten anderer Schädlinge beeinträchtigt wird, ist zu empfehlen, soweit angängig, sämtliche Pflanzen, auch die Kontrollpflanzen, gegen andere Schädlinge durch eine einheitliche Behandlung zu schützen. Ist z. B. ein Pflanzenschutzmittel gegen *Fusicladium* zu prüfen, so werden sämtliche Pflanzen in gleicher Weise durch Arsenbehandlung vor Beschädigung durch tierische Schädlinge zu schützen sein.

Der Termin für die Ausführung der Versuche muss durch einen bestimmten Entwicklungszustand der Wirtspflanze oder des zu bekämpfenden Schädlings genau charakterisiert sein.

V. Ausführung der Versuche.

Die Ausführung der Versuche muss stets unter der Kontrolle eines Phytopathologen oder Entomologen erfolgen, darf also nicht Landwirten oder Gärtnern allein überlassen werden. Während der Dauer des Versuches müssen Notizen über die Witterungsverhältnisse gemacht werden. Abweichungen von dem gemeinsamen Versuchsplan sind unter allen Umständen zu vermeiden.

VI. *Feststellung des Versuchsergebnisses.*

Der Erfolg des Versuches muss nach einheitlichen, vorher zu vereinbarenden Grundsätzen festgestellt werden. Über jeden Versuch ist ein genaues Protokoll anzufertigen, aus dem hervorgeht, wer den Versuch ausgeführt hat und für die richtige Durchführung verantwortlich ist, unter welchen klimatischen und Bodenverhältnissen, mit welchen Pflanzensorten und zu welcher Zeit der Versuch zur Ausführung gelangt ist. Alle Momente, die das Ergebnis des Versuches in dem einen oder anderen Sinne beeinflusst haben, sind besonders hervorzuheben.

VII. Begutachtung des Pflanzenschutzmittels.

An der Hand der einzelnen Versuchsprotokolle entscheiden die Versuchsansteller gemeinsam unter Berücksichtigung aller von Herrn Dr. BERNATSKY bereits erwähnten Momente, wie das geprüfte Pflanzenschutzmittel zu bewerten ist.

Durch gemeinsame Arbeit mehrerer Phytopathologen bezw. Entomologen mit einer massgebenden, möglichst amtlichen Charakter besitzenden Stelle nach einheitlichem Plan werden die, von Herrn Dr. BERNATSKY mit Recht gerügten Miszstände bei der Begutachtung von Pflanzenschutzmitteln vermieden werden können. Diese einwandfreie Begutachtung wird aber für die Landwirtschaft nur von Nutzen sein, wenn man durch chemische Kontrolle der Pflanzenschutzmittel dafür sorgt, dass die begutachteten Pflanzenschutzmittel stets in derselben Zusammensetzung geliefert werden, in der sie für wirksam befunden waren.

DISCUSSION.

Dr. H. FAES: *l'Experimentation, l'utilisation et la mise au commerce des remèdes pour plantes.* La prochaine conférence internationale de phytopathologie devrait inscrire à son programme l'étude de l'expérimentation et de la mise au commerce des remèdes pour plantes, dans le but d'assurer aux agriculteurs la sécurité des produits employés, leur fourniture à un prix raisonable, tout en donnant également des garanties au commerce international.

Dans chaque pays, une station centrale ou plusieurs stations centrales pourraient enregistrer les demandes et recevoir les produits à expérimenter. Elles délivreraient ces produits aux stations secondaires qui par leur situation en milieux variés (climat et sol) assuraient les conditions voulues pour une expérimentation pratique sérieuse. Les rapports des stations sécondaires seraient adressés aux stations centrales qui posséderaient seules la compétence pour autoriser ou refuser la mise en vente des produits.

L'analyse chimique des remèdes pour plantes (controle) pourrait être fait par les stations centrales ou les stations secondaires.

Considérant le fait que la plupart des grandes fabriques de produits chimiques instituent actuellement des sections de phytopathologie dans lesquelles elles s'attachent des spécialistes, il apparait indispensable que les remèdes pour plantes ne puissent être sans autre lancés dans le commerce, sous les noms les plus divers, mais qu'ils doivent être soumis dans chaque pays à un controle officiel préalable.

Mr. HOWARD, entomologiste chef des Etats-Unis d'Amérique a communiqué une note de son chef de service, Mr. QUAINTANCE qui déclare également très désirable l'étude et la mise au point prochaine de cette question.

For Dr. APPEL's paper: „DER PFLANSENSCHUTZ IM UNTERRICHT" see page 226.

Several members then visited the institutions named on p. 14 or examined the exhibitions in the Great Hall; the evening was spent in visiting the beautiful surroundings of Wageningen.

EXHIBITIONS IN THE GREAT HALL

Along the walls on amphitheatrically built stalls the *Phytopathological Service* exhibited a collection of objects such as are used at the agricultural and horticultural shows of farmers- and growers-unions (see also p. 90 of this Report). The objects were ranged in accordance with the plants attacked, so there was to be seen a collection of diseases and pests of cereals, of potatoes, of cabbages, of tomatoes, of apples, of grapes, of roses etc. If possible the material is dried and glued on white or black cardboard; if the object keeps better in liquor, it is put in a cylinder of suitable size, containing a solution of 6% commercial formaldehyde with $\frac{1}{2}$ % coppersulphate; in this mixture most plants keep their green colour. Some of them however, e.g. pear leaves, have to be boiled for one or two minutes before, and even then they are apt to become rather black. The leaflets and bulletins, referring to the diseases shown on the boards or in the cylinders, were also put on the tables together with some photographs. On small paper plates living objects, e.g. scabby potatoes or apples, mildewed grapes, smutted cereals were also shown. This is always very much appreciated by the visitors of the rural shows, as they are then able to recognise the diseases often more easily than when the objects are dried or put in liquor.

The materials used in Holland for the control of diseases and pests were not forgotten on the stand. For a general view see Pl. XIV.

The ornithological section of the Service (see p. 89 of this Report) also showed something of its work [1]; some proofs of the constant domicile and „constant marriage" of birds were exhibited. Some nestboxes of different sizes destined for smaller and larger birds were to be seen on this stand. Furthermore there were beautiful fotoes of birds bathing etc., and also the contents of the stomachs of several kinds of birds, e.g. barn-owl and night-jar. The methods by which the work of the numerous assistants is being directed were also explained.

The *Seed-testing Station* exhibited a series of diseases of plants, which are carried by the seed. The *Fusarium* (= *Gibberella*) disease of cereals, the *Gloeo-*

[1]) See: Verslagen en Mededeelingen van den Plantenziektenkundigen Dienst, nr. 17, Vogelcultuur en Vogelstudie, 1921 and nr. 30, id. id., 1922.

sporium of beans, the *Ascochyta* of peas, the *Colletotrichum* of flax etc. were to be seen, both on the host and in pure cultures. Miss Dr. L. C. DOYER, mycologist in the Station, who had arranged this part of the exhibition, was present to give information about her investigations.

Prof. Dr. W. ROEPKE had exhibited an extensive collection of beautiful and clever fotoes and drawings, by himself and by native artists, of injurious and beneficial insects from the island of Java (Dutch East Indies). The larger part of these pictures has never been published or exhibited for examination before. The attending entomologists showed great interest in these pictures.

Early the next morning the company was divided in two; nearly one half joined in the trip to Boskoop etc., a few more including all potato-men followed Prof. QUANJER to Groningen etc. Several Dutchmen also joined in the trips; so each party consisted of about 40 persons.

Groningen is the capital of the province of the same name, where agriculture is highly developed. In the afternoon Mr. HUDIG read his paper in the school of Agriculture.

DISEASES OF CROPS ON ALCALINE AND SOUR SOILS

BY

J. HUDIG

(Plate IX, X)

Ladies and Gentlemen,

The committee of management of this Conference has asked me to give you in a few moments a summary of our studies of the phenomena that we have called the *soil-diseases*.

I have acceded to this request with great pleasure, thinking it of considerable advantage that a conference of international scientists should get acquainted with a deviation in normal plant-growth, not only of local, but also of general significance.

There is however a special difficulty in the request of the Committee, caused by the circumstance of my being obliged to speak in English to your illustrious society; therefore I must make an appeal to your kindness and ask your indulgent judgment for my modest knowledge of that language, and for the insufficiency of my pronunciation.

Although the soil-diseases, of which we know "a triplet", are studied by us only from a chemical point of view, and are cured in the same way, these phenomena will be of great importance to the phytopathologists, because the primordial cause of the soil-diseases is to be sought in the micro-biological influences; influences, which are to be considered, — scientifically as well as economically, of high interest.

The soil-diseases are chiefly found in the sand-and peat-soils, that is to say, in soils in which the fertility depends merely upon the quantity and the character of the organic matter, the humus, whilst the mineral constituents consist for the greater part of pure sand or SiO_2 and other neutral minerals.

As the greater part of the Netherlands consists of such soils, you'll understand at once the importance of the study for our country.

I

DUTCH OAT-DISEASE.

I'll begin with the description of the earliest known disease, called in Dutch the „Veenkoloniale haverziekte" which can be translated by: oat-disease of the colonies in reclaimed moors; I'll briefly call it before you: the "Dutch oat-disease".

About 20 years ago this disease appeared coincidently, with the increasing application of artificial manures, called in the Rothamsted terminology: "minerals"; it grew slowly but steadily on to critical dimensions.

The symptoms for oats can be described as follows:

In the beginning the little plants on the field look quite normal, with green healthy leaves of normal feature. Then suddenly on a hot day, the little plants will turn a yellowish pale colour and on examining the leaves, one beholds little spots of a greenish gray hue, as if the leafblades were touched locally by hot air. These spots lie without any regularity, just on the edges of the blades.

The leaves themselves become weak and drooping and form as a rule, on the feeblest places a fold or crack. It is remarkable that the top of the blades will remain for a long time undamaged, without any whithered spot, and may look fresh and healthy, until the middle of the blade is covered with withered spots. In case of severe sickness the plant will die, in less severe cases the plants may recover, in so far as the youngest leaves are not affected and develop normally; but the production of grains is reduced.

Not only oats are susceptible, but other plants are also affected, however in different degrees.

The varying degrees of susceptibility can be noticed as follows: Oats, rye, potatoes, beets, mangolds, turnips, whilst clover, peas, beans don't differ much, and are rather resistant. The symptoms with other plants except cereals, can be described principally as a kind of stained (spotted) chlorosis and a diminution of the turgor, yet without the withered spots which we have seen in the oat plants.

As to the cure of this malignant disease, it has been stated, by several experiments, that only the use of acid-mineral manure is effective, whilst the basic is pernicious. So for instance limestone, marle, quicklime or slaked lime, and other calcarious matter as town and industrial refuse, basic slag, and last not least nitrate as a physiological basic salt.

On the contrary, acid material as peat, mosslitter, the residues of starch-works, then superfosfate, salts of potash, and finally ammoniumsulfate, arrest the course of the disease.

Hence a factor of principal importance has been sought in soil reaction. After studying this factor it was stated afterwards that the reaction itself is not the primordial cause of the disease, but only the principal guiding factor.

I'll show you this by some diagrams (see the note on p. 141) of a series of potcultures in pure sand of about 98 $^0/_0$ SiO_2 by which the soil reaction is regulated by a mixture of the nitrates of sodium and ammonium. The reaction of the soil-solution, as has been stated at the end of the experiment, can be expressed in the following figures, meaning the H-ion-concentration:

PH. 9.03 8.52 7.70 6.60 6.60.

Another very remarkable remedy is sulfate of manganese, in the very slight dose of 50 K.G. per H.A. or by reducing the quantity to our potcultures of 10 m.gr. $MnSO_4$ 4aq per plant! The effect will be shown on Pl. IX, fig. 2 and Pl. X.

It must be emphasized that after complete cure by application of the sulfate of manganese, the reaction of the soil solution does not change in any way. On the contrary the alcality of the solution may sometimes, by the intense digesting of the nitrate, reach a higer value than the sick cultures ever demonstrate. So we found PH. values up to 10.

That the primordial cause really is to be sought in microbiological circumstances, can be demonstrated by the fact, that the Dutch oat disease never will be found on pure sand (chemically spoken), but appears only when slight parts of nearly homoeopathical quantities of organic matter, as cellulose, dextrose, glucose, saccharose, starch, humified sugar, are present.

This will be shown clearly by next figures (see the note on p. 141).

A remarkable exception is found in the effect of ground leaf-blades from oats, which, unless containing 60 $^0/_0$ of cellulose, seem to be favourable to normal growth.

When the material has been reduced beforehand, by a strong acid and an alcali of sodium to crude fibre, it is as disastrous in its effect as pure cellulose.

As to the disease in agronomical practice, it can be declared that it has diminished considerably since the general application of acid manures and the application of the sulfate of manganese.

II

It has been proved by several experiments, which I don't mention here, that the soil-reaction on sand soils, is practically determined by the lime-content.

This means exactly that, from a certain point, which I've called "the neutral point", an excess of lime becomes disadvantageous in ratio to the increase of the content. On the other hand a deficit will also become disadvantageous, and by passing a limit, a new disease appears, which can be considered as the opposite of the Dutch oat-disease.

This disease has appeared to a very large extent in practice, because of the farmers having begun to avoid the basic manures generally and to apply prevailingly acid ones, after the bad experience with basic minerals.

Gradually, after this changed management of soils and plants, the yields decreased in a notorious degree, until the soil itself became sick.

As we studied the phenomenon first in the little village of Hoog halen, we called the disease, "the Hooghalen disease". It is very remarkable that the degree of susceptibility of the different plants is almost the opposite of the Dutch oat-disease, viz. beans, clover, peas, beets, rye, oats, potatoes. Here we see that the basic mineral fertilizers are the remedies and that the acid are of pernicious influence.

As to the symptoms, here also a chlorosis is to be seen, but it is of a fade yellowish green. We don't find a diminished turgor, but on the contrary the feature of the plants is stiff.

With cereals we find a remarkable design of the leafblades, in so far as the chlorophyl around the ribs seemed to be undamaged, and not to share in the general chlorosis .The leafblade looks speckled like the skin of a tiger. Specially oat and wheat can be so evidently "tigred" that even an unexperienced observer must notice it. (Pl. IX, fig. 1).

The next plate (see the note on p. 141) shows an example on rye. As to the latter plant, you'll observe how abnormal its growth is and how the leafblades do not unroll themselves and often keep the younger leafblades tightly enclosed.

With other plants no other symptoms are obvious than the chlorosis of special fade hue, and a notorious delay in growth.

The economical damage and the cure of the disease by basic fertilizers, as lime, calcarious material from industrial refuse, nitrates (instead of amm. sulfate) basic slag (instead of superfosfate) will be shown by a diagram (see the note on p. 141).

On one of our experimental fields, we had among others the following series of manures:

1. Superfosfate and sulfate of amm. (acid).
2. Basic slag and nitrate. (alc.)
3. Superfosfate and sulfate of amm. after a dose of 800 K.G. of marle ($CaCO_3$).
4. Without minerals.

The effect is obvious and is exactly demonstrated by the yields of the different plots, expressed in the percentage of the crop by No. 3, which is to be considered a normal crop, by the application of marle, at the beginning of the experiment, although it has been acidly manured over 6 years.

You'll see how the crops fluctuate, and how they are influenced by the kind of manuring, whether in an acid or in an alcaline form. Another example can be demonstrated by an experiment on peas where on the same soil the dose of pure calciumcarbonate has been varied at regular intervals.

As to this disease on sandsoils with a deficit of lime, which demonstrates in its suspension a slightly acid reaction, it must be clearly understood, that no more than with the Dutch oat disease the reaction itself is to be considered as the primordial factor of the disease; there are a lot of soils of the same acidity, which produce excellent crops, without a shade of abnormal phenomena. Water-cultures will also demonstrate the exactness of this opinion. Nevertheless there is another phenomenon in practice, which is of great importance and depends on the soilreaction viz. the *potato-scab* which disease has been so nicely studied by two of the members of this conference: Mr. MILLARD and Dr. WOLLENWEBER.

I'll show you some diagrams, which show the influence of the reaction of manure and soil upon the scab in a considerable degree: when acid, the tubers are smooth, when alcaline, they are rough and covered with scabby spots (see the note on p. 141).

III

Finally I have to mention, shortly, another soil-disease of quite a different nature, which is to be found only on newly cultivated or reclaimed moorland and heath-soils.

Of this disease we know so far, that it is caused by a peculiar kind of black peaty organic matter, which is formed on such spots where in wintertime the surface water does not find an outlet, but evaporates in summertime. On such spots, drained by reclaiming, a black amorph-organic matter becomes an undesirable ingredient of the cultivated soil.

We only know that this soil-disease, which we want to call the "black peat disease" can only be cured by an application of ordinary town-refuse, richly transfused with human excrements.

Neither dung, nor any other organic manure, effects any considerable amelioration.

So far the disease has only been studied on oats and rye; as far as we know, potatoes, and perhaps also the legiminosa, are resistant against the hurtful causes of the disease.

As to the symptoms on oats and rye, I can mention chlorosis, and diminution of the turgor, somewhat in the same way as with the Dutch oat-disease, but the typical withered spots are never to be observed. On the contrary, the blade itself remains undamaged, except the top of the leaves (apices) which wither completely to a white or light gray hue. Later on, the spikes or the panicles, although appearing normally, show themselves to be more or less "deaf"; hence the yield is moderate, or may sometimes become a failure, whilst the plants develop a lot of new side culms and nothing else. When studying the development of the plant, a delay in growth can be clearly ascertained; this delay is specially found in the stem-culm, and when the internodia are measured, the delay will be demonstrated clearly by the younger ones.

A few diagrams will demonstrate this (see note at base of page).

IV

Coming to the end of my summary of the studies of the experimental station in Groningen, I must emphasise that what I told you on the matter of soil-disease, is only a bird's eye view.

The whole study, which has been going on for about 15 years, remains full of problems, and contains material for a generation, not only for the chemist and botanist, but also for the phytopathologist.

Ladies and gentlemen,

I hope to have succeeded in giving you a slight idea of the questions of soil-diseases and the significance of their study for agricultural science and thank our President Prof. QUANJER sincerely for having given me the occasion to do so.

If anybody wishes to discuss the subject, I'm willing to answer eventual questions.

N.B. Only three of the figures and diagrams demonstrated in Groningen, could be published in this report on account of the great expense. — EDITOR.

Several professors of the University and of the School af Agriculture attended this meeting and invited the visitors afterwards to their teaching and research departments. After dinner a general visit was made to the central buildings of the University.

The following morning, Thursday June 28, the farm of Dr. OORTWIJN BOTJES in Oostwold was visited. On this farm of more than 100 acres the selection of potatoes is performed.

THE POTATO-SELECTION-FARM AT OOSTWOLD

BY

J. OORTWIJN BOTJES

Since 1922 the farm of Dr. OORTWIJN BOTJES has been at the disposal of the Institute of Phytopathology for the purpose of growing healthy potatoes.

The Board of Agriculture has chosen this farm as no potatoes are grown in its immediate neighbourhood and as the owner during the past ten years has made a study of the so-called degeneration diseases of potatoes.

The subsidy from the Board of Agriculture was granted not only with a view to establish a centre of distribution of healthy potato stocks, but also to enable Dr. OORTWIJN BOTJES to pursue his researches concerning the degeneration diseases of the potatoes in co-operation with Prof. QUANJER.

The healthy tubers, grown at Oostwold, are intended to be used at Wageningen for infection experiments. Besides they are at the disposal of the managers of experimental-farms, the keepers of trial plots, the breeders of new varieties.

The following method of selection is used:

If we have a number of tubers of a certain variety whose condition as to disease is entirely unknown, these tubers are separately planted in the midst of a crop chosen for this purpose. So far we do not know which crop is most suitable for this purpose. Peas, broad beans, beets, clover often suffer from mosaic disease. In 1922 the mosaic disease of beets was not transmitted to potatoes. An attempt to find out whether the mosaic disease of broad beans can be transmitted to potatoes was not successful.

The mutual distance between two "sets" is from 8 to 10 M. The plants are examined frequently during the summer, the diseased hills are removed as soon as possible, the healthy ones are lifted in immature condition. They are stored separately in small baskets in a cellar. In winter they are disinfected by sublimate against *Rhizoctonia* disease.

The year after the contents of the baskets are planted in plots at a mutual distance of 10 M. If any plot shows disease in one or more hills the whole is lifted and rejected. The hills of the remaining plots are lifted in immature condition, and stored in trays, so that a tray contains the yield of one plot.

In the third year the tubers of each tray are separately planted in greater plots. The hills of one plot are compared with those of other plots of the same variety, and the hills of the best plots are kept for further cultivation.

So the method of growing healthy potato "sets" is based on three principles: selection, lifting in immature condition, and isolation.

Researches in 1916—1922 in Oostwold and in Wageningen showed the importance of isolation, researches in 1922—'23 prove the influence of the date of lifting upon the state of health of the progeny.

EXPERIMENTS REGARDING THE USE OF IMMATURE SEED SEEN AT OOSTWOLD DURING THE CONFERENCE

Experiment I.

In 1922, 100 tubers of the variety Eigenheimer were cut into four parts. These parts were planted in four lots, A, B, C, D, so that the parts of each tuber came in a corresponding place in each of the four lots.

The numbers 60—100 of lot A and C were lifted on July 1 and stored separately in little baskets: the numbers 30—60, were lifted on July 19, the numbers 1—30 on August 5. All numbers of B and D were lifted on October 10. The hills were growing in healthy surroundings.

The tubers, lifted on July 1 and July 19 were very small and, as a consequence of their size, have produced smaller hills than the tubers lifted on October 10. At the date of the conference all hills were healthy. Later a very small number of mosaic diseased hills were perceptible both in the progeny of the mature and immature seed. In this experiment the immature seed gave no better result.

Experiment II.

In 1922 four tubers of healthy Eigenheimers A, B, C and D were cut into four parts. These parts were planted between two rows of mosaic Paul Krügers. In contrast with experiment I the healthy hills therefore stood in the midst of diseased neighbours. For the rest there was no difference between the two experiments.

A_1, B_1, C_1, and D_1,	were	lifted	on	July 13
A_2, B_2, C_2, and D_2,	,,	,,	,,	July 21
A_3, B_3, C_3, and D_3,	,,	,,	,,	Sept. 26
A_4, B_4, C_4,	,,	,,	,,	Sept. 26

D_4 failed to germinate.

In contrast with the plants in experiment I there was a very great difference between the progeny of mature and immature seed in experiment II.

STATE OF HEALTH OF THE PROGENY IN 1923

	Date of lifting in 1922	Number of healthy hills in 1923	Number of mosaic diseased hills in 1923
A_1	13 Juli	25	0
B_1	,,	13	2
C_1	,,	14	1
D_1	,,	14	0
Total	,,	66	3
A_2	21 Juli	27	0
B_2	,,	13	1
C_2	,,	11	2
D_2	,,	14	4
Total	,,	65	7
A_3	26 Sept.	1	13
B_3	,,	0	10
C_3	,,	4	7
D_3	,,	0	15
Total	,,	5	45
A_4	26 Sept.	4	5
B_4	,,	17	13
C_4	,,	3	0
D_4	,,	—	—
Total	,,	24	18

In this experiment there was a very great difference between the progeny of mature and immature seed. It is evident that the early lifting gave protection from infection.

Experiment III.

56 tubers of Paul Krüger were cut into four parts and planted in the same way as the Eigenheimers in the first experiment. All the hills in the four lots were healthy and stood in healthy surroundings.

In 1922 the numbers 28—56 of A and C were lifted on July 19, the numbers 1—28 on August 5. All the hills of B and D were lifted on October 10.

STATE OF HEALTH OF THE PROGENY

	Date of lifting in 1922	Number of healthy hills in 1923	Number of mosaic diseased hills in 1923	Number of leaf curl diseased hills in 1923
A 1—28	19 July	193	0	0
C 1—28	,,	245	0	0
Total	,,	438	0	0
B 1—28	10 Oct.	224	2	0
D 1—28	,,	221	0	7
Total	,,	445	2	7
A 28—56	5 Aug.	227	0	0
C 28—56	,,	255	0	0
Total	,,	485	0	0
B 28—56	10 Oct.	185	3	0
D 28—56	,,	307	3	0
Total	,,	492	6	0

The early lifted tubers gave a healthy progeny, the mature tubers gave a progeny which was healthy to the extent of $98^1/_2$ %.

The difference is not very great, much smaller than in experiment IV, in which the plants in 1922 had been growing near diseased neighbours.

Experiment IV.

Four tubers from a healthy hill of Paul Krüger. A, B, C and D were cut into four parts and planted between two rows of leafcurl diseased tubers of the same variety.

A_1, B_1, C_1, and D_1, were lifted on July 19,
X, B_2, C_2, and D_2 ,, ,, ,, Aug. 5,
A_3, B_3, X, and D_3, ,, ,, ,, Aug. 27,
X, B_4, C_4, and D_4, ,, ,, ,, Oct. 1.
X = failed.

STATE OF HEALTH IN 1923

	Date of lifting in 1922	Number of healthy hills in 1923	Number of leaf curl diseased hills in 1923
A_1	19 July	6	0
B_1	,,	10	0
C_1	,,	10	0
D_1	,,	3	0
Total	,,	29	0
A_2	fails		
B_2	5 Aug.	11	0
C_2	,,	8	7
D_2	,,	10	0
Total	,,	29	7
A_3	27 Sept.	0	4
B_3	,,	1	17
C_3	fails		
D_3	27 Sept.	0	3
Total	,,	1	24
A_4	fails		
B_4	10 Oct.	0	10
C_4	,,	7	18
D_4	,,	1	10
Total	,,	8	38

This experiment shows a very great difference between the progeny of mature and immature tubers in favour of the immature ones.

It is evident that the benefit from the use of early lifted seed is not a consequence of the state of maturity, for the immature tubers, growing in healthy surroundings have not given better results than the mature seed. The use of early lifted seed has to be considered as a method to shield from infection healthy plants, growing in diseased surroundings.

Mosaic and leafcurl are transmitted by insects from the foliage of diseased to the foliage of healthy plants. The grafting experiments of Prof. QUANJER make it evident that the contagion does not progress rapidly in the plants. The fact, that tubers of one stalk of a potato hill are often partly healthy and partly diseased, concurs with this observation. If the infection of the foliage does not occur very early in summer, it will be possible to protect the tubers from infection by lifting them at an early date or by early cutting off the foliage.

After the visit to the farm the excursionists where invited to lunch by Dr. and Mrs. OORTWIJN BOTJES. After a word of welcome from Dr. OORTWIJN BOTJES Prof. APPEL from Berlin—Dahlem responded on behalf of the attendants from abroad. He thanked Mrs. OORTWIJN BOTJES for her splendid reception and expressed great admiration for the work of Dr. OORTWIJN BOTJES, which he considered to be of great scientific interest and of practical value for the potato-culture of the world.

The party then left for Amsterdam via the province of Frisia and the Zuiderzee; dinner was taken aboard the steam-ship.
Mr. WHITEHEAD from Bangor gaveduring the trip, an account of his experience made in North Wales in studying leaf-roll.

TRANSMISSION OF LEAF-ROLL OF POTATOES IN N. WALES DURING 1921

BY

I. WHITEHEAD

The accompanying diagram illustrates the method used at Bangor, N. Wales, in 1921 and 1922 to determine the way in which healthy plants become infected by leaf-roll under farm conditions (see p. 148).

Both healthy and leaf-roll stocks were obtained from the same locality in Scotland and large differences in yield were regarded as a rough indication of the degree of infection, in conjunction with field notes made during the growing season.

The healthy roots of row B were partly protected by sinking large roofing slates to a depth of four inches below the level of the mother tubers.

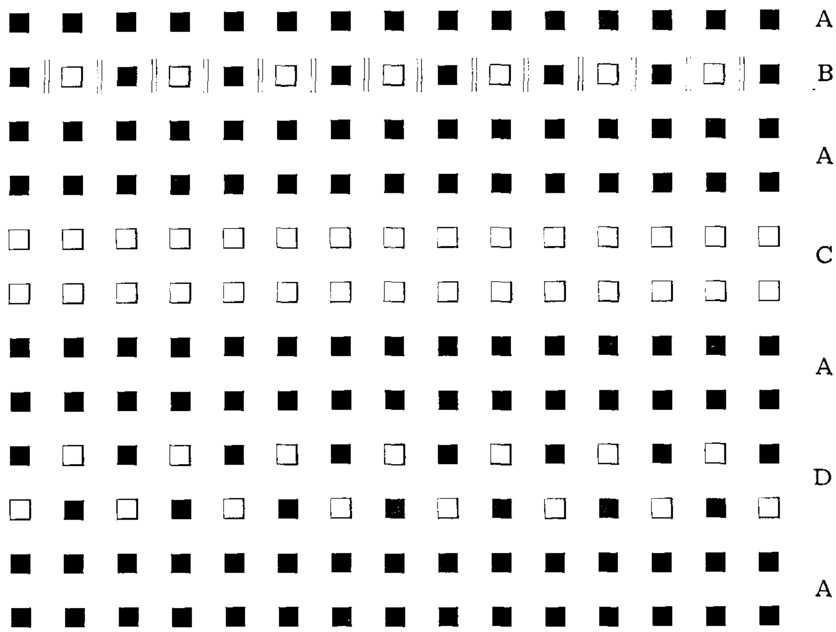
The double row C was laid down in triplicate and the double row D in duplicate.

No aerial insects were seen feeding on the potatoes although a careful search was frequently made during the summer of 1921.

Briefly stated, the results show:

1. That leaf-roll only passed from plant to plant in the same row, and not to adjacent rows although the foliage of diseased and healthy plants was in close contact during a large part of the growing season.
2. Transmission was largely prevented by partial isolation of the roots of healthy plants. This cannot be explained on the ground

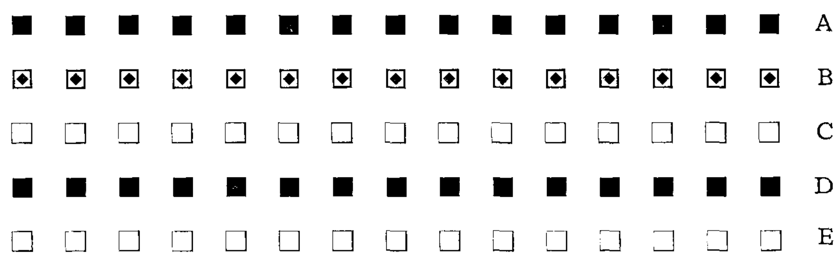
1 1921 → 44



A = Leaf-Roll 1920 and '21. Yield = 44.2 % of healthy crop.
B = Rolled and healthy plants alternately; roots protected. Yield of healthy = 100 %.
C = Healthy-exposed to infection from one side. Yield = 100 %.
D = Rolled and healthy plants alternately; roots not protected. Yield ot healthy = 100 %.

1922

1 PROGENY OF ABOVE → 44



A = Leaf-Roll 1920, '21, '22. Yield = 52.1 lbs. Average number of tubers per plant = 8.85.
B = Slight, general roll in 1922. Yield = 72.1 lbs. Average number of tubers per plant = 10.85.
C = Healthy 1922. Yield = 105.75. Average number of tubers per plant = 17.65.
D = Badly rolled in 1922. Yield = 54.25 lbs. Average number of tubers per plant = 7.8.
E = Field grown healthy in 1921 and exposed to infection from adjoining row in 1922. Yield = 101.3 lbs. Average number of tubers per plant = 17.3.

The figures 1—44 refer to the number of tubers per row.

that some plants escaped infection since all the progeny in 1922 produced plants which were distinctly rolled although the disease was not so marked as in the case of the rows of plants known to have been rolled since 1920.

3. No primary symptoms were observed in any of the healthy plants in 1921.

4. Plants in the double row D and its duplicate gave a normal yield in 1921 although they were thoroughly infected in that year, as was shown by growing the progeny in 1922.

5. The conclusion arrived at was that *transmission took place through the soil and not aerially by means of insects* — a mode of transmission first shown to occur by QUANJER.

In support of this contention it is urged *a.* that the crucial point is not the fact of transmission but the failure to secure transmission when the foliage of healthy and diseased plants was in contact, for this eliminates the criticism that the presence of aerial insects was overlooked, *b.* the most probable explanation of the absence of primary symptoms is that the virus only infected the tubers and never reached the *aerial* parts of the plants in 1921; an inference which is strongly supported by the fact that the yield was not affected, thus showing that the tissues concerned in assimilation and translocation were functioning normally, *c.* finally, QUANJER and OORTWIJN BOTJES have stated that whilst leaf-roll may spread for a distance of several yards from an infected plant growing in sandy soils, it rarely spreads farther than the next healthy plant in clay soils. It is difficult to see how soil characters could affect the distribution of aerial insects such as Aphides whereas their importance in determining the extent of transmission through the soil is obvious.

6. The suggestion is offered that transmission occurs in nature both aerially by means of insects and through the soil by some means as yet incompletely understood. The relative importance of the two methods will vary from season to season and according to soil and climatic factors.

The horticultural trip [1]) (to Boskoop etc.) was under the guidance of the SECRETARY with the aid of Mr. P. HUS, of the Phytopathological Service. On arrival at Gouda the party was welcomed by the member of the Committee Mr. v. STRAATEN VAN NES, and several other prominent Boskoop plantgrowers (Messrs DEN OUDEN, v. GELDEREN, BLAAUW, RADDER, Mr. SMITS from Naarden etc.). In four beflagged swift motorboats the company sailed to Boskoop, where nurseries of ornamental plants, flower-shrubs etc. were visited. The stock was very healthy and

[1]) Space does not allow giving a circumstantial report of the excursions. For particulars about the places visited members are requested to consult the pamphlets forwarded to them together with the Programme.

noxious insects were not at all or only sporadically present. This is chiefly due to the winterspraying with 7½ % carbolineum, which is put into practice by nearly all nurserymen. This spraying kills all stages of insects hibernating outside on the trees or shrubs, and even under the outer scales of the buds. Of course it does not protect the plants against attacks by insects, which in summer come flying over from other places, or by insects, hibernating in the soil. Such pests are immediately after their presence has been detected, controlled by spraying either with a stomach poison (Paris green or arsenate of lead) or a contact insecticide, such as methylated spirit 1 % and soft soap 2% (against soft-bodied insects as plantlice) or a nicotine spray, e. g. X. L. All. The combating of diseases and pests is constantly supervised by the officers of the Phytopathological Service, stationed at Boskoop.

The luncheon kindly given by the Town Council of Boskoop, was presided by the Burgomaster of that municipality, Mr. A. P. COLIJN, who cordially welcomed the guests from abroad and expressed the hope, that they would have received the impression, that the Boskoop growers, in constant co-operation with the Phytopathological Service, did their utmost to grow quite healthy plants, free from insects. He would be glad if the visit to Boskoop would always be kept in pleasant remembrance by the guests. For the growers-association Mr. JAC. SMITS delivered a humorous speech; Dr. HOWARD responded to the speeches on behalf of the guests, and the SECRETARY thanked the Burgomaster and the Municipality of Boskoop on behalf of the Committee of Management.

The company now embarked again for Aalsmeer; during this journey there was ample opportunity to get an impression of the typical Dutch scenery and of the „polders" with the pastoral and arable land below sea-level, the boats in the canal sailing several feet higher than the backs of the cows in the meadows.

On board of each boat refreshments were served by the gay and charming daughters of our Boskoop hosts.

At the water village of Aalsmeer a few nurseries were visited; the well-known clipped box-trees, trimmed in the most bizarre forms, were examined with much interest. The box-trees and shrubs, which are grown in large quantities in Aalsmeer and in Boskoop, are nowadays practically free from the mussel-scale *Lepidosaphes ulmi*, thanks again to the winter-spraying with carbolineum. Before this method of control was in general use, the pest did great damage, but now it has lost its dangerous character. In Aalsmeer also an officer of the Phytopathological Service is stationed. Besides the growing of nursery-stock the chief-industry of Aalsmeer is the growing of flowers for cutting purposes; among them roses grown in glass-houses play a prominent part. In some cases the air-post has already been used to ship the cut flowers to the capitals of Europe.

After having enjoyed afternoon-tea, kindly offered by the Aalsmeer Growers Association, the party left for Amsterdam, where the night was passed.

On Thursday June 28 the company travelled by train to Haarlem, where the member of the Committee Mr. E. H. KRELAGE awaited the party with 12 to 15 cars, provided and mostly driven by owner-bulbgrowers. Through the Haarlemmerhout the party drove to Lisse where in the Laboratory for Bulb-Investigation Dr. E. VAN SLOGTEREN delivered the following address on:

MODERN METHODS OF COMBATING BULB DISEASES

Ladies and Gentlemen,

I welcome you all in this laboratory and consider it a great honour not only for myself but for our Bulbdistrict that you have decided to visit our cultures and will look at my work on the combating of the diseases.

I only regret that the time of your visit is not the most favourable to get a correct opinion of the bulbculture. It is a pity that you have missed the famous view of our beautiful bulbfields, because you cannot get that impression which you should have had, had you seen them in full bloom. The time of the principle development of the other crops did not allow an earlier date for the congress, and you have come here at a time, when the leaves of most of our bulbs have already begun to decay and part has already been removed to the bulb-houses, where they are sorted, one part for export, and the other part receives a special treatment for the next planting season.

As participants of the Phytopathological Congress you will not only be interested in the diseases and their combating, but certainly will also like to see the results we have obtained. Now I can show you some of the most important diseases and describe you our methods of combating them, but still I should have preferred to give you an opportunity of seeing the results of our combating of the diseases with your own eyes. Of course I must now limit this to those varieties, whose development is late and which are at the moment green enough to judge the state of their health.

Owing to the short time available I must be rather brief in my explications. To those who might possibly have special interest in our bulbculture and its problems, I will gladly give any information desired, after the busy days of the congres, either verbally or by writing.

Of the great number of subjects available I have taken the following three, of which the significance exceeds by far the limits of the special bulb culture and which still have a fundamental importance for our methods of combating the diseases. All three are connected with the nematode diseases, which I have been studying particularly for the last few years.

They are:

1. The transition of the nematodes from one crop to another, with which the question of the biological strains and the possible danger of the transportation of plants is closely connected.

2. The movements of the nematodes in the soil, which is of great importance for the combating of these parasites.

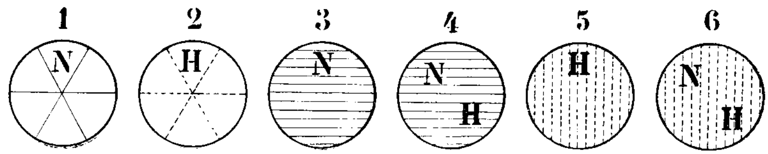
3. The combating of the nematodes in the stocks, first in the fields, and later on in the dry bulbs after they are lifted out of the soil. This will show you how necessary it is for the phytopathologist to study all the factors which govern the life of the plants.

1. THE BIOLOGICAL STRAINS.

In our culture both a nematode-disease of Hyacinths as well as a nematode disease of Daffodils is known. Already from olden times the so called „ringziekte" „annular disease" or „old disease", of the Hyacinths has been known here which, as PRILLIEUX discovered in 1881, was caused by the nematode *Tylenchus devastatrix*. Since about 1910 however, we also know a nematode-disease in Narcissus, which originally was supposed to originate from the nematodes of the Hyacinths, which had adaptated themselves to the life in the Daffodils.

From a theoretical point of view this matter is very important, but not less for our practical culture, because we must know here how far we have to fear a mutual infection between both those two crops here much cultivated. There is also the danger, which in general can be connected with the transportation of the nematodes by other culture crops.

So this point has certainly obtained an international economical signification. To solve the question I have made a very large number of experiments, from which I will describe a few in short (fig. 1).



	1	2	3	4	5	6
Infected by eelworms from:	Hyac.	Narc.	Hyac.	Hyac.	Narc.	Narc.
Result	Narc. healthy.	Hyac. healthy	Narc. healthy.	Narc. healthy. Hyac. gone.	Hyac. healthy.	Hyac. healthy. Narc. all diseased.

Fig. 1.

In 6 mortar cylinders, as I will show you out of doors, I made the following experiments of infection. In the first cylinder I planted three rows of diseased hyacinths intersecting diagonally and in the sections between the diseased hyacinths, I planted sound narcissus bulbs.

In the second cylinder I planted the same rows with diseased narcissus and between them sound hyacinths. In No. 1 all the hyacinths vanished and the Narcissus remained sound and in no. 2 all the narcissus vanished and the hyacinths were healthy. In the other 4 cylinders the numbers 3 and 4 were very heavily infected with pieces of diseased hyacinths and number 5 and 6 with pieces of narcissus. From the first couple no. 3 was planted with narcissus only and no. 4 with hyacinths and narcissus alternatively; further no. 5 was planted with hyacinths only and no. 6 like no. 4 with hyacinths and narcissus alternatively. The result was that from both cylinders infected with hyacinths in no. 3 all the narcissus remained free from disease and in no. 4 likewise, whilst all the hyacinths in no. 4 got diseased, and on the other hand all the narcissus in the cylinders infected with narcissus got the disease; the hyacinths remained sound in no. 6 and in no. 5 all the hyacinths proved to be healthy.

On my trial grounds I have made several experiments by placing on a number of beds a piece of a diseased narcissus next to every hyacinth and on another field next to every narcissus a piece of a diseased hyacinth.

I have in this way given on my trial grounds an opportunity to more than 6000 hyacinths to get infected and to the same number of narcissus, but never noticed that a hyacinth got the disease from nematodes of the narcissus nor ever the reverse. One must remember however above all things, that one may not speak of a transition of the disease, if one succeeds in finding a nematode of a narcissus on a hyacinth, but one must notice the special symptoms of disease of the latter.

I saw this very distinctly in a great number of infection trials in pots, where I put thousands of eelworms in the centre of a bulb by means of a subcutane syringe.

I can show you a photograph of a hyacinth that was entirely curled up and deformed by the great number of eelworms from the daffodil I had put into it. The next year however the hyacinth was quite healthy again and showed no symptoms of the disease at all, neither in the foliage, nor in the bulb.

From all this we may draw the conclusion that the feared transition doesn't happen so easily and one must be very careful to state this transition. In connection herewith the appearance of *Tylenchus* in the clover in America, which disease on the Plant-Quarantine Conference in Washington, May 1922 was ascribed to an infection with our bulbs, is of great importance. Up to the present no single scientifical evidence for this transition is supplied and during my discussion held at the request of the Chairman of the F.H.B. with the famous nematode-specialist Dr. Cobb, the latter positively admitted to me, that there did not exist any indication whatever to ascribe the origin of this clover nematode rather to our bulbs, than to one of the many other crops which are infected by nematodes.

The results of these experiments are, as you will see, also of very great importance for other cultures outside the bulb district, although in the first place we can conclude from them, that we need not fear a mutual infection of hyacinths and narcissus.

2. Movements of the nematodes in the soil.

The second point which is of great importance for the combating of the diseases in our culture, was the speed by which the nematodes move in the soil. It was thought, that the nematodes could live for many long years in the soil and that only by burying deep the infected upper part of the infected soil, the soil could be made free from eelworms.

The only question was how deep one must dig the soil to get rid of the parasites. As the saving of every inch of digging could diminish wages I have made a lot of experiments.

In the first place in 96 tubes to a depth varying from 5—90 centimeters I put a certain amount of pieces of diseased bulbs. Pure sand was thrown upon this and therein the bulbs were planted. To my astonishment I saw that in all the tubes the bulbs got the disease, which proved that the nematodes can travel upwards through a distance of at least 90 centimeters of earth. These trials have been repeated in several ways, time does not allow to discuss them all. Even over a distance of 125 centimeters I saw the nematodes coming upwards through the soil. I have also placed the greater part of the tubes above the groundlevel to see if the movement of the water in the soil had any influence on the movement of the nematodes to a great extent (fig. 2).

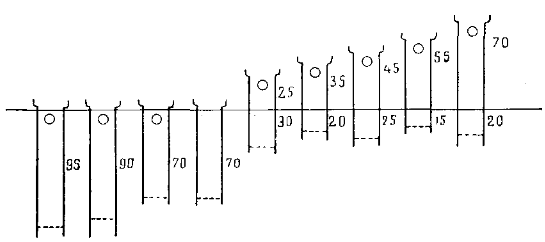


Fig. 2. Infection-pots above the groundlevel.

The result was, that, even when the tubes exceeded more than 70 c.M. above the surface of the soil, the eelworms travelled through a layer of 90 c.M. of sand. Out of doors on the experiment-field I can show you presently such an experiment.

I have further seen that the eelworms soon die in the soil when there is not sufficient food for them, and this is not at all astonishing for us, as we have to do with very specialised parasites. In our wet soil the nematodes will seldom succeed to dry sufficiently to attain a state of lethargy, in which they can live a very long time without any food at all. In the course of this year I hope to be able to give a more elaborate report of my experiments on this subject.

3. COMBATING OF THE DISEASE IN THE BULB STOCKS.

A. On the Bulbfields.

We know that the parasite we have to destroy is not only lodging in the bulbs but also remains in the soil, after the removal of the diseased bulbs. On the other hand we cannot discover the eelworms in the soil otherivise than by looking for the plants that show the symptoms of the disease. On this knowledge our method of combating the disease in the fields in the spring is founded.

We have a staff of highly trained specialists who inspect the stocks in the spring, looking for any infected plant which may appear. On sunny days these men are armed with umbrellas to obtain a neutral light on the plants before them (Pl. XI, fig. 1).

If these specialists, whom we call „disease seekers" find a suspected plant, they lift it out of the ground with a large round borer. This borer takes up the soil about 6 to 8 inches in circumference with it.

He then places a marking stick near the spot where the plant has been taken out. To ascertain whether the plant is sound or attacked by disease, the bulb is cut open and examined.

If in the latter condition a gang of working men is directed to the spot where this particular bulb had been found. They scoop out he surrounding bulbs and soil for a width of at least from one to two square feet. This soil is then carefully removed to a place where the parasites cannot do any harm. By this method both the soil and the stock are freed from eelworm.

You can see on the photographs of a bulb-field [1]) in which great quantities of bulbs and soil are taken out, that we are not afraid to spoil a lot of bulbs, when it seems to be necessary so as to be certain that no trace of the disease remains in the soil.

To further combat the spread of the parasite, the field in which the diseased plant has been found, is turned to a depth of two to three feet in autumn or winter and we do not grow the crop which had been diseased in this field for a few years.

The planting stock of a variety in which symptoms of the disease have been discovered is subjected to a treatment in hot water, which is so effective that, if the method is applied in the right manner, the disease can be entirely got rid of.

B. Combating of the Disease in the dry Bulbs.

It is impossible to recognize the diseased bulbs in the dry stocks and therefore we have to treat the whole stock to be sure that the stock is freed from disease.

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[1]) Owing to printing expenses only two of Dr. v. SLOGTEREN's photoes could be reproduced. — EDITOR.

During the last few years we have been able to give the bulbs a treatment with hot water by which, if applied in the right manner, we can cure the stocks. The principle of the use of hot water for the combating of plant-diseases is not at all a new one. Probably owing to the many difficulties which arise in practice, it must be ascribed that this method till now has not been applied more.

A lot of difficulties had to be mastered and if you make a comparison between the results obtained at the beginning and now, you will see a great difference. I will enumerate some of the difficulties we had to overcome.

First of all we wanted an instrument by which it is possible to keep the water at a fixed temperature so that in every part of the mass the temperature is exactly uniform.

This problem may probably be solved in many ways, but I will only show the results we have obtained.

We constructed a boiler that can contain from 150 to 300 liter of water, which is heated by means of gas. If the latter is not available a special construction has been made for the use of compressed petrol gas. The water is kept at a fixed temperature by means of a thermoregulator which works very accurately and with this instrument, which has proved to be very useful, we have gained splendid results.

As was to be expected, we saw that we were not at the end of the difficulties by having a good instrument to work with. This will not astonish any scientist who knows anything of the life of plants. For it must be kept in mind that we have to do with living objects, whose sensibility to the hot water treatment is variable and depends on a great number of factors. Besides we cannot obtain very good results, if we do not know the influence of the different factors which govern the development, the growing and the flowering of the normal healthy plant.

For as I told you before, our stocks are kept in the field under a very severe control and every bulb that only seems suspect, is taken out of the stock; so you will understand that after the lifting only a very small percentage of those stocks can be attacked by the disease. We shall in any case treat the suspected stocks, to be certain, that our soil is not reinfected and at the end absolute freedom from disease is obtained, but a stock will be comparatively heavily infected, if one out of a thousand bulbs has got the disease. It will be clear, that in those circumstances not only the influence of the treatment on the few diseased bulbs must be observed, but that the effect on the whole sound part of the stock is not less important.

We can cure our bulbs of the eelworm-disease by treating them with hot water at a temperature of 43½ Centigr. for 2½ to 4 hours, depending on the size of the bulbs. Also the large and the small narcissusfly *(Merodon equestris* and *Eumerus strigatus)* can be killed in this way.

The results of the treatment however will vary greatly depending on the time of the treatment and on the development of the bulbs.

As the development of the bulb varies with the meteorological influences and the time of the year, you will understand that we have to know the mutual relations of those influences. From a scientific point of view it is very interesting to see the sensibility to the treatment of the same stock varying greatly in the course of time between the lifting and the time of planting.

The treatment must be arranged according to the purpose for which the bulbs must be used. If we want good flowers after the treatment, we are much more limited, than when the treated stock will only be used as nursery stock.

The latter is generally the case, but that we can give the bulbs a full treatment without doing any harm to the flowers, I can show you by some of these photographs, I have here.

On the other hand, if we don't care for the flowers, we have often a very good result in the growth of the bulbs, which sometimes is much better than that of the untreated ones.

In both cases however the result depends to a great extent on the way the dry bulbs have been kept *before* and *after* the treatment. It is not in the scope of this address to give you full details of my investigations. I soon hope to give a detailed report in print.

Let me give you only one example, that will show you at the same time one of the most interesting results of our investigation, the fact that there exists, to a certain extent an antagonism between the influence of the treatment on the development of the roots and that on the growing capacity of the bulbs.

For the same stock of hyacinths of the variety „Dr. Lieber" I took among others 15 groups of fifty bulbs. Three groups I left untreated and the other 12 groups were treated on the first of September 1921 in this way: I put them together in the boiler in which the water was kept at a temperature of 3½ centigrade. After from 1 to 4 consecutive hours, I took 3 groups out of the boiler. The 12 groups were kept after the treatment together with the 3 untreated ones in the same heated bulb-house till the date of planting of the different groups.

On Oct. 14th., Oct. 28th. and Nov. 11th. 1921 respectively I planted one untreated group together with one of each of the groups that had been treated for one, two, three and four hours consecutively.

The results of the growth are to be seen on this graph, where the growth of every group in percentages of the original weight of every group is indicated. (fig. 3).

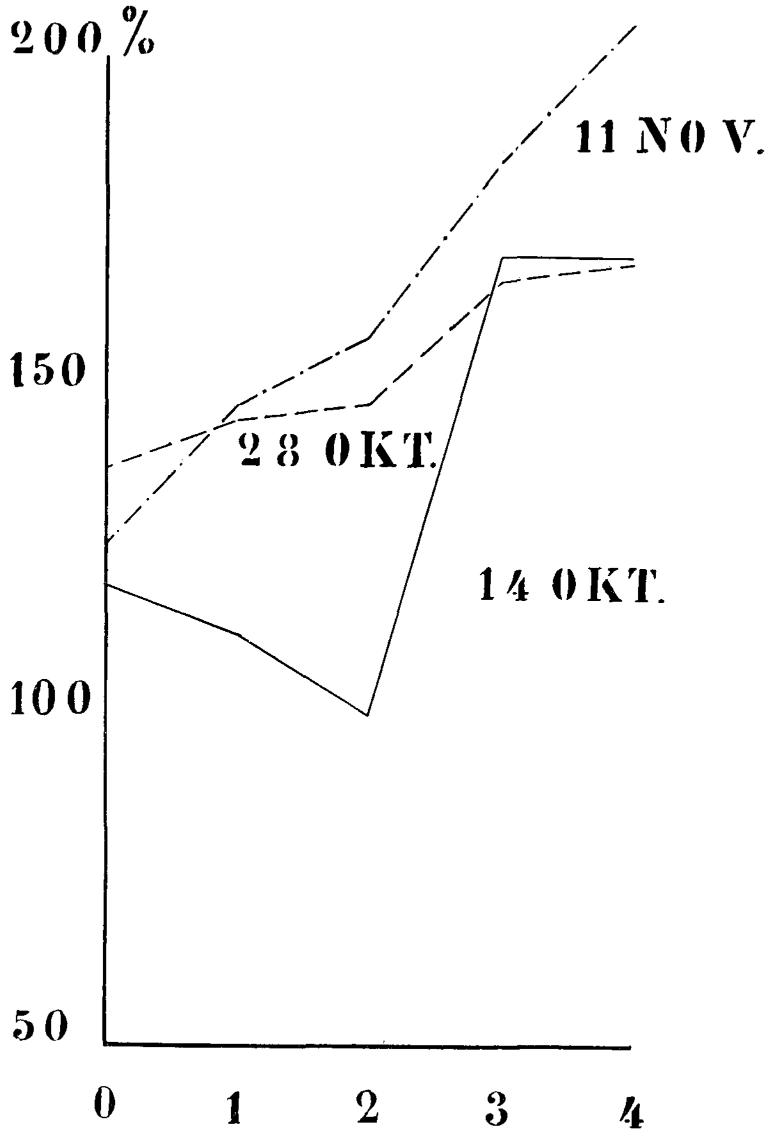

Fig. 3. Hyac. Dr. Lieber.
Growth of the different groups, untreated and treated in hot water for 1, 2, 3 and 4 hours. Increase of weight in percentages of the original weight of every group.

If you first look at the 5 groups planted on Oct. 14th 1921, it is clear that the bulbs which have been treated for 1 and 2 hours are worse, and the other two groups are better, than the untreated ones. As the latter two groups have been in the boiler together with the former couple, an acceptable explanation must be given of the growth of the bulbs.

How can this be explained? It seems to me as follows: On the date of the treatment, September 1st. 1921, this variety had already begun the first development of the roots and by the treatment these little buddings were killed.

The treatment did harm to all the four groups, but it is not strange, that after two hours the greater part of the harm had been done.

On the other hand we all know, that a treatment with hot water can stimulate the growth of many kinds of plants. I can show you a large number of photographs of bulbous plants, illustrating this.

It is very obvious that there is an optimum dose for this stimulating influence, but it is not surprising, that the effect is greater after four hours treatment than after that of one hour.

If we now add the effect of the harm done to the roots and that of the stimulating of the growth by the hot water bath, it is not difficult to explain the course of the graph. I think I can prove by the results of the growth of the other groups of treated bulbs that the foregoing interpretation of the facts is right.

I have found by other experiments that I can increase the development of the roots by storing the bulbs in the autumn for a rather long time in a heated bulb house and even when the roots are severely damaged in any way I can undo the harm to a great extent by doing so.

If you look now to the graph, you see that the results of the growth of the other groups, treated on the same date together with the first group, but planted later on October 26th. and Nov. 11th. 1921 respectively, are better than those of the bulbs planted on Oct. 14th. The bulbs planted at the latest date are the best.

You must especially notice that the growth in this case increases from one to four hours treatment and that there is no dropping of the line. If I undo within these two groups, planted at a later date, the harm done to the budding root tops by giving them an opportunity of recovering in a heated bulbhouse, you can only expect in the graph the effect of the stimulating influence of the hot-water bath on the growth. This corresponds with the facts.

I hope you will see by this how interesting the study of the effect of the hot-water treatment on the whole development of the plants is and you will understand that there is a great deal more that is interesting in this line.

In the foregoing I have given you a short survey of the ways we use in fighting the diseases in our crops and I hope that you have understood, that there is a close co-operation between the scientific research and the practical growers.

The grower needs the assistance of the science, but the scientist, who wants to understand something of the life of the plants he is studying, can no more do without the help of the men who have cultivated them during their whole life and have grown up among them.

By this close co-operation we have had very good results.

I can show you already large stocks of half a million and more of one variety of bulbs of which I personally can give you a scientific guarantee of their absolute healthiness.

And we shall continue to work on and not rest before all our bulb-stocks are as free from plant diseases as it is humanly possible to produce them. The degree of healthiness which we have already reached with the great majority of our stocks, you can only understand by visiting our bulbfields at the time they are in full bloom.

Now I can only submit some photographs to give you an idea of it (Pl. XI, fig. 2).

Before concluding my address I beg to say a few words which come from the bottom of my heart and touch upon the foundations of all phytopathological research.

The motive for science and scientific research must be, as MOLL expresses it so justly in his inaugural speech in 1910, the scientific emotion which forces the search of the truth.

Therefore science is international and knows no borders. Besides sound Phytopathological science can only be based on international co-operation for the study of the different plant diseases and the means of combating them.

My field of activity brought me in close contact with the views of control of plant diseases of the Fed. Hort. Board of America which find expression in the Plant-quarantine action. This is based on the availability of the plant products in America.

I believe that this policy will be the finishing stroke to a sound Phytopathological science. Instead of international co-operation in the study and control of plant diseases, a struggle will be created to shut out the agricultural and horticultural products from each other's country.

From an economic as well as a scientific standpoint this seems to me to be very calamitous.

I should like to quote here the words spoken by the Honourable JOHN OLIVER, Premier of British Columbia, at the Opening of the Proceedings of the Third Convention Western Plant Quarantine Board (Victoria, British Columbia, June 7th. 1921):

....„In suggesting to the governing bodies the powers to make rules governing the transportation, importation and exportation of the various commodities making up the neccessities of the world, it occurred to me that there was an opportunity in speaking to you this afternoon, to say a word or two along the line of what appears to me to be a natural truth and embodying a natural law.

The Creator [has] evidently, as you all know, [so ordained that (Ed.)] on this earth of ours, we should have in different regions of the earth different climates, different conditions of soil and climate, and the plant or fruit which may beproduced abundantly in one part of the earth cannot be raised in another. And yet we find in our experience that the products of one part of the earth are necessary to the inhabitants of another portion. Hence we learn the natural lesson that it is to human advantage to exchange products, and here we come up against the question of what is necessary for the protection of these products, and sometimes I am led to think that the word protection is used to cover up what I might call greed or covetousness.

We should realize what that word „protect" means and not make that a covering for some ulterior motive. And it occurs to me, as I have said, that it is necessary to have an exchange of commodities. I take it that when the Creator made the earth, He made the whole of it. He correlated the different parts of it, and as far as we know the highest aim of creation was to enable human life to be sustained and propagated. Therefore it occurred to me that it might not be out of place for me to make this suggestion to you, that when as a result of your deliberations, you make recommendation to the governing bodies who have power to make laws and regulations, I would ask you to bear in mind the fact that these recommendations should not go farther than what is really necessary for the practical object which you have in view."....

I think we all must agree with these very sensible words.

Would not we all consider it madness to stop the commerce on the whole world?

What is commerce? It is the international exchange of products. If we cannot stop this, are then the products of Agriculture and Horticulture the only exception to this general rule? I think not. And you must not forget what is at stake here.

It is not only the exclusion of a few plants more or less. It is *the whole* that we must keep in view.

We phytopathologists have the task to protect Agriculture and Horticulture and as a matter of fact we wish to protect our own cultures as well against foreign as domestic plant parasites.

We must not forget however that Agriculture and Horticulture cannot exist in any country without the mutual interchange of its products. If any danger is connected with this interchange of plants products, we must make this danger as small as possible by close international co-operation in the fighting and research of plant diseases.

If the basis of international exchange of plant products is a reasonable freedom from plant diseases, every basis, such as an absolute quarantine against latent plant enemies cannot be justified.

I am however convinced, that it is possible for the scientifically applied phytopathology to harmonize the interests of an importing country with that of an exporting country.

I hope that this international congress instead of searching for arguments for exclusion or seeking its strength in severe isolation, will bring an appreciation of each other's work and a close international co-operation for a mutual agreement in the exchange of the different plants and plant products the Creator has made to grow in the different parts of the earth.

This will be as well to the profit of human welfare as to the profit of our Phytopathological science.

Dr. HOWARD thanked Dr. van SLOGTEREN for his interesting lecture.

As at this time of the year there is nothing more to be seen on the bulbfields, a visit was paid to some store-houses and packing-sheds of bulbs, where tulips were just being brought in for cleaning and sorting.

After a beautiful drive along the foot of the dunes, the part of the country where bulb-growing is practised, the members sat down to luncheon at the kind invitation of the Bulb-growers' Association. The President of the Association Mr. KRELAGE presided to welcome the guests. He hoped that in the bulb-district too the guests had become convinced, that neither costs nor trouble were spared to secure healthy crops; in a humorous part of his speech he hoped, that, although artificialness is much in vogue now, it would never occur that in American gardens iron tulips and stone narcisses should be seen; although he admitted that they would retain a permanent freedom from disease. — Dr. METCALF and the SECRETARY responded respectively on behalf of the guests and of the Committee.

In the afternoon the company drove in two large motor-omnibuses to Broek-op-Langendijk, where the member of the Committee Mr. J. G. HAZELOOP was waiting to conduct the party to the building of the auction, where he read the following paper:

Ladies and Gentlemen,

I have much pleasure in showing you this auction-room, called „*Broeker veiling*" in the Dutch language.

This „veiling" or auction was established in the year 1887 and was the first in this country.

By establishing this auction for fruit and vegetables a new system of sale was inaugurated, which was of great importance for the development of horticulture in our country.

Before that time we had many other methods of sale, which, though differing greatly among each other, had *one* thing in common: each grower namely sold his produce separately. The auctions, which we hold now, have changed this. The growers act no longer separately, but the association of growers, which was formed by them, sells the produce of all its members. The advantages gained are many:

1e. As the sale of the produce of the whole district is in one hand, there is no competition among the different growers;

2e. Several abuses which were of frequent occurrence formerly, have been suppressed by concerted action;

3e. All productions being brought together in one place, intending purchasers can buy what article they want and in any quantity;

4e. Owing to the supervision exercised on the assortment and the quality of the produce supplied, the soundness of the trade has been much improved.

In the beginning these sales by auction were very simple and primitive. One day three or four growers of this village tried to sell their vegetables by Dutch auction somewhere in the open air.

The results proved favourable and it was not long before they were joined by others who also wanted to sell their produce in the way indicated, and in the very same year — 1887 — the association was formed, whose aim it was to sell fruit and vegetables by Duch auction, as the English call this system.

And the greater the number of growers was, who sold their produce by this new system the greater the profits proved to be. A short time afterwards auctions were also founded in other districts of the country and in the year 1897, so ten years after the first auction, there were already as many as 15 in our country and in 1907 there were 78, and at present there are 176 auctions, where fruit and vegetables are sold.

Not only the number of auctions, but also the amount of business done, has rapidly increased. The business of 1897 amounted to f 6.000.000 and the present turnover amounts to f 75.000.000.

The greatest sale was in 1918, when for no less than f 117.000.000 was sold. Owing to different circumstances, especially in consequence of the low prices, which set in after the great war the value of the supplies has had a heavy fall since 1918.

The way in which the goods are sold was changed materially in the course of years. We have seen, that the first auctions were held in the open air, but soon difficulties arose, which caused the erection of a very simple building — about 1897 — where at least the buyers could find a seat and in 1921 the present building was erected. The whole process of the auction takes place now in a building, especially erected for this purpose.

Since 1905 automatic registration has been used at the auctions. The automatic machine, as you see here, consists of an apparatus with a dial-plate, showing much resemblance with that of a clock. Instead of the hours we have here figures from 1 to 100.

Whenever a parcel of vegetables is sold now, which is always done in lots of 100 Kilo, 100 bunches or 100 pieces, the auctioneer generally settles the figure 100 to represent 10 guilders, 99 in consequence f 9.90, 98, f 9.80 and so on.

But it is possible of course that the value of an article may be more than 10 guilders per 100 K.G. In this case the auctioneer settles to the figure 100 does not represent 10 guilders, but 20 or 30 and then 99 does not mean f 9.90, but f 19.90 and the other figures proportionally. Now, supposing this parcel of carrots is to be sold.

The auctioneer, who attends to the automaton and who knows the prices of the day, adjusts the indicator and causes it to point to a high figure and then the apparatus is put in motion. The indicator moves regularly in a downward direction until one of the buyers presses the button near his seat, by which he signifies that he accepts the offer.

At this moment the indicator stops and indicates the price at which the carrots have been sold per 100 bunches.

At the same moment the number of the buyer who pressed the button, is electrically lighted, on the annunciator beside the automaton.

The same number occurs beside the button of the seat of the dealer, so that there also the buyer is pointed out.

This, ladies and gentlemen, is a short survey of the development of the method of sale by auction which is in general use in Holland nowadays.

The auction now going on was watched with much interest.

Afternoon-tea was then offered by the Municipality of Broek op Langendijk; the Burgomaster Mr. Slot bade the visitiors a cordial welcome in his typical village, and expressed his pleasure that also a small, but from an horticultural and commercial point of view, a by no means unimportant village as Broek-op-Langendijk was visited; he hoped that the days spent in Holland would tend to a mutual good-understanding of foreigners and Dutchmen, from which as much freedom as possible in commerce might result. After a few words of thanks by the Secretary the party embarked in two motor-cargoboats, in which a nice trip through the village and the surrounding fields of early potatoes, cabbage, carrots and other vegetables was made. These fields are all entirely surrounded by water, so that they can only be reached by boat. As the sun was setting over the low, flat land, the party could feel something of the frame of mind, in which several Dutch painters have tried to picture on their canvas the beautiful light and the clouds in the high skies of their country. After having dined at Alkmaar the party travelled by train to Amsterdam, where the party from Groningen had already arrived.

Next morning all travelled together to Baarn, where in the Laboratory Willie Commelin Scholten the sessions were continued with Prof. WESTERDIJK in the chair, who cordially welcomed the Conference in the laboratory under her direction. Owing to the lack of a well-appointed meeting-room a former coach-house had been cleverly changed into a convenient meeting-hall.
The first paper read was:

THE „CENTRAALBUREAU VOOR SCHIMMELCULTURES"

(CENTRAL BUREAU FOR FUNGUS CULTURES)

BY

JOHA. WESTERDIJK

It is a joy to me to have so many illustrious phytopathologists and mycologists visit this laboratory and the collection of pure cultures of fungi, for the maintenance of this institution requires the assistance of many of them. The exhibition of part of the cultures of fungi, will, I hope, give you an idea of what it contains and of our methods of culture. As to the history of its development, I can give you the following short exposé:

This bureau exists since 1904, when Prof. WENT, Utrecht, at the request of the „Association internationale des botanistes", began to collect cultures of fungi from different authors and places. In 1907 this bureau, which was financed by the „Association internationale", and which comprehended 100 species came to the Phytopathologisch Laboratorium „Willie Commelin Scholten" under my direction. Since then the collection has grown and expanded. Many mycologists and phytopathologists send us their cultures regularly, others always must be requested to do so, and alas, between the investigations and the publications the fungus often dies out. The financial side although was always a very difficult one, because the funds, which the association supplied for assistance and expenses, were always much too small. When war conditions became worse, the Association stopped its subvention and I had to beg to keep the collection going through the war-time, some Dutch scientific Associations and foundations giving small sums, each time for a year only. At last, the Royal Dutch Academy of Sciences reached us a helping hand. It now entirely supports the Bureau with as much as it can spare from its own small income, but the annuity is *entirely* insufficient. The more so as after the war, owing to the disorganized financial condition of the world, laboratories and scientists in different countries cannot afford to buy the cultures.

Now the collection of fungi is supervised by one member of our Royal Academy, one member from the Association and the directress of the Laboratory „Willie Commelin Scholten".

By employing one assistant, we have been able to keep the collection going, but I am well aware that by asking your co-operation, your help in augmenting and improving this collection of type cultures, we shall have difficulties to overcome as to the material side of the question, as the ever increasing number requires more work and money.

But this is not a day to talk too much of difficulties. I hope to show you what has been done by asking you to look over the exhibition of fungus cultures we have made in some rooms of the laboratory. About 1200 types are now kept in culture; you will find fewer names in the official list, but there is always a part we keep in revision and out of the list, as they are uncertain or the cultures contaminated. Some of the classes and genera are well represented, others are very poorly and many of you will know directly what they could send to complete us. Do not think that I shall ever hope or wish to get together the average of a hundred thousand species of fungi that have been described. I hope that by then, about nine-tenths of these species may have been suppressed as being „double, triple or more" descriptions of others. But even if this had been done, it would be impossible for one kind of laboratory to keep them all.

The co-operation of yeast-technical, medical and veterinary institutions would be desirable. Already we have the loyal co-operation of the Laboratory for Microbiology, Delft, which supervises our yeast cultures. But one of the principal things I want to talk about is the methods of cultivating the fungi, we follow here. The exposé I am going to give to you is not a summary of scientific investigations of culture-conditions, no — it is rather to be taken as a gardener's experience, a gardener who wants to keep up a large collection of plants and keep them for a length of time, not for one period of intense flowering but for regular cultivation. This is a thing to be kept in mind, as we know that on some media, under certain circumstances of culture, we may in the beginning find a very intense formation of spores, which however is lost very readily. A growth in the beginning luxurious, may end in abnormal mycelium production, the hyphae being swollen, the cells full of fat-drops. The methods, which in general are followed in growing fungi have been taken from the bacteriologists. These investigators grow their organisms at high, constant temperatures, far from light and air, in dark incubators on agar and gelatine media. These methods have long pressed upon the advancement of our knowledge, specially in cultivating plant parasites. We here in this bureau appreciate agar cultures as very helpful, but we know that the poor air content is a great obstacle to the growth of the fungi. They like an air medium, substances they can penetrate into and for this reason grow miserably on agar.

Rice, kernels of mais, wheat, oats, pieces of carrot and potato, stems and twigs of plants, sometimes pieces of leaves or bulbs have in many cases proved to be more advantageous than the different agars.

The second reason why the bacteriological gelatines and agars are poor media for fungi, is that they are used filtered to the extreme, every insoluble particle being taken out. Now fungi, the parasites as well as the saprophytes, secrete many enzymes, specially cellulose and starch ferments. It is better to have them use these enzymes; for regular growth it is desirable that the foodstuffs are solved gradually. Therefore we prefer to feed insoluble carbohydrates than supply the fungi with plenty of sugar. High percentages of sugar in the long run have a notorious influence. Our media then look cloudy and very often are a nuisance to well-trained bacteriologists.

As to the contents, for general culture it is best to have the media containing the most varied elements and for parasites in a rather dilute state. For saprophytes we use up to 5 % sugar, for parasites a lower rate. Our cherry-decoction with agar is a very good medium for parasites, and far better than the prune juice-agar generally used. Next to sugar, a great many parasites require starch. We, for instance, add to beer-wort agar containing no more than 3% sugar, a small dosis of salep, which has proved exceedingly advantageous. Decoctions of germinated oats or other grains, are likewise favourable to parasites. Natural media, decoctions of plants are in general far better than synthetic ones.

Another way of cultivating is the using of very thin layers, in Lindner flasks or in Petridishes, which is, as you will see, especially favourable for the formation of pycnidia like *Phoma, Ascochyta, Melanconiaceae* and stromata, sometimes for perithecia.

As to the reaction of the medium it is an old rule that fungi grow on acid media, but you will see in the *Nectria* cultures, which are exhibited in the laboratory, that the slightly alkaline media are of the same value. This is perhaps more general than we have thought. The acid media then are, in the first place, used to suppress the development of the bacteria.

Another principle of cultivating, which has to be kept in mind when running cultures for years and years, is the constant *changing of the media*. If once a fungus, for instance a *Mucor* spec. is doing well on carrot plugs, it is not possible however to keep it growing on that medium in a normal way. After a time the mycelium produces fat, which is to be found in-and outside the hyphae. At the same time the sporangia diminish in size, until the producing of fruiting bodies is entirely stopped. Transferring to malt decoction or starchy media is necessary. The use of another medium with every tranfer is a necessity; two or three of the best alternately will do very well, if only this measure s carried out from the beginning.

We know that fungus spores may keep their germination power sometimes for years. Knowing this, transferring once a year might seem sufficient to keep the fungi growing in a normal way, it is best however to transfer them as often as possible. When we want to ameliorate the growth and development of a certain species, we put it in the hands of people who transfer it continually, changing the medium as often as possible, stimulating it. In this way for instance it was possible to give new vitality to species of *Pestalozzia* which had been grown for years and which changed their „cotton plug growth" for large black masses of sporodochia.

We think cherry agar by far the best medium for isolations and in the long run for *Hymenomycetes,* which generally grow well on bread too. Starchy media for *Sphaeropsidales* and *Melanconiales,* rich synthetic media, or carrots or beetroots for *Mucors,* carrots for sclerotia producers.

Besides the medium itself, the influence of *light* is of the greatest importance; many mycologists however still have a secret fear for its influence. The dark incubators of the bacteriologists are forsaken, fungi are organisms that in general require light, and I think perhaps few or even none want complete darkness. You all know that the colours of the fungi are largely influenced by light, *Fusarium, Monilia, Trichothecium* do not colour in the dark. The light has an influence which is expressed in the concentric growth in dishes; the rings representing sometimes the night-sometimes the day rythm. Others grow concentrically independent from light influence. For instance we found the influence of light extremely favourable on the fruiting of *Basidiomycetes.*

A third important factor, and the second climatic factor, is the *temperature.* The old bacteriological idea was that of growing fungi at a constant temperature. But think of the parasites, living outside in winter frost and heat and never disappearing by extreme climatic conditions. As nearly all living things, they require *changes* of temperature, undulating lines which sometimes go to the extreme. Let me give you an example.We had to prepare, in a great hurry, a collection for Strasburg. As it has been found that changes of temperature act as a stimulant so we tried to tease the fungi by using 25 degrees and 4 degrees alternately. Within three weeks we had fruiting bodies of *Schizophyllum, Polyporus* and *Pleurotus,* a success we never had before. In general these cultures take months in producing their fruitings.

Humidity is also best changed from time to time. In general we obtain more airy mycelium, when the carrot or the potato is very wet; the spores are often formed more abundantly in a dryer medium. All the conditions however should vary; from cold to heat, from wet to dry, from rich to dilute media.

A very important matter for us is the preserving of the *virulence* of the cultures. We have no unfailable tests as to this quality, but our experience is, that when the morphology of the fungus is absolutely normal, the virulence in general is also not altered. But we know that, until now, it has been hardly possible to preserve the size of the spores, to keep the hyphae as broad as they should be. They all gradually change a little. Even the saprophytes do it very often. Spores of *Aspergillus* and *Mucor* after some years, have only three quarters of their size, the hyphae become thinner. We very often can regenerate them, but only in one way, that is by transferring them very, very often, at least once a month, and preferably every fortnight and changing the medium each time.

You see that one might keep things in a normal state, but only by more funds, more assistants, so that every group might receive proper care. Transferring thrice or four times a year, as we do is only a poor gardener's practice, and it is only by hard work that we can keep things going.

Ladies and gentlemen, what I ask is a loyal co-operation. Send us every culture you have, send it directly after you have described it. Every species, not represented in our lists, is welcome. Your help, I hope, will enable us to maintain and ameliorate our fungus garden.

DISCUSSION.

DR. C. L. SHEAR:

Having taken an interest in this question of pure culture supplies and also feeling that some words of Miss WESTERDIJK'S were perhaps directed to me, it may not be out of place for me to make a few remarks on the subject. We have been for years endeavouring to get a source of supply for pure cultures of fungi in America, but I can assure Miss WESTERDIJK that we have not had the slightest thought or intention of entering into competition with her. Our only purpose has been to co-operate in making this service more general and more helpful if possible. The exceedingly valuable work which Miss WESTERDIJK has so successfully inaugurated and developed under such difficult conditions should receive the most active and enthusiastic support of all mycologists and pathologists. The character and value of our work must depend to a considerable extent upon the availability and use we make of pure cultures of type or authentic material of the organisms with we are testing. Description matter cannot be relied upon entirely and without actual examination and comparison of living cultures many grave errors will occur in our identification of organisms which will not only greatly depreciate the value of our own work but prove misleading to our colleagues.

I cannot too strongly commend the great work which Miss WESTERDIJK is doing and wish to urge all of you to support it as much as possible. As for myself I shall promise to go home and do more than I have in the past in sending cultures, and co-operating in this exceedingly important aid to research in phytopathology.

Prof. J. WESTERDIJK replies: Mr. SHEAR has supported the bureau by sending a good many really pure cultures. I can understand that the U. S. want their own type collection, as the great distance between the two parts of the world is a handicap. It is only that the bureau at present is in want of the money paid by the American institutions for the cultures. This source of support would entirely be lost, if the U. S. had a collection of their own.

DR. S. G. PAINE:

Miss WESTERDIJK, Ladies and Gentlemen,

I would first like to say that my connection with the Collection of Type Cultures is only a minor one as a member of a committee with the duty of trying to procure cultures of bacteria which cause plant diseases. May I first say that I think I am only voicing the sentiment of the whole conference when I express my admiration for the work of this important institution, and I would add my thanks for help which it has given, not only to me, but also to the phytopathologists of England as a whole. While I hope that the nations will regard this as the premier institution and continue to give it their support, I regard it as a useful thing to have similar collections of type cultures in different parts of the world. I will introduce the case of the Lister Institute during last year; some infected animals had, for the sake of experiment, been imported from America carrying the very obscure disease *Tularaemia*. The disease was contracted by the Curator and his entire staff, rendering it for some six months very difficult to maintain the functions of the Bureau. This was a most exceptional and unfortunate occurrence, and I hope that such a thing may never happen here. Nevertheless accidents may happen which make it hard to maintain the customary standard of efficiency and some species may be lost; I think that it is of great advantage to have other collections from which any species which may fall out can be replaced in your collection.

Prof. WESTERDIJK repeats that she understands the necessity for each scientist to have some cultures at hand. As to yeasts and to fungi, pathogenic to men and animals, she would like to hand them over to another institution; the „Centraal Bureau" would then be able to confine itself to fungi, associated with plant diseases.

Dr. O. APPEL feels sure, that in future the „Centraal Bureau" ought to be more generally supported than has been the case hitherto. He should like to see the urgency thereof pointed out in the program of the International Union to be created to-morrow (see p. 215).

UNTERSUCHUNGEN ÜBER NECTRIA COCCINEA PERS. UND NECTRIA GALLIGENA BRESADOLA.

VON

JOHA. WESTERDIJK

Seit verschiedenen Jahren haben in diesem Institut Untersuchungen statt gefunden, die zum Ziel hatten die Krankheitssymptomen, die durch die beiden obengenannten Pilze verursacht werden, festzustellen und dazu die Morphologie der beiden Arten zu kläien. Die Arbeit, die vielen Wahrnehmungen, Messungen und Infektionen sind von Herrn Assistent VAN LUYK gemacht worden.

Wie Ihnen bekannt sein wird, ist die Morphologie der beiden Pilze in letzter Zeit von WEESE behandelt worden. Der kam zu dem Schluss dass *Nectria galligena* der krebserzeugende Pilz sei und *coccinea* nur auf glatten Rinden lebe. Dazu seien die Pilze hauptsächlich durch den Bau des Peritheciums und die Grösse der Ascosporen verschieden. Er gründet aber seine Behauptung nur auf die Beobachtung von frischem und Herbarmaterial; er hat die Pilze nicht in Reinkultur gehabt. Wir haben die Pilze, sowohl in Conidiën- als in Ascusform in künstlicher Kultur gezüchtet und viele Infektionsversuche gemacht. Von diesen interessieren uns auch noch hauptsächlich die auf Pappeln, da die Ursache des Pappelkrebses nicht mit Sicherkeit bekannt war.

Die Dicke der Perithezienwand haben wir nicht ausschlaggebend gefunden. Sie ist zu unregelmässig um sicher zu gehen. Die vielen Messungen, die an Ascosporen vorgenommen sind, haben aber sichere Unterscheidungsmerkmale ergeben. Auf Pomaceen (Apfel, Birne und Sorbus) haben wir mit sehr geringen Ausnahmen immer Ascosporen von durchschnittlich 17—18 μ Länge gefunden, das ist also die Form, die *galligena* genannt wird. Auf anderen Laubbäumen (Linde, Populus, Buche) fanden wir vorwiegend die kleine Form, die durchschnittlich 12—13 μ misst, und die also *coccinea* heissen soll. Es war aber gleich ob man in beiden Fällen von Krebsstellen oder von glatter, toter Rinde isolierte. Eine einzige Form, von einer Buche abkömmlich, hatte Ascosporen mit 16 μ mittlere Grösse.

Alle diese Schlüsse haben wir auf Grund von Frequenzkurven gemacht nach ± 20 Stämmen, die an grossen Tabellen demonstriert und an andrer Stelle veröffentlicht werden sollen.

Gruppiert man die Grössen nach den Zahlen der mittleren Sporengrössen, so zeigt sich noch dass die Zwischenform, die auf Fagus angetroffen wurde, gänzlich in dem Grössenkreis der *Nectria galligena* hineinpasst. Sie bildete also eine Ausnahme.

Ebenso stellte sich ein Stamm, von Salix isoliert, als *Nectria galligena* heraus. Dieses darf uns nicht allzusehr wundern und es ändert auch an unserem Resultate nichts, dass *Nectria galligena* ein Pomazeen- und *N. coccinea* ein Laubbaumpilz ist. Wir brauchen bloss Vergleiche mit den zwei *Monilia*-Arten *(Sclerotinia) M. cinerea* und *M. fructigena* anzustellen. Die erste kommt hauptsachlich auf Amygdaleen, die zweite auf Pomazeen vor. Man findet aber trotzdem *M. fructigena* hie und da auf Pflaumen. Der Pilz produziert dann die gleiche Fruchtfäule, als *cinerea*. —

Sämmtliche Messungen sind hauptsächlich an lebendem Material, aber auch an Kultur-Askosporen vorgenommen worden. Diese Messungen sind praktisch genommen vergleichbar, da die Grössen auf den zwei Substraten nur wenig auseinander gehen. Verschiedene Frequenzkurven bringen den Beweis. In der Kultur sind die Sporen etwas kleiner. Die Differenz liegt aber gewöhnlich nicht über 1 mikron.

In der Kultur sind makroskopisch *N. coccinea* und *N. galligena* nicht leicht zu unterscheiden. Zwischen den Stämmen innerhalb der Spezies bestehen ziemlich grosse Unterschiede, besonders was die Farbe anbelangt. Bei weiterer Kultur behalten diese „Rassen" ihre Eigentümlichkeiten. Die *coccinea*-Isolationen entwickeln meistens etwas mehr Luftmyzel, und weniger Sporenschleim als die, welche zu *galligena* gehören.

Was die Empfindlichkeit auf Säure und Alkali anbelangt, so kann man sagen dass auch durch diese Nährbodenunterschiede *N. galligena* und *coccinea* nicht unterscheidbar sind. Wohl sind einzelne Stämme unter sich in ihrem Verhalten auf Alkalifestigkeit verschieden.

Wir haben auch zahlreiche Messungen an den *Fusarium*sporen dieser *Nectrien* vorgenommen, in der Hoffnung hier einen konstanten Unterschied aufzufinden. Dieses ist uns aber, trotz der Anwendung sehr verschiedener Messungsmethoden nicht gelungen. Die grosse Variabilität in der Form und in der Zahl der Zwischenwände, das

Vorkommen von Mikrosporen macht, dass Vergleiche kaum durchführbar sind. Im allgemeinen kann man sagen dass die *coccinea*-sporen etwas mehr gebogen sind, wie auch aus den Figuren ersichtlich.

Die Methode der Messung von 200 Ascosporen fuhrte uns also bei jeder Bestimmung zum Ziel. Wir haben also mit grosse Sicherkeit *N. coccinea* von Populuskrebs isoliert, auch von Buchenkrebs, aber auch von Buchenrinde, worauf der Pilz saprophytisch leben kann; ausserdem von der Rinde von Ulmus. Auf Buchen- und Salixkrebs haben wir ganz vereinzelt *N. galligena* angetroffen, während der letztere Pilz sonst regelmässig auf Krebsstellen an Sorbus, Apfel und Birne aufzufinden ist. Sogar auf Apfelfrucht kann er eine Fäule hervorrufen.

Was die zahlreichen Infektionsversuche anbelangt, so wollen wir erwähnen dass es gelungen ist Krebs an Populuszweigen durch *N. coccinea* zu erzeugen, so dass auch die Ursache dieses Krebses geklärt ist. Aber auch mittelst *N. coccinea* von glatter Buchenrinde und Populuskrebs haben wir typische Apfelkrebse auf der Apfelsorte Bismarck erzeugt. Auf Buche sind Krebse mittelst *N. coccinea* und *N. galligena* hervorgerufen. Trotzdem ist aber *N. coccinea* der typische Buchenpilz, der sowohl ein parasitisches als ein saprophytisches Leben führen kann.

Es haben diese Untersuchungen wieder einmal gezeigt dass es nur auf Grund sehr ausgiebiger Sporenmessungen möglich ist die Identität eines Pilzes festzustellen, und dass es der Infektion mit zahlreichen Pilzstämmen bedarf, um die positive oder negative Pathogenität eines Pilzes zu beweisen.

DISCUSSION.

H. W. WOLLENWEBER
expressed the view that the species *Nectria ditissima* Tul. may be re-established on account of its morphological characters. The ascospores of this *Nectria* are somewhat larger than those of *N. coccinea,* but smaller than those of *N. galligena,* whilst its conidia are longer and have more septa than those of the two other *Nectria.*

Prof. WESTERDIJK feels sure that this species will be shown to belong either to *N. galligena* or to *N. coccinea,* if only the method of measuring the ascopores and making graphs of the figures is used.

ON THE RESISTANCE OF THE POTATO TUBER AGAINST PHYTOPHTHORA

BY

M. P. LÖHNIS

As material for the research into the problem of resistance of the potato tubers against *Phytophthora infestans*, I used potatoes from various countries (Holland, Germany, America, England). As a standard variety of the greatest susceptibility the Dutch variety of Eigenheimer was used. The same varieties were cultivated in Baarn in dry sandy soil and in our heaviest clay soil in a „polder". The observations in the clay soil were made by Miss KRUSEMAN under my direction. Amongst the varieties used in the field experiment, all degrees of susceptibility were to be found in the tubers, combined with, or not combined with, susceptibility in the foliage.

In laboratory conditions various qualities of the tubers were tested in order to find differences that might correspond with the degree of resistance determined in the field.

In looking for those qualities I worked from the interior of the tuber to the exterior and at first no differences were to be found.

The parenchyma was tested by using the method of JONES (i. e. cultivation of *Phytophthora* on raw sterile potato blocks in test tubes); the results of this method were compared with those obtained after inoculating, in a slit, tubers of the same varieties. As a great drawback of the method of JONES, where the exterior extension of mycelium is observed, I found that often the interior of the block appeared severely infected whilst the exterior showed no growth of mycelium. To judge the extension of the mycelium the blocks have to be cut.

In slit inoculations in summer, tubers of 28 varieties, susceptible as well as resistant, showed the same extension of mycelium. No correlation was to be found between the degree of extension in the parenchyma and the degree of resistance. The degree of resistance was no property of the parenchyma.

More exterior parts of the tubers had then to be tested. The result produced by the following very simple field experiment made me follow a new method. After inoculating with blighted leaves the tubers still on the plants of Eigenheimer, 75 $^0/_0$ of the potatoes when dug were diseased. On the other hand with Bravo, a much cultivated variety with moderately susceptible foliage and very resistant tubers, all tubers treated in the same way kept sound. This result astonished me, because the inoculated Bravo tubers had exceptionally large lenticels and I wondered what would happen, if I made the lenticels larger still; so I drew off the whole skin, as the tubers were still unripe — and after bringing these skinned tubers into contact with the fungus the tubers kept sound.

It appeared that a property of resistance was found in the boundary layer of cork and parenchyma in the variety of Bravo.

I repeated this experiment with Bravo tubers during three summers and put all my other varieties to the test. The result was that of 17 varieties 100 % of the tubers thus treated appeared to be easily infected, in 21 varieties 100—60 % of the tubers were infected and of Bravo only 9 %. One German variety Neuer Markt showed a resemblance to the behaviour of Bravo, but I had used all my seed potatoes and I could not put it further to the test.

This spring I could get seed potatoes of 9 different seedlings of Bravo and when the tubers have grown I will examine their behaviour. [1])

In comparing the boundary layer of Bravo with Eigenheimer no anatomical difference was to be observed.

The rate of wound-cork formation compared with Eigenheimer and the variety of Blauwen (both highly susceptible) was the same when the tubers were kept at the same temperature. (At 25° C. after 2 days old cells were suberised, after 4 days new cells were formed, — at 15° C. after 4 days new cells were formed.)

In treating the boundary layer of Eigenheimer and Bravo with $CuCl_2$ the Eigenheimer cells were deeper coloured so that the resistance cannot be due to a greater quantity of tannin in the boundary cells. It appears probable that there is a physiological difference which we cannot further analyse now.

So in one variety the resistance of the tubers to *Phytophthora* is due to its boundary layer between cork and parenchyma. In the great bulk of other varieties other qualities must be looked for.

In working from the interior to the exterior I am coming now to the skin. Microscopically the thickness of the skin was determined in tubers of 33 varieties. The thickness varied between 8 and 14 cells; once as an exception 21 cells were found. No correlation whatever was to be found in relative thinness of cork and susceptibility in the field. As further no mycelium growth is ever to be seen in cork cells, and as no mycelium ever comes out of the intact skin when inoculated tubers are kept in petri-dishes, differences in the thickness of the skin cannot account for the degree of resistance of a variety.

The difficulty to be met now was that very little is definitely

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[1]) *Oct.* After inoculating tubers of the 9 seedlings, one proved as resistant as Bravo, and 8 proved susceptible. — M. L.

known about the way in which the spores manage to enter into the sound tubers. The observations stated in the literature do not agree with one another — and I too found that the first observations I made were widely different from those made by Miss KRUSEMAN and myself last summer. It is by the comparison of the behaviour of tubers grown in different soils that the confusion existing in the statements is to be explained.

Among potato growers it is a very well-known fact that soil differences may influence the percentage of diseased tubers in the crop. Here in Holland potato-growers on sandy soil are generally not afraid that their crop may become seriously blighted even in severe epidemics, notwithstanding the degree of foliage-infection is not any slighter on sandy soil than on clay soil. Generally it is thought that soil differences will influence the rate of extension of the fungus or increase the time *Phytophthora* can keep in good condition in the soil. But after inoculating Eigenheimer tubers grown on sandy soil and on clay soil in laboratory conditions, just the same difference in the number of the infections was to be observed; so the soil factors influence the tubers and not, or not especially, the fungus.

Miss KRUSEMAN and I proceeded in the following way: Eigenheimer tubers with a sound skin were for a moment put into water wherein zoospores were swimming in great numbers. Control tubers the skin of which was drawn off were put by each lot to make sure that the spore-emulsions used were quite infectious. After a few days if the inoculations have been successful small discolored spots are to be seen through the skin. If the infections are quite recent they are so small that they are easily recognised as small limited spots and one can see which parts of the tubers are contained in the spots. The number of infected parts per tuber were registered and the newly infected parts kept in alcohol. This winter I examined a part of them microscopically.

The results, all obtained with inoculated tubers of the variety of Eigenheimer, are stated in the table:

	Tubers grown in:	
	clay soil	*sandy soil*
Inoculated tubers	155	158
Inf. lenticels per tuber 40	8 tubers	—
Inf. lenticels per tuber 39—15	27 tubers	—
Inf. lenticels per tuber 14—5	31 tubers	—
Inf. lenticels per tuber 4—1	37 tubers	—
Inf. lenticels in toto	—	13
Inf. eyes per tuber 6	9 tubers	—
Inf. eyes per tuber 5—3	18 tubers	—

	clay soil	sandy soil
Inf. eyes per tuber 2—1	39 tubers	—
Inf. eyes in toto	—	6
Inf. directly under eye	69	6
Inf. through rents	42	1
Way of inf. unknown	36	20

As you see, the greatest possible difference is to be seen in the number of lenticel infections. While the total number I observed in my Baarn inoculations was 13 lenticels, there were among the clay tubers some to be met where the number of lenticel infections per tuber was about a 100.

In examining the alcohol material of the lenticels during the last winter, lenticels of sound tubers grown in clay soil and sandy soil could be compared and the infected lenticels of the clay and sand grown tubers were studied.

Here a constant anatomical difference was to be met with, — a difference that in my opinion accounts for the resistance of the sand-grown tubers. I treated all my sections with Sudan III glycerine, a stain that colours suberised cell-walls red; and in the drawings you can see the difference that occurred. While the lenticels in clay grown tubers are filled with unsuberised parenchyma cells those in sand-grown tubers are covered with some layers of suberised cells. This difference was quite constant; in the examined sound lenticels no exception was met. Only in the sections of the 13 infected sand lenticels the suberised layers were missing.

I cannot tell whether these suberised parenchyma cells act themselves as a shield against infection or whether they only express the state of greater dryness of the sand lenticels, so that the suberisation and resistance are only correlated factors. At all events last summer the correlation was a fact.

In the coming months Miss KRUSEMAN and I hope to compare lenticels of Eigenheimers in all states of development and study the anatomy of the lenticels of varieties with susceptible foliage whose tubers keep sound in clay soil, and of the few varieties I observed last summer whose tubers are susceptible even in the sandy soil of Baarn.

I hope that these observations will help to change into fact my hypothesis that in the behaviour of the lenticels is to be found the chief explanation for the differences in the degree of resistance against *Phytophthora infestans*.

Only very superficially shall I talk about the other modes of infection stated in the table, since research on them is still in its beginning.

Under the eyes the skin is very thin; here often lenticels are grouped, and after keeping tubers in moist condition the parenchyma is apt to grow through the skin.

In the clay-grown tubers many eyes were found infected. I made microtome sections of infected eyes. In the drawing a diagram of a bud is given; in the middle the meristematic tissue, and at the outside, two further developed leaves are to be seen. These small leaves are covered by a phelloderm. Very constantly a group of stomata or a lenticel was to be met with in the middle of the back of the leaf and the top frequently showed some stomata or a larger parenchymatic region.

I can state that the diseased part of the bud always contained an unsuberised part of the small leaf. The meristematic part kept sound. It is probable that in the buds, too, the fungus enters through natural openings in the corky shield of the tuber. How it is that the sand-tubers were less infected through the eyes than the clay-tubers I cannot explain; this has to be further looked into.

As a summary of my observations I can say that as yet only one variety is known in which the property of resistance is to be found in the boundary layer between cork and parenchyma. In all other varieties examined natural openings in the suberised tissue round the tuber may account for their resistance.

DISCUSSION.

Prof. QUANJER would like to know if Dr. LÖHNIS had been able to ascertain any difference in the growth of the fungus in clay soil and in sandy soil.

Dr. LÖHNIS answers that the time-limit at which sandy soil kept in the open can retain its infectiousness was determined last summer; for the clay soil no dates were present. After the outbreak of *Phytophthora* new dates for clay soil and sandy soil will be collected. The fact that a great difference in susceptibility can be observed under laboratory conditions proves that the condition of the tuber plays an important part in the chance of infection.

Dr. MURPHY: Dr. LÖHNIS appears to have discovered an important correlation between the morphology of potato tubers and the development in them of the *Phytophthora* disease. She has shown that tubers grown on a clay soil are susceptible when exposed to artificial infection, while tubers of the same variety grown on a sandy soil are resistant when exposed to the same degree of infection. It remains to be determined, if I have understood the speaker correctly, if in a number of varieties which possess varying degrees of susceptibility, the same morphological differences will be shown by the tubers when all are grown under the same conditions.

Our own experiments in Canada and in Ireland have shown that the development of blight in tubers during storage is largely influenced by external conditions, and principally by the amount of the blight fungus present on the foliage or in the soil at the time of digging. Thus in laboratory experiments it was found that contaminated clay soil remained pathogenic to tubers for about six weeks, or a considerably longer time than similarly contaminated sand was capable of reproducing the disease.

Dr. LÖHNIS answers that she has seen how 50 tubers fresh after digging out of sandy soil brought together with cut blighted tubers in very moist condition kept sound; of 50 washed clay-grown tubers treated in the same way 8 were infected. So the condition of the tubers plays its part too in the spreading of the disease during storage.

Mr. MILLARD asked if Miss LÖHNIS was acquainted with the work of PRIESTLEY on the deposition of Suberin and the subsequent formation of cork on the cut surface of a potato. This author has shown that a suberin layer is formed much more quickly in a dark and damp atmosphere than in bright sunlight. Mr. MILLARD thought that some connection might exist between this fact and the difference found in the amount of suberin in potatoes grown on clay and sandy soils.

Dr. LÖHNIS answers not to have been aware of the work of Prof. PRIESTLEY.

The session was now interrupted to allow members to inspect the different exhibits, shown in the

Laboratorium Willie Commelin Scholten.

The „Centraal bureau voor Schimmelcultures" was represented by ± 300 show cultures, partly in Erlemeyer flasks, partly in Petri-dishes, in large tubes and on thin layers of gelatine in Lindner flasks.

The fungi were divided into the following groups: Plant parasites, saprophytes, parasites of man and animals. Of the plant parasites we note the following groups:

1e. The originators of different kind of rots: as the *Fusaria* as originators of foot- and tuberrots, the sklerotial fungi, the *Botrytis,* the *Monilia's* as fruit rotters, the *Phytophthora* etc. The woodrotters like *Polyporaceae* and *Agaricineae*, many of them producing fruiting-bodies; the originators of dry rots of twigs: the *Valsa's*, *Diaporthe's*, *Nectria's*.

2e. The maculicolar fungi, like the *Ascochyta's*, *Gloeosporium*, *Mycosphaerella*, *Septoria*, *Macrosporium*, *Fusicladium*, *Cladosporium*.

3e. The originators of the „blacks" (Schwärzen): *Alternaria*, *Macrosporium*, *Cladosporium*.

4e. The sooty moulds represented by species of *Dematium*, in different habitus, *Hormodendron*, *Fumago*, *Cladosporium*.

5e. The bark spots and cancer fungi, like *Nectria galligena* and *Dasyscypha*.

6e. The *Actinomycetes*, producers of scabs.

7e. Lastly the fungi that cause wilt diseases like *Fusarium*, *Verticillium*, *Graphium*.

Among the saprophytes, we find the *Trichothecium*, *Cephalothecium*, *Penicillium*, *Aspergillus*, *Chaetomium* species.

The animal parasites comprehending the *Trichophyton*, *Microsporion*, *Sporotrichum* and *Oospora's*.

The influence of different culture media on the growth of one fungus was illustrated with species of *Cladosporium*, *Dematium*, *Phoma*.

Mr. VAN LUYK demonstrated several cultures of *Nectria galligena* and *coccinea*, to show the differences between these species, and to illustrate the influence of different concentrations of acids and alkalis. The large number of strains of the two *Nectria's* from different hostplants showed the difficulty of recognizing these races by macroscopic characters. Lastly the infections of *Nectria coccinea* and *Nectria galligena* on beech, poplar, and apple proved with great certainty that both these fungi may produce cancers.

Dr. LÖHNIS showed her infections of Bravo and Eigenheimer potato-tubers with *Phytophthora infestans*. By taking off the outer skin from the Bravo, the layer underneath proved to be resistant, whereas Eigenheimer was most susceptible (see p. 175). Young infections through lenticels of clay-grown tubers were demonstrated (see p. 176).

In the garden light refreshments, served by relations of Miss WESTERDIJK and by her girl students, were to be had. Here Prof. BERNATSKY from Budapest spoke a few words full of feeling; he said that during the last years he had nearly lost his faith in the future of mankind, but on attending this Conference, where he had seen so many people of different nationalities dealing with each other on the most friendly terms, he had regained his faith and hoped again for better times to come.

At 2 p. m. members were again called together in the meeting-hall; Miss WESTERDIJK now called on Dr. METCALF to read his paper.

HISTORY OF PLANT-PATHOLOGY IN AMERICA

BY

H. METCALF

[Although Mr. METCALF sent his paper in due time, it seems to have never reached Wageningen. The Secretary's requests for another copy met with a series of accidents, but the worst of all is that Mr. METCALF's only copy, when sent by him to Washington, has become the victim of another postal error, and has been lost. So it is impossible to print the paper here. Mr. METCALF intends to write it anew and publish it in „Phytopathology"; he will then forward a copy to the members of the Conference.]

Miss WESTERDIJK now called on Mr. FOËX to read the paper of Mr. CAVADAS (Greece) who had been unable to attend.

SUR LA BIOLOGIE DE VERMICULARIA VARIANS DUC.

PAR

D. CAVADAS
INGENIEUR DE L'INSTITUT AGRICOLE DE L'UNIVERSITÉ DE NANCY.

En poursuivant l'étude de *Vermicularia varians* Duc. dans le but de connaître sa biologie, nous avons entrepris ainsi que nous l'avons mentionné dans notre rapport précédent [1]) des recherches dans la serre de la Station de Pathologie végétale de Paris. Nous tâcherons d'exposer ici les résultats de ces dernières.

Nous avons rempli de terre stérilisée dans le four Pasteur, un certain nombre de pots et nous avons établi le dispositif suivant:

	a	b	c	d	e
Nombre de pots	2	6	2	2	2
Tubercules		ordinaires et stérilisés au Cl^2 Hg (témoins)	inoculés par des conidies	inoculés par des sclérotes	
Terre	infectée par des conidies				infectée par des sclérotes

[1]) D. Cavadas: Notes sur la Dartrose et ses conséquenses. Bul. de la Soc. de Path. vég. de Paris, t. X, pp. 67—75, 1923.

Quand les plantes issues de ces tubercules ont acquis une hauteur de 8—12 c.M., c'est-à-dire quand elles ont atteint l'âge d'un mois et demi, nous avons sur deux des six pots que nous avions gardés comme témoins, opéré des inoculations sur le collet par des conidies du champignon, et sur deux autres nous avons disséminé des conidies et des sclérotes sans aucune blessure. Ainsi, à ce moment, notre dispositif se composait de sept lots de deux pots chacun.

En même temps que nous proposions l'étude biologique de *Vermicularia varians* Duc., nous cherchions à vérifier l'identité des spores de la forme hyphomycète que nous obtenions toujours sur certains des milieux nutritifs désignés dans notre rapport précédent (loc. cit.) Toutes les inoculations ont été faites à partir de conidies ou de sclérotes prélevés dans des cultures de ce champignon.

La germination des tubercules a été régulière dans tous les pots, jusqu'à ce que toutes les plantes aient acquis une hauteur de 10—15 c.M. Dès ce moment, nous avons pu constater que le développement des plantes indemnes ainsi que celles dont l'infection a été faite tardivement, était plus vigoureux et plus régulier que celui des autres, dont les tiges restaient grêles, tout en donnant une poussée extraordinaire en hauteur et des signes apparents de dégénérescence. Des phénomènes analogues à ceux décrits par CREPIN [1]) sous le nom d',,enroulement" flasque ont suivi les symptômes ci-dessus, mais l'examen microchimique ainsi que l'examen micrographique nous ont bien montré que ces phenomènes n'ont aucune relation avec la maladie bien connue de l'Enroulement proprement dit ou leptonécrose de QUANJER.

Tandis que ces symptômes s'accentuent et se généralisent, les feuilles deviennent de plus en plus pâles, se courbent, se rabattent le long de la tige et enfin se détachent laissant à nu les tiges, qui, ayant pu jusqu'alors rester debout, se courbent à leur tour et se couchent sur le sol. C'est à ce moment que nous avons pu constater que ces symptômes sont dûs à l'action du parasite. Nous avons en effet vu apparaître à l'endroit oû la tige a été pliée, de petites ponctuations noires qui n'étaient autre chose que les fructifications mélanconiennes de *Vermicularia varians* Duc.

Les symptômes, que nous venons de décrire, sont bien visibles dans les plantes issues de tubercules infectés ou ayant poussé dans un sol infecté avant la semence. Dans ce cas, le parasite attaque la plante avant que celle-ci ait pu développer ses tissus de soutien, la circulation de la sève ascendante est alors entravée, la turgescence de la plante diminue de plus en plus, et la mort de la plante est

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[1]) C. CREPIN: Une maladie grave de la pomme de terre dans le Forez. Bull. de la Soc. de Path. Veg. de France, t. IX, pp. 237—243, 1922.

certaine. C'est le cas de la maladie grave, où la récolte est complètement annulée.

Il en est de même pour les plantes inoculeés quand elles ont acquis un certain développement; dans ce dernier cas ces symptômes sont peu apparents et la plante réagit contre le parasite en limitant son action au voisinage de la partie inoculée. Les dommages causés dans ce cas sont insignifiants et si une cause étrangère (sécheresse, humidité, pucerons etc.) n'intervient pas pour mettre la plante en état de réceptivité, elle peut donner d'aussi bons résultats que les plantes indemnes. Ajoutons que le parasite est incapable d'attaquer une plante ayant acquis un certain développement, s'il n'existe une porte d'entrée. En effet, les pommes de terre sur lesquelles nous avons disséminé des conidies et des sclérotes et que nous avons protégées de toute cause qui pourra amener une blessure soit sur les tiges, soit sur les feuilles, elles ont gardé leur santé pendant toute leur vie.

De ce que nous venons d'exposer, nous pouvons conclure que le *Vermicularia varians* Duc. devient un vrai parasite et peut amener des dégats très sérieux seulement dans le cas où son attaque a été faite au début de la germination de la plante. Dans tous les autres cas, le champignon est inoffensif, mais il peut concourir à la destruction de la plante, si une cause étrangère vient diminuer sa résistance. Ce dernier fait est vérifié par le phénomène que les fructifications du parasite apparaissent très tardivement dans le cas des attaques graves et très vite dans le cas des attaques bénignes. En effet les fructifications du champignon sont apparues vers le quatrième mois sur les plantes issues des tubercules inoculés, où la maladie était très grave et a mené la mort de la plante; au contraire, dans le cas d'une inoculation sur une plante déjà assez développée où la maladie a été très bénigne et l'action du parasite a été limité au voisinage de l'inoculation, le champignon a commencé à fructifier à partir du deuxième mois.

Prof. WESTERDIJK thinks that *Vermicularia varians* Duc. may be identical with *Colletotrichum solanicolum* O'Gara.

Dr. FOËX cannot say; he has only read Mr. CAVADAS' paper.

QUELQUES FAITS RELATIFS AUX ERYSIPHACEES

PAR

ET. FOEX.

AVANT-PROPOS

La plus grande partie du présent travail a été effectuée à Montpellier (Hérault) de 1903 à 1912. Depuis l'époque où nos fonctions nous ont appelé à Paris (Juin 1912), nous n'avons plus trouvé les loisirs, ni le moyen de poursuivre notre étude sur les *Erysiphacées*. Aussi, devons-nous nous excuser de présenter un travail vieux de plus de onze ans et que les circonstances ne nous ont pas permis de porter au point où nous aurions voulu l'amener. Comme il est peu probable que nous ayons jamais la possibilité de reprendre cette étude, nous nous sommes décidés à prier la Commission arrangeant la Conférence internationale de Phytopathologie et Entomologie agricole, presidé par Mr. le Professeur QUANJER, de bien vouloir nous autoriser à en présenter quelques éléments devant cette Conférence. Nous remercions la Commission d'avoir bien voulu nous permettre de produire devant cet important Congrès un travail fragmentaire, dont mieux que tout autre nous voyons les lacunes.

Le Conidiophore

Nos observations nous amènent à admettre l'existence de 4 types de conidiophores:

1e Type: La cellule base est à la fois pédicelle et cellule génératrice de cellules mères de conidies. (*Erysiphe graminis*; *Sphaerotheca Humuli* sur *Erodium malacoides*; *Sphaerotheca pannosa* sur Rosiers divers; *Erysiphe cichoracearum* sur *Senecio vulgaris*). *Erysiphe graminis* se distingue non seulement par la forme de sa cellule pédicelle, mais encore parce que la formation des cellules conidiennes est précédée de la constitution de deux générations de cellules mères.

2e Type: Un pédicelle unicellulaire porte une cellule mère au-dessus de laquelle se trouve une chaîne plus ou moins longue de cellules destinées à se différencier directement en conidies. (*Erysiphe Polygoni*; *Microsphaera Mougeotii*; *M. Quercina*; *Oïdium Evonymi-japonici*). Par son long pédicelle, parfois pluricellulaire, *Uncinula Salicis* ménage une transition entre le 2e et le 3e type.

3e Type: le conidiophore, très allongé, ne présente qu'une seule conidie, laquelle est portée par une file de cellules très grêle dans sa partie inférieure. Tout à fait à la base du conidiophore, existe, souvent une, mais parfois aussi plusieurs (deux, trois) cellules cylindriques, étroites, vides ou à cytoplasme rare. Cette partie inférieure de l'appareil supporte en général une file de deux, trois, quatre cellules plus courtes et qui sont d'autant plus larges qu'elles sont plus rapprochées de la conidie, qui est l'élément apical. Ces cellules ont un cytoplasme dense. La cellule mère est sans doute l'élément court, à cytoplasme dense, qui vient immédiatement au-dessus du pédicelle. (*Phyllactinia corylea.*)

4e Type: Pédicelle, en général, pluricellulaire, qui peut bourgeonner pour constituer des conidiophores; de plus, l'appareil conidien primaire, s'insère, non pas au-dessus d'un filament mycélien externe et perpendiculairement à la direction de ce dernier, ce qui est le cas chez toutes les autres Erysiphacées, mais à l'extrémité ou près de l'extrémité d'une hyphe endophytique, dont il paraît être le prolongement. (*Erysiphe taurica.*)

Peut-on baser une détermination spécifique sur les caractères de l'appareil conidien?

Les facteurs qui déterminent le nombre des articles conidiformes de la chaine sont au nombre de trois: 1 activité de la cellule génératrice; 2 rapidité de la différenciation; 3 rapidité de la désarticulation. Pour une espèce déterminée le nombre n'est certes pas constant. Cependant, dans les conditions normales d'habitat, il est assez peu variable. Dans sa magistrale monographie, SALMON a du reste figuré les conidiophores de la plupart des *Erysiphacées*. Certes en milieu humide, atmosphère calme, sur un substratum bien vivant, les chaînes conidiennes peuvent s'allonger au point qu'un conidiophore normalement unispore, tel que celui de *Phyllactinia corylea*, peut porter une série de conidies enchaînées (NEGER). L'application des méthodes biométriques aux conidies à permis d'établir des distinctions entre diverses espèces ou variétés voisines. (REED, BLUMER etc.) La comparaison des conidiophores pourrait rendre des services. Certains caractères, moins inconstants qu'on ne le suppose généralement, faciliteraient cette distinction: 1° nombre de cellules constituant la chaîne complètement évoluée; 2° proportion et forme des divers éléments du conidiophore (pédicelle, longueur, largeur des cellules homologues); 3° facilité avec laquelle s'effectue la désarticulation (fréquence, rapidité de cette dernière); 4° eléments du conidiophore qui se détachent par cette voie.

Enfin, il est parfois possible de faire état dans une assez large mesure des corpuscules de fibrosine de ZOPF, lesquels sont des éléments callosiques répandus dans la plupart et peut-être dans tous les appareils conidiens des *Erysiphacées* et qui affectent dans certaines espèces des formes assez nettes et suffisamment constantes pour servir de caractère de détermination. Toutefois, ces réserves que BLUMER fait à cet égard nous paraissent assez justifiées.

Dans la cellule basilaire initiale et plus tard dans les cellules génératrices existent généralement de nombreuses granulations douées de métachromasie par le Bleu Polychrome de Unna. C'est à l'intérieur, sous ces dernières ou à leur contact que se constituent les corpuscules de ZOPF, qui sont finalement entourés d'un liséré rouge, seul vestige qui subsiste de la substance métachromatique dans les éléments supérieurs du conidiophore.

La substance des corpuscules de ZOPF représente-t-elle une matière de réserve? Ce qui est certain c'est que ces éléments disparaissent de la conidie en germination et que de nouveaux corpuscules se montrent bientôt dans le tube germinatif qu'elle forme.

La substance des premiers entre-t-elle dans la constitution des secondes soit après avoir subi une simple liquéfaction suivie d'une récondensation, soit après avoir participé à des transformations chimiques intermédiaires? La substance des corpuscules du tube germinatif dérive-t-elle de celle des éléments homologues de la conidie? Nous ne savons. Comment l'évolution d'un conidiophore se termine-t-elle? Tantôt la désarticulation de la chaine conidienne n'est que très incomplète (*S. Pannosa* sur Rosier; *S. Humuli* sur *Erodium Malacoides; P. oxyacanthae* sur *Armeniaca vulgaris*). Par contre la désarticulation est parfois très loin, chez *S. Humuli* sur *Calendula arvensis* généralement jusqu'à la seconde cellule à partir de la base; chez *P. leucotricha* jusqu'au pédicelle lui-même (c'est de toutes les espèces, celle chez laquelle la désarticulation est le plus souvent complète). Dans les conidiophores de notre second type la cellule génératrice se transforme parfois en conidie. Il arrive que le pédicelle d'un vieux conidiophore pousse un filament mycélien par une sorte de bourgeonnement latéral (retour à l'état végétatif). La cellule mycélienne qui porte un conidiophore, peut, lorsque ce dernier est usé, en constituer un second (*S. Humuli* sur *Calendula arvensis*). Les conidies sont parfois, très rarement, il est vrai, binucléées.

La fragilité des conidies paraît assez grande. Nos essais ont surtout porté sur le *S. pannosa* du Rosier. Abandonnées sur une lame de verre, dans une pièce, ces conidies perdent leur faculté germinative au bout de 24 h. à la lumière diffuse; et de 3 à 4 h. au soleil. En ne tenant compte que des conidies bien vacuolisées on peut observer que les conidies prélevées à la surface des feuilles à la fin d'une journée chaude, sèche, ensoleillée germent à peu près dans une aussi forte proportion que des conidies récoltées le matin. Cependant, dans ces conditions atmosphériques, la production des conidies peut n'avoir lieu que pendant la nuit et la proportion des éléments conidiens et mycéliens qui subit des altérations pendant le jour est considérable. Il paraît vraisemblable que les conidies encore portées par le conidiophore et qui par son intermédiaire reçoivent de l'eau puisée par les suçoirs dans les feuilles, subissent moins rapidement dessication que les conidies détachées. Seules germent les conidies à vacuolisation nette, celles dont le cytoplasme est granuleux ne germent pas. Par contre, on peut voir germer des éléments du conidiophore qui n'ont pas encore acquis leur différenciation morphologique définitive. La germination s'effectue sur l'eau mais non à l'interieur de ce liquide. Elle a lieu entre 5° et 30° (nous n'avons pu déterminer avec précision ni les limites extrèmes, ni la temperature optime). Dans les conditions les meilleures, la proportion des conidies qui ont germé n'a jamais dépassé un tiers. Sans doute la maturité physiologique ne marche-t-elle pas tout à fait de pair avec la maturité morphologique. Ces faits seraient à rapprocher de ceux observés par SCHAFFNIT dans le cas des *Urédinées*. On admet que grâce à la forte proportion d'eau emmagasinée dans leur vacuome, les conidies d'*Erysiphacées* germent en atmosphère humide. En les plaçant dans ces conditions, nous n'avons obtenu que le tiers des germinations réalisées sur l'eau. Encore notre technique était-elle trop peu précise pour que nous puissions affirmer que les conidies n'ont pas germé dans les gouttelettes de condensation. Pendant les périodes de sécheresse la germination doit s'effectuer grâce aux rosées fréquentes de grand matin, même en pleine canicule. Dans du suc de feuille de rosier dilué la germination des conidies s'effectue dans les mêmes conditions qu'on ait affaire à des sortes sensibles ou résistantes. Résultats analogues à ceux obtenus par SCHAFFNIT pour les *Urédinées*. Un séjour de quelques heures en glacière (de O° à + 3° à 4°) a favorisé peut-être un peu la germination. Il n'y a cependant rien de bien net à ce sujet.

Périthèces.

Certaines *Erysiphacées* donnent de nombreux conceptacles sur toutes leurs espèces d'hôtes (*Erysiphe graminis*; *Uncinula Aceris*, *Phyllactinia corylea*; *Podosphaera oxyacanthae*, etc.). Certaines constituent des périthèces sur certains hôtes et pas sur d'autres: *Erysiphe Polygoni*, en forme 1° souvent sur *Convolvulus arvensis*, *Polygonum aviculare*, *Ononis campestris*, *O. repens* etc., 2° rarement sur *Trifolium pratense*, *T. repens*, *Medicago sativa*. Les conceptacles d'*Erysiphe taurica* sont fréquents sur *Phlomis Herba-venti*, nous ne les avons jamais vus sur *Mercurialis tomentosa* ni sur *Onobrychis sativa*. *Uncinula salicis* donne de nombreux périthèces sur *Salix cinerea*; il en forme rarement sur *Populus nigra*.

Existe-t-il une sorte de balancement entre la production des conidies et celle des périthèces? Certains faits paraîtraient l'indiquer. Des pieds de Lyciet, Rosiers etc., observés pendant neuf ans n'ont jamais montré que d'abondantes productions conidiennes. Dans les cas suivants, les conidiophores sont relativement peu abondants et les périthèces nombreux: *M. alni* sur *Viburnum Lantana*; *E. taurica* sur *Phlomis Herba-venti*; *S. Mors-Uvae* sur *Ribes-Uva crispa*; *P. Corylea* et *P. Oxyacanthae* sur de nombreux hôtes. Par contre, certaines graminées donnent abondance de conidiophores et de périthèces (*E. graminis*); *S. pannosa* sur rosier Banks constitue en quantité les deux sortes de fructifications. *U. Salicis* donne autant de conidies sur *Salix cinerea* que sur *Populus nigra*, or ses périthèces sont fréquents sur le premier de ses hôtes, non sur le second.

Neger a formulé la règle suivante: „La formation des conidies est favorisée par un milieu nourricier formé de parties de plantes fraîches et turgescentes. La température et l'humidité semblent être d'une importance secondaire. La formation des périthèces implique un milieu nourricier âgé (adulte), non encore épuisé par la production de conidies". Neger paraît avoir raison dans l'ensemble. Les conidies se constituent surtout sur les jeunes feuilles ou tiges; les périthèces apparaisent souvent déjà sur les portions plus ou moins âgées de tiges ou sur les feuilles déjà un peu coriaces (R. Banks). L'influence d'une dessication ménagée sur la production des périthèces est manifeste dans bien des cas (les conceptacles d'*E. taurica* se constituent lorsque le *Phlomis Herba-venti* commence à se dessècher). Mais la dessication ne doit pas être trop accentuée. En septembre 1921, sur des côteaux secs du sud-est de la France par une grande sécheresse les chênes des taillis ne portaient pas de périthèces de *Microsphaera quercina* qu'autant qu'ils se trouvaient sous le couvert d'autres arbres. Le mycélium producteur de périthèces est parfois accompagné d'hyphes stériles à parois épaisses (*E. graminis*; *S. pannosa*; *S. Mors-Uvae*; *S. Euphorbiae*). Enfoncée dans le feutrage formé par ces filaments les conceptacles ne se détachent souvent qu'avec lui; lorsqu'il se disloque en lambeaux qui sont emportés par le vent et par l'eau. Mais dans le cas du *S. pannosa* tout au moins, ce feutrage reste parfois plus d'un an fixé au support qui le porte.

Conditions qui entravent et favorisent le développement des Erysiphacées

Si les pluies sont indispensables à la contamination de la Vigne par le *Plasmopara viticola* elles le sont moins à l'infection de cette plante par l'*Uncinula necator*, qui s'accommode assez bien à la sécheresse. Plusieurs *Erysiphacées* sont dans le cas de ce dernier. Ces champignons ne se développent pas en milieux très humides. Des espèces végétales qui sont indemnes d'*Erysiphacées* lorsqu'elles se trouvent sous un épais couvert d'arbres, sont attaquées par ces champignons dès qu'elles sont en clairière ou à la lisière des forêts (Jura). Cependant, une humidité ménagée leur est favorable (*Erysiphe graminis* est surtout répandu sur les feuilles basses et sur les céréales quelque peu ombragées). Soumises à une forte sécheresse beaucoup d'*Erysiphacées* subissent des altérations graves (dessication de cellules mycéliennes et conidiennes), que pendant les périodes d'humidité parfois fort courtes (pluies, brouillard, rosées nocturnes ou matinales) elles arrivent à compenser par la production de nouveaux éléments mycéliens ou conidiens. Cette réparation n'est possible naturellement que lorsque l'organe qui porte l'*Erysiphacée* ne se dessèche pas. Souvent à cette époque, le *Cicinnobolus Cesatii* joint son action destructrive à celle de la sécheresse qui, lorsqu'elle est intense et se maintient longtemps, constitue une période très critique pour certaines *Erysiphacées*. Dans les côteaux secs et calcaires (garrigues) de la région montpellieraine nous avons cependant vu des exemples de grande résistance à la sécheresse présentés par *E. Polygoni, E. Cichoracearum, Sphaerotheca Humuli, Microsphaera quercina* (ce dernier arrive à se maintenir, pauvrement il est vrai, sur *Quercus Ilex* et *Q. coccifera*).

Mode d'hibernation des Erysiphacées

1°. Les périthèces ne se constituant pas sur toutes les espèces; or étant donnée la grande spécialisation qu'offrent les *Erysiphacées*, il n'est pas dit qu'un hôte qui ne porte pas ces conceptacles soit contaminé par un de ceux sur lesquels ils se constituent.

2°. Dans le cas des plantes vivaces l'hibernation peut sans doute s'effectuer dans les bourgeons (*U. necator*; *M. Quercina*; *P. leucotricha*; peut-être *S. pannosa* sur Rosiers). Généralement la proportion des bourgeons où se produit l'hibernation est faible.

3°. Dans le cas d'une plante à feuille vivace (*Evonymus Japonicus*) sous le climat d'Angleterre (SALMON) aussi bien que sous celui du Midi de la France, l'hibernation se produit grâce à la persistance d'un mycélium dont certains éléments restent vivants, alors que le plupart des autres meurent. Dans ces plaques mycéliennes on observe des épaississements callosiques dont certains très accentués affectent la forme de boutons. FERRARIS les a interprétés comme des bourgeons dans le cas du *Microsphaera Quercina*. Ils existent aussi dans plusieurs autres *Erysiphacées* et notamment dans les plaques que l'*Uncinula necator* constitue à la surface des rameaux de vigne à l'arrière saison. Dans le mycélium persistant de ces deux dernières espèces nous n'avons jamais trouvé les éléments vivants ni observé les productions mycéliennes ou conidiennes qu'à la suite de SALMON nous avons mis en évidence dans l'*Oidium Evonymi japonici*. Les épaississements callosiques sont fréquents sur les parois des *Erysiphacées*, sur lesquelles ils se traduisent parfois par de simples aspérités, parfois encore par des productions en forme de boutons, de calotte, d'anneau. Enfin, des épaississements généralisés se manifestent sur tout le pourtour d'une cellule ou d'un filament. Ces productions accompagnent souvent la dégénérescence cytoplasmique dont elles ne sont sans doute qu'une manifestation. Nous avons traité cette question ailleurs.

DISCUSSION.

Prof. WESTERDIJK has observed that the white mycelium which is found during the winter on peach twigs, does not develop in spring.

Dr. FOËX supposes, that this mycelium is sterile.

Mr. v. POETEREN has observed that in the mycelium of *Sphaerotheca mors uvae* which grows abundantly in August, no perithecia are formed. The perithecia, formed earlier in the summer, seem for the greater part to fall off before midsummer; the perithecia which remain on the twigs, are very often empty.

Dr. FOËX answers that these facts, if observed, have not been studied in France.

Prof. QUANJER points to the great variations of climatic conditions during the last years: 1921 and spring and early summer of 1922 very dry and arid, late summer of 1922 very wet, 1923 also very rainy. Perhaps Dr. FOËX has been able to gather some data about the sensitivity of the *Erisyphaceae* to climatic conditions.

Dr. FOËX says that these fungi seem to be rather resistant against drought: it is sure that in the dry period there was much mildew in France, but it seems to him that development was slightly hampered. Exact data have not yet been collected.

Prof. MANGIN confirms Dr. FOËX's observations.

Mr. v. POETEREN says that several years ago already, he ascertained that the oakand apple mildews hibernate in the buds, but only in a rather small number of buds of each tree or shrub; he has published a small account of his observations in „Tijdschrift over Plantenziekten", 1912.

SUR LES PROTOZOAIRES DES PLANTES

PAR

J. FRANCHINI

Je ressens tout l'honneur que me fait l'Institut Pasteur en m'envoyant exposer devant vous le résultat de mes recherches commencées avec mon illustre maître Monsieur LAVERAN, recherches dont le sujet est si nouveau qu'il donne encore lieu à de chaudes controverses.

Depuis la découverte faite par LAFONT des flagellés dans le latex des Euphorbes, les études sur les Protozoaires des plantes, surtout celles sur les Protozoaires des plantes à latex, se sont intensifiées, et des flagellés et des Protozoaires ont été trouvés dans plusieurs pays, spécialement dans les régions tropicales. Une partie des plantes parasitées sont malades, elles jaunissent, se flétrissent, leurs feuilles tombent, leur développement est sérieusement entravé.

Des plantes saines ont été infectées à l'aide du latex des plantes parasitées.

Nous allons maintenant exposer les recherches que nous avons faites, d'une part sur des plantes contenant du vrai latex, d'autre part sur celles qui n'en contiennent pas.

Les plantes sont groupées par ordre de familles.

Plantes à latex

Euphorbiacées. Nous avons vu des flagellés du type *Leptomonas* et *Herpetomonas* dans plusieurs espèces d'Euphorbiacées (E. segetalis, E. dulcis, E. falcata, E. grandis, etc.) et des *trypanosomides* dans le latex de E. nereifolia, E. vivosa, E. drupifera, E. antiquorum, E. emarginata, etc.

Infection expérimentale

Nous avons réussi à infecter des pieds de E. sauliana et d' E. pilosa avec des cultures des flagellés de la puce du chien (*Herp. ctenocephali*) et des pieds d'E. ipecacuanha, avec des cultures de Kala-Azar.

Dans le latex de différentes espèces d'Euphorbes nous avons cultivé des flagellés d'insectes et des Trypanosomes, y compris un trypanosome humain (*Trypanosoma Cruzi*).

Asclepiadacées. Nous avons pu voir des flagellés et des Amibes dans le latex de deux asclepiadacées: Cryptostegia grandiflora et Chlorocodon withei.

Les amibes du latex de Chlarocodon withei sont cultivées en milieux de Nöller sur plaques.

Apocynées. Les amibes étaient assez fréquentes dans le latex de différentes espèces de Strophantus, dans le latex de Thevetia nerei folia, de Cerbera odollam et de Plumeria alba.

Dans le latex d'Acokanthera venenata et de Caudrania javanensis, nous avons vu des Protozoaires semblables à des Trypanosomes.

Les amibes de Strophantus rigali cornu ont très bien cultivé dans le milieu de Nöller. Ces cultures, très riches, montraient des amibes de toutes sortes et de toutes dimensions. On y trouvait des formes de multiplication par schyzogomie, d'autres se multipliaient par bipartition. Un certain nombre de ces amibes phagocytaient les globules rouges.

L'inoculation de ces amibes dans le rectum des chats s'est montré pathogène.

Urticacées. On rencontre des Amibes, des Trypanosomides et des Flagellés dans le latex de certaines espèces de *Ficus.*

Dans le latex de Ficus carica de la région parisienne, nous avons pu voir quelquefois des amibes qui ont très bien cultivé et qui phagocytaient les globules rouges.

Artocarpées, Sapotacées, Menispermées, Anacardiacées, etc. On rencontre des Protozoaires, et spécialement des Amibes dans le latex des différentes plantes des deux premières familles. Nous avons vu de très belles amibes dans le latex de Antiaris toxicaria et de Lacoocha artocarpus; elles étaient plus rares dans le latex des plantes des autres familles.

Composées. Dans le latex d'un spécimen de Lactuca sativa, nous avons pu voir des amibes de toutes sortes et de toutes dimensions. Elles se multipliaient par bipartition et par schyzogomie. Dans d'autres laitues on trouvait également des bactéries, parfois en culture pure.

Spirochètes dans le latex des Euphorbes

Dans le latex d'un plant d'E. peplis des environs de Syracuse (Sicile), nous avons vu un certain nombre de *Spirochètes,* libres ou en amas, plus longs et plus gros que les Spirochètes humains, ressemblant aux Spirochètes de certains insectes vivant sur les plantes; ils étaient bien mobiles à l'état frais.

Plantes sans latex

Flagellose du chou. Dans les tissus des feuilles d'un chou très malade, nous avons vu des flagellés de différentes formes et dimensions :

Certains parasites avaient un long flagelle (*Herpetomonas*), d'autres avaient un flagelle plus court pourvu d'une petite membrane (*Crithidia*) ; d'autres encore avaient l'aspect de *Trypanosomides*.

Sur la surface des feuilles de ce chou nous avons recueilli une quantité de punaises (*Pentatomidae*) ; celles-ci hébergeaient dans leur tube digestif de nombreux flagellés, ce qui rend très probable l'admission que les flagellés du chou sont les mêmes que les flagellés des punaises qui vivent sur ses feuilles. En effet les fèces de ces punaises sont nombreuses à la surface de ces feuilles ; or, dans ces fèces les flagellés et leurs formes enkystées sont assez fréquents.

Transmission des protozoaires des plantes à latex.

Quant à la transmission des différents protozoaires des plantes à latex, il faut admettre que celle-ci est due, non pas seulement à une seule, mais à plusieurs espèces d'Insectes (*Hémiptères* ou *Muscides*).

Parmi les *Hémiptères*, nous devons surtout prendre en considération les *Stenocephalus* et les *Nysius* ; parmi les Muscides, nous avons déjà décrit des flagellés trouvés dans le tube digestif de certaines mouches vivant sur les plantes (*Anthomyia maculata* et *Graphomyia maculata*) ; ces flagellés sont morphologiquement semblables au *Leptomonas Davidi*. Il est notoire que, surtout dans les pays chauds, les mouches domestiques, et autres, hébergent dans leur tube digestif des flagellés.

La transmission de ces flagellés peut se faire, soit à l'aide des piqures, soit à l'aide des fèces parasitées. Les parasites des fèces, en général plus résistants que les autres, déposés sur les feuilles ou sur les tiges, peuvent aisément pénétrer à travers de petites lésions, à l'intérieur des plantes.

Au sujet de la Spirochétose des Euphorbes, nous avons précédemment signalé que, dans le tube digestif des *Lygus*, *Nysius* et des *Sarcophagidae* capturés sur des Euphorbes (et aussi sur d'autres plantes) nous avons pu voir de nombreux Spirochètes morphologiquement identiques à ceux du latex des Euphorbes.

Conclusion.

1e. Il ressort donc de ce qui précède que dans les latex de différentes plantes, et dans des plantes sans latex, nous avons vu des Protozoaires, flagellés ou non, ayant le même aspect que ceux qui se trouvent chez les Invertébrés (Insectes) et chez les Vertébrés, soit à température variable, soit à température constante.

2e. Nous avons réussi à infecter des plantes à l'aide de cultures de parasites d'insectes et de parasites de l'homme (Kala-azar). Nous avons réussi encore à cultiver dans divers latex différents Protozoaires parasites des animaux et même de l'homme (Trypanosomes).

3e. Les plantes hébergeant des Protozoaires sont souvent malades. Etant donné que chez les plantes on trouve de nombreux Protozoaires de l'homme et des animaux, on peut légitimement supposer que des végétaux servent parfois de réservoirs aux virus des maladies à Protozoaires.

Très probablement, plusieurs maladies des plantes, inconnues ou mal connues, attribuées à des virus indéterminés, ont leur étiologie dans la présence des Protozoaires.

Depuis quelques années déjà, le Prof. PETRI, de l'Ecole forestière de Florence, a décrit dans une maladie de la vigne (roncet) des corps spéciaux ressemblant beaucoup à des Protozoaires.

M. RAY NELSON a, d'autre part, décrit des Protozoaires flagellés ou non, mobiles à l'état frais, dans la Mosaïque de la tomate, du haricot et du trêfle; il a aussi décrit des Trypanosomides dans l'Enroulement de la feuille de la pomme de terre [1]).

FRANK P. M. WORTHER a décrit un Protozoaire semblable à une Amibe qui serait la cause d'une maladie de Fiji (galle) de la canne à sucre. Il a cultivé cette Amibe dans le suc de la canne à sucre, et dans cette culture il a pu voir le cycle de développement du parasite, de la forme enkystée à la forme végétative. Le parasite de ces cultures ressemble beaucoup à celui que nous avons obtenu dans les cultures des Amibes ou dans celles d'autres Protozoaires de différents latex.

Nous ne voulons pas discuter la question de savoir si les Protozoaires décrits par NELSON, par WHORTER et par d'autres sont ou non les agents étiologiques des maladies des plantes hébergeant ces Protozoaires; pour cela il faudrait inoculer les parasites eux-mêmes ou les parasites en culture à des plantes saines; l'on verrait ainsi s'ils sont capables de donner la maladie [1]).

Quant à la Mosaïque des plantes, nous savons déjà que son agent est filtrable et très résistant soit à la chaleur, soit au froid, et aux agents chimiques. Les Protozoaires, en général, n'ont pas de tels caractères, à moins que l'on admette qu'il y ait des stades dans lesquels certains d'entre eux seraient très petits et très résistants.

Nous avons pu examiner, grâce à l'amabilité de M. FOËX de la Station de Pathologie Végétale de Paris, et de M. DUCOMET de l'Ecole nationale d'Agriculture de Grignon, des pommes de terre affectées de la Mosaique et de l'Enroulement. Nous avons examiné avec beaucoup de soin les petites branches et les feuilles malades,

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[1]) See p. 24, point 9. — (ED).

mais nous n'avons pu voir ni Protozoaires, ni parasites d'aucune sorte.

Désormais, dans l'étude des maladies des plantes, il faudra tenir des différences morphologiques existant entre les Protozoaires des plantes et les protozoaires des animaux.

On sait, en effet, qu'un Protozoaire modifie sa forme selon le milieu dans lequel il se développe ou est cultivé. Des parasites qui dans l'organisme humain (*Leishmania*) sont petits et n'ont pas de flagelle, deviennent très longs et flagellés dans les cultures. C'est déjà beaucoup qu'un Protozoaire d'une plante puisse cultiver dans un milieu sanguin ou qu'une Amibe des plantes soit capable de phagocyter des globules rouges, et que elle puisse se multiplier dans l'intestin d'un chat. MIGONE en Sud Amérique a cultivé dans un milieu composé de gélose et de sang humain, des flagellés d'une Asclépiadacée (Morrenia odorata); ces cultures ont été très riches et très toxiques pour les animaux. Nous-même avons réussi à infecter des souris et de jeunes chats à l'aide de Protozoaires du latex des plantes.

Il serait à souhaiter que la recherche des Protozoaires des plantes soit étendue dans tous les pays, en vue d'établir la répartition géographique de ces flagelloses végétales. En particulier j'invite les collègues de la Hollande et d'autres pays à en rechercher l'existence autour d'eux parce que les Protozoaires des plantes que l'on croyait propres aux régions tropicales ont pu être retrouvés récemment dans des pays dont la température n'est pas très élevée comme la France et la Suisse. Dans ce dernier pays on a trouvé des parasites dans le latex des Euphorbes à une altitude de 1.200 mètres.

DISCUSSION.

Dr. O. NIESCHULZ (Conservator in the Veterinary University, Utrecht) has found in the latex of Euphorbia palustris from Utrecht organisms showing an amoeboïd motion. The material was too scanty to allow of cytologial investigation. Flagellates were not observed. Dr. NIESCHULZ points out that the morphology of the interesting amoeboïd forms is abolutely unknown, which makes it as yet impossible to determinate the parasites even approximately.

Dr. R. MAYNÉ states that Dr. RODHAIN, in 1912, observed a *Leptomonas* spec. in the latex of Euphorbia indica in Belgian-Congo. Dr. MAYNÉ on his journey in the Congo (district Manyema) found anew at the beginning of the dry season Dr. RODHAIN'S *Leptomonas*. All plants infected showed the following symptoms: intense red discoloration of the leaves, slight leaf-roll, afterwards drying-up and falling of the lower leaves.

These Euphorbia's were frequently visited by numerous plant-bugs.

UN NOUVEL ENNEMI DE NOS HABITATIONS: LE PHELLINUS CRYPTARUM KARST

PAR

L. MANGIN.

(Pl. XII)

Le nombre des espèces de champignons, qui se développent dans les bois de construction, est assez considérable mais en éliminant les espèces rares ou accidentelles, il ne reste qu'une demidouzaine de ravageurs qui par l'importance de leurs dégats retiennent l'attention et nécessitent des précautions spéciales dans les constructions.

Si l'on élimine les Lenzites: *L. saepiaria* et *L. abietina* localisés seulement dans les habitations construites en sapin, nous devons signaler le *Trametes vaporaria*, le *Coniophora cerebella* et le *Merulius lacrymans* comme réellement redoutables. A ces trois espèces, il faut ajouter le *Phellinus cryptarum* signalé dans les catacombes mais inconnu jusqu'alors dans les habitations.

Nous l'avons découvert M. PATOUILLARD et moi dans les combles de l'aile Louis XII du chateau de Versailles, où ses ravages ont necessité la réfection complète de cette partie du chateau. Depuis cette époque nous l'avons reçu au Laboratoire de Cryptogamie du Museum National d'Histoire Naturelle de localités très variées: Paris, Canton d'Etamps (Seine & Oise) à la Forêt Ste Croix; Vallée du Grand Morin (Seine & Marne); Le Havre, Lyon etc. et dans ces diverses régions il a causé l'écroulement de planchers ou de terrasses.

Il est vraisemblablement très répandu.

Le bois attaqué par le *Phellinus cryptarum* a un aspect très particulier, qui le différencie au premier aspect des bois détruits par le *Merulius lacrymans*, le *Trametes vaporaria* et le *Coniophora cerebella*.

Chez ces derniers le bois décomposé présente un grand nombre de fentes disposées en deux directions perpendiculaires qui le décomposent en masses parallélépipédiques; celles-ci s'effritent et donnent sous la pression des doigts une poussière semblable à celle que donnent des fragments de résine. (Pl. XII, fig. 3).

Dans le cas du *Phellinus cryptarum* le bois est transformé en une sorte de charpie molle et légère, à éléments longitudinaux souvent entremêlés de traînées floconneuses d'un blanc de neige; cette charpie dès qu'elle est sèche brûle lentement comme de l'amadou.

Cet aspect du bois décomposé est dû à ce que la lamelle intercellulaire est altérée la première de sorte que la cohésion des tissus disparaît dans le sens transversal, tandis que dans le sens longitudinal l'enchevêtrement des éléments dissociés maintient une certaine résistance.

Toutefois suivant la nature du bois l'aspect peut-être différent. Ainsi dans le cas de bois de chêne, qui est hétérogène avec ses fibres ligneuses, ses larges vaisseaux et ses rayons médullaires, la totalité du bois est-elle transformée en une charpie assez homogène où la cavité des larges vaisseaux est remplie de masses mycéliennes floconneuses.

Au début de l'invasion du bois de chêne par le mycélium destructeur les ponctuations aréolées sont libérées par la dissolution de la membrane périphérique de sorte que la paroi encore intacte des vaisseaux apparaît criblée de trous circulaires dont chacun correspond à une ponctuation. Quand la décomposition est un peu plus avancée, les éléments ligneux sont déjà désorganisés mais les rayons médullaires sont plus résistants et forment autant de plaques dispersées au milieu des tissus transformés en charpie (Pl. XII, fig. 2). Quand la décomposition est complète toutes les régions de tissus sont transformées en une charpie molle et légère.

Quand le bois envahi est un bois homogène tel que le sapin, l'altération présente un aspect un peu différent. Et d'abord quand elle débute, les ponctuations aréolées, caractéristiques du bois ne sont pas dissociées comme dans le cas du chêne, elles restent incluses dans la paroi et sont corrodées en même temps qu'elle. En outre la décomposition du bois de printemps est bien plus rapide que celle du bois d'automne très compact; il en résulte la formation de lames tangentielles à surface lisse du côté du bois d'automne et légèrement rugueuse du côté du bois de printemps, de là l'aspect très particulier du bois de sapin tel qu'il est représenté (Pl. XII, fig. 1) Quand la décomposition est complète toutes les régions sont transformées en une masse molle et friable, l'action du champignon ayant libéré les éléments qui avaient conservé une certaine cohésion.

À la surface des poutres envahies le *Phellinus cryptarum* développe des stromata stériles appliqués contre cette surface et plus ou moins proéminents; leur masse spongieuse est à chair fauve. Puis ça et là il se forme des réceptacles sous la forme de plaques étalées plus ou moins orbiculaires atteignant jusqu'à 40 cent[es] de diamètre, attachées au support par un point central ou par plusieurs points lorsqu'elles sont confluentes.

Toute la surface libre c'est à dire la face dorsale de la fructification est de couleur fauve ou brune, villeuse ou soyeuse, ridée ou vaguement zonée, sillonnée.

Les tubes très longs (1 a 5 c.M.) situés à la face inférieure sont disposés d'ordinaire en une seule assise, plus rarement ils sont stratifiés; leur couleur est brun clair ou cannelle. La trame ordinairement peu épaisse est de la même couleur que les tubes, sa consistance est spongieuse. La structure de la trame est semblable au feutrage qui existe dans le bois décomposé mais au lieu d'être blanc, il est fauve clair à cause de la présence de filaments mycéliens de 2 ou 3 μ., assez abondants et colorés en fauve clair. Le feutrage du mycélium est de plus en plus dense à mesure qu'on s'approche de la surface. Celli-ci doit sa couleur brune à un depot de granulations irrégulières dans le lacis des filaments mycéliens.

Je n'ai pas réussi à voir les spores et les cultures qui sont en voie de développement n'ont encore fourni que des ébauches d'appareil fructifère insuffisants pour l'étude des spores.

Le *Phellinus cryptarum* tel que nous venons de le définir par ses fructifications et les altérations qu'il produit dans le bois n'avait pas encore été signalé ni étudié comme destructeur des charpentes, on l'avait bien vu dans les caves, les catacombes, les galeries de mines mais on ne le connaissait pas dans les habitations. Les confusions faites par divers auteurs n'ont pas peu contribué à obscurcir son histoire et à rendre difficile son identification.

Il a en effet été souvent rapporté à *l'Ungulina annosa* et dans les mines aux ébauches stériles connues sous le nom de *Polyporus Gilloti* Rouin. Ni les fructifications ni les altérations du bois ne permettent ce rapprochement. Mais l'erreur la plus grave a été faite par MONTAGNE [1]) qui a décrit sous le nom de *Phellinus cryptarum* un champignon des mines de Luchon que lui avait communiqué M. CAZIN [2]). Ce champignon par sa couleur jaune pur en dessous, et sa teinte grenat roux en dessus ne ressemble en rien au *Phellinus cruptarum*. C'est une autre espèce, le *Leptoporus rufoflavus* Berk. et Curt., décrite des Antilles en 1869, retrouvée dans l'Amérique tropicale. Il a été publié en nature et décrit par RABENHORST en 1876 sous le nom de *Polyporus Braunii*.

Le veritable *Phellinus cryptarum* Karst a pour synonymes: *Polyporus cryptarum Fr., Boletus cryptarum Bull., Polyporus undatus Pest.*

Son développement est assez lent contrairement au développement du *Gyrophana lacrymans*. Il est difficile d'avoir des renseignements à cause de son apparition insidieuse et de sa localisation étroite; toutefois à la Forêt Ste Croix le *Phellinus cryptarum* a été signalé dans une maison d'école dont l'appartement était resté inhabité pendant 15 ans. Dans une chambre close et obscure où des infiltrations se sont produites le plancher s'est effoudré par suite de ses ravages. On peut donc estimer a 15 ans ou plus la durée de son développement. Comme il reste localisé dans le bois envahi sans

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[1]) MONTAGNE, Ann. Sc. Nat. Bot., 1858, p. 156.

[2]) CAZIN, Champignons de Bagnères de Luchon (Ann. Sc. Hydrol. Méd., 1858—1859, p. 417.

envoyer de rhizomorphes au dehors, sa présence ne se manifeste que par l'apparition des fructifications et trop tard pour porter un remède efficace contre la dévastation. Ajoutons enfin que lorsque le bois décomposé se dessèche, la masse de charpie qu'il forme brûle lentement comme de l'amadou. Cette circonstance pourrait expliquer les incendies qui éclatent brusquement sans cause apparente.

Having finished the reading of his paper, and having answered a few questions Prof. MANGIN again adressed the meeting. He said, that no doubt everybody present felt the urgency of coming to a deed. Within a few days the company would separate again, and therefore it was necessary to establish a permanent bureau, which would be charged with the arrangement of the next conference, for it was evident that this successful conference ought to be followed by another.

By its loud applause the audience showed its approval; it was however determined to postpone deliberations about that very important matter till the next morning.

In the evening the Conference was entertained by Prof. WESTERDIJK, with the aid of her students at a very humorous marionette-show; potatoes dressed as dolls representing several potato diseases acted as marionettes. A clever and amusing dialogue in English, French and German was read by Misses WESTERDIJK and LÖHNIS, the latter acting as jester at a reading-desk. The show met with tremendous success, and gave rise to roars of laughter; it was the beginning of an evening of general rejoicing and merry-making; national hymns and popular songs from all nationalities, including even a very exotic and greatly approved Chinese song, were sung. It was long after midnight, before the last members looked up their hotels. This evening will certainly be reckoned among the most pleasant memories attached to the Conference.

Next morning the session was continued with Prof. QUANJER in the chair. He called on Miss BENSAUDE to read some papers on the part of Prof. BEAUVERIE and Prof. F. R. JONES.

THE CRITICAL PERIOD OF WHEAT

BY

J. BEAUVERIE

PROFESSEUR FACULTÉ DES SCIENCES DE L'UNIVERSITÉ DE LYON

(ABSTRACTED BY M. BENSAUDE)

Definition of Critical Period. Following the definition of Professor AZZI the writer designates as „critical period" the period during which the wheat plants are particularly sensitive to climatic conditions. This period comprises the three decades before heading and the decade during which the heads burst forth from the sheath. The success of the crop depends to a great extent on the conditions under which the heads develop. Prof. AZZI has shown in his experiments that rainfall is of primary importance during the critical period. Drought during this period means crop failure, and rain at a later time does not benefit the crop materially.

Field data without further experiments would themselves suggest that much. In 1921 the crop surpassed all previous records. During that year the month of May was very moist and so was the first decade of June; after that no rain fell until harvest. In 1922 the crop was smaller by a quarter than that of the preceding year. In that year there was drought during the month of May, while the beginning of June was moist. From then on rainfall was frequent until harvest. The crop, however, never recovered from the effects of the early drought.

Season of the Critical Period in the Puy-de-Dome. Prof. BEAUVERIE has studied the date of heading of 50 strains of wheat grown at the Botanical Gardens of Clermont. The heading season of the several varieties grown throughout the Puy-de-Dome was reported to him by correspondents. As a result of this investigation, he found that the heading of wheat in the Puy-de-Dome begins somewhere between the 25th of May and the 10th of June. It is completed between the 5th and the 20th of June. The period of heading varies for any one variety with the period of sowing, the elevation at which the plants are grown, and with the climatic conditions of the particular season. Heading, however, is most frequent during the first decade of June, and one can say, in a general way, that in the Puy-de-Dome the critical period of wheat comprises the three decades of May and the first decade of June.

Calculation of Probability of Drought during the Critical Period. By studying the meteorological records of many consecutive years and by ascertaining how often during this period a decade has been dry (less than 5 mm. rainfall in 10 days), one can calculate the probability of drought for any given period of ten days.

Prof. BEAUVERIE has worked out the probability of drought for the month of May and the first two decades of June in the department of the Puy-de-Dome. He based his calculations on the meteorological data recorded by the observatory for the twenty-year period of 1901—1920, and multiplied the figures obtained by five in order to establish the probability of drought per 100. The results are recorded in Table I:

Table I. *Probability of drought in the Puy-de-Dome during the three decades of May and the two first decades of June.*

Clermont: (Rabanesse 388 M., Cote de Landais 400 M.)			Orcines: (832 M.)
1st decade	May	10 %	5 %
2nd „	„	25 %	10 %
3rd „	„	15 %	20 %
1st „	June	30 %	25 %
2nd „	„	15 %	10 %

As shown in the preceding table the percentage of drought is lowest during the three decades of May; in June it increases rapidly. It is therefore desirable in the region studied to grow varieties of wheat whose critical periods occur in May. It ought to be the aim of selection everywhere to obtain strains whose critical periods coincide with the time of probable low drought in the given region.

France, a Wheat Country. In France the coincidence between rainfall and critical period exists normally in most places. This is why, as the writer suggests, France is so favourably situated for the raising of wheat. The coincidence between the requirements of the wheat and the characteristics of the climate could, however, be perfected still further by selecting the right strains and by modifying the schedule of sowing in different regions so as to produce the desired coincidence between the critical period of wheat and a season of probable low drought.

ON THE DEVELOPMENT OF WHEAT RUSTS IN RELATION TO CLIMATIC CONDITIONS

BY

J. BEAUVERIE

(ABSTRACTED BY M. BENSAUDE)

The observations reported in the present paper were made in 1921 and 1921, on about 50 strains of wheat growing either in the field in Limagne or else in the author's experimental garden in Clermont.

The climatic conditions during the summer of 1921 and 1922 were diametrically opposed. Observations made during these two seasons are therefore particularly valuable and furnish interesting indications regarding the behaviour of *Puccinia graminis, P. glumarum,* and *P. triticina* in different environmental conditions.

Table I. *Rainfall during the summer months of* 1921 *and* 1922.

	1921:	1922:
1st decade May........	22.2 mM.	4.5 mM.
2nd „ „	60.9 mM.	20.1 mM.
3rd „ „	65.6 mM.	0.0 mM.
1st „ June........	12.6 mM.	43.0 mM.
Throughout the summer:	No rain until harvest.	Rainfall frequent and often abundant.

In 1921 *P. glumarum* was found abundantly during the early moist period. As soon as the dry weather set in, *P. triticina* developed and persisted with moderate intensity until harvest. *P. graminis* did not develop.

In 1922 *P. glumarum* appeared sparsely at an early period; later the infection was only observed on young shoots. *P. triticina* developed a little later and was found throughout the season. *P. graminis* developed later than the other two rusts, and became more and more prevalent as the season advanced.

The preceding data indicate that the three rusts of wheat develop during the season in the following order: (1) *P. glumarum,* (2) *P. triticina,* and (3) *P. graminis.*

According to the observations recorded in the present note, it appears that *P. glumarum* is pre-eminently the rust of early vegetation and of young growth, *P. triticina* the rust of dry seasons, whereas *P. graminis* is essentially the rust of wet seasons. (Cf. with American data.)

Susceptibility of Different Varieties of Wheat Grown in the Neighbourhood of Clermont.

Very resistant: Kanred Cl. 5146, *T. monococcum,* C. Strampelli Victoria. (*T. dicoccum,* usually very resistant, was infected).

Resistant: Hybride inversable, H. des Allies, H. de la Paix, Dattel, Rieti, Nonette de Lausanne, Poulard d'Auvergne, Rouge de Bordeaux, Australian, Flandres blancs, winter Chiddam (red chaff), Altkirch, Marquis, Cosgrave, Soleil Extra-Squarehead (1921 from Svalof is reported susceptible in Sweden).

Susceptible: *T. spelta* (only to *P. triticina*), Saumur, Svalof's wheats: Fylgia, Pansar, Wilhelmina [1]), Thulen, Pansar II, Extra-Squarehead II, Extra-Squarehead III. In 1921 these Wheats were only attacked by *P. triticina* in the late season and proved absolutely resistant to *P. glumarum.*

Very susceptible: Bordier, Japhet, gros bleus, Poulards (called

[1]) Wilhelmina is not a Svalof wheat, but a Dutch variety, bred by Prof. Dr. L. BROEKEMA at Wageningen. — (ED.)

Tanganrock in Auvergne). These wheats are particularly susceptible to *P. glumarum* and *P. triticina*. The Poulard strains are reported resistant in England (PERCIFAL), and susceptible both in Auvergne and in Morroco, (MIÈGE). *T. polonicum*,[1]) for instance, was infected by *P. glumarum* in Auvergne in 1921. Kubanca, a resistant variety of hard wheat grown in the dry regions of the U. S., when grown in moist climates usually becomes susceptible to the attacks of rusts, particularly of *P. glumarum*.

Most susceptible varieties: Poulard of Australia (*P. glumarum*) Noe, Bon Fermier.

Certain pedigreed strains of one same variety have often shown marked differences in resistance. The writer hopes in the course of the next few years to undertake further research on this subject.

ROOT-ROT OF PEAS IN THE UNITED STATES

BY

FRED. REUEL JONES

BUREAU OF PLANT INDUSTRY (WASHINGTON, U. S. A.).

Although root-rot of peas appears to have been encountered as a serious disease wherever the plant is grown, the earliest and most widely known investigation of this condition is that which was done in Holland by VAN HALL [2]). This study in which the cause of the disease was found to be a species of *Fusarium* later included by APPEL and WOLLENWEBER [3]) in *Fusarium falcatum* has remained until recently our only important source of information regarding root parasites of peas.

In the United States a widespread and destructive „soil sickness" to peas has developed which produces symptoms which in general aspect are not unlike the „Sankt-Johanniskrankheit". A study of this disease during the past five years which has extended to all important pea growing districts of the United States has found four fungous parasites which are usually associated in producing this condition, although only two of these are usually of considerable importance and capable of producing it independently.

[1]) Known as Polish, and not as Poulard, in U. S., according to U. S. Bulletin 1074. Poulards are varieties of *T. sativum*, Tanax, Turgidum. (Note of M. BENSAUDE).

[2]) Van Hall, C. Die Sankt-Johanniskrankheit der Erbsen verursacht von *Fusarium vasinfectum* Atk. In Ber. der deutsche botan. Gesellschaft, Bd. 21, p. 2—5, 1903.

[3]) Appel, O. and Wollenweber, H. W. Grundlagen einer Monographie der Gattung *Fusarium* Link. In Arb. Kais. Biol. Anst. Land- und Forstw., Bd. 8, p. 1—207, 1910.

The less important of these two parasites is a species of *Fusarium* previously found by BISBY [1]) in Minnesota, and described in a forthcoming publication as a new variety of *Fusarium martii*. The more important parasite which appears to cause more damage than all others combined is a Phycomycetous fungus which has been assigned by Dr. CHARLES DRECHSLER to the genus *Aphanomyces*, and which in certain morphological details exhibits departures from the specific description of any member of the genus hitherto reported.

This fungus after entering the plant at any point, but preferably at the base of the stem, rapidly traverses and softens the cortical parenchyma of all parts of the plant below the soil level, and leads to the immediate death of young plants, and even of older plants in hot dry weather. The more usual effect of the invasion is retarded growth and unfruitfulness. The presence of this disease can usually be determined readily by gross examination from the fact that when diseased plants are pulled, the woody vascular central portion of the tap root and important branches comes from the soil more or less completely, while plants diseased from other causes almost always break near the surface of the ground. The disease is readily distinguished from all others by a microscopic examination of the decayed parenchyma of rootlets in which characteristic oospores of the fungus are found, often abundantly, and usually well distributed. The disease has become important in the United States wherever peas have been grown repeatedly or in short rotation close to pea canning establishments or in market garden districts.

MYCORRHIZAL FUNGI IN THE ROOTS OF LEGUMES

BY

FRED REUEL JONES

During the investigation of the root diseases of the garden pea, a characteristic yellow colour of roots of plants was found constantly in many fields where no disease was apparent. When such roots were carefully examined, the characteristic colour was always found accompanied by the presence of a coarse mycelium traversing the root tissue outside the endodermis. This mycelium passes freely through the outer cells to the deeper layers where it traverses the intercellular spaces penetrating each cell with which it is in contact with one or more haustorium-like structures which may become greatly branched. The contents of each cell thus penetrated becomes

[1]) Bisby, G. R. A. *Fusarium* disease of garden peas in Minnesota. In Phytopathology, v. 8, p. 77.

a greenish yellow colour, a condition which gives the characteristic colour to the invaded roots. Further search has discovered this fungus or a similar fungus more or less abundant in the rootlets of all the cultivated clovers, of alfalfa, of the sweet pea, and of other legumes, native and introduced. During late summer when root growth is not as active as in spring all the rootlets of many plants, especially of *Lathyrus odoratus* become completely invaded. The rootlets of *Pisum sativum* are completely invaded in some localities by the time the plant has passed the blossoming stage, and *Trifolium pratense* and *Medicago sativa* have been found with rootlets equally infected. Since the character of the fungus appeared similar to that which Dr. J. MAGROU has described in the mycorrhiza of *Orobus tuberosus*, stained sections of the rootlets of four of these plants mentioned above were sent to him for examination. In reply Dr. MAGROU has stated in a personal letter to the writer that he believes that the fungus in all four of these plants is identical with that which he found in *Orobus tuberosus*.

The extensive occurrence of mycorrhizal fungi in the roots of our cultivated legumes does not appear to be generally recognized. Whether or not they exert any important effect upon the development of the plant remains to be determined: but their extensive occurrence in the sweet pea appears to be associated with a pathological condition.

EUROPEAN PHYTOPATHOLOGIC COLLABORATION. [1])

BY

JAKOB ERIKSSON

THE HISTORY AND THE BEARING OF THE QUESTION.

During the last thirty years we have seen in Europe an endeavour to bring together the phytopathologists of different countries to a systematic collaboration for combating the diseases of cultivated plants.

This idea is based on the fact, now, I think, uncontested, that not only the growers but also the men of science are in most cases puzzled as to how to act against the parasites of different kinds, which now and then menace the culture of plants. Why this annoying state of things? The answer to this question is that our impotence against these enemies is due chiefly to serious deficiencies in our knowledge of the nature of the destroyers.

[1]) To save time Prof. ERIKSSON read at the Conference only a short abstract of his paper.

In a few cases only do we really know the nature of these so well that we may found on this knowledge an effective control of the diseases. Such is the case with the smuts (*Tilletia* and *Ustilago*) on the cereals, parasites that we know well enough to be able to control somewhat.

But in how many other cases is this true?

In different countries calculations have been made of the losses caused by the diseases of cultivated plants. Astounding figures have resulted. Through the grain-rusts, Germany lost in the year of 1891 about 100.000.000 Doll. and the United States of North America, through the rust of wheat about 67.000.000 Doll. The yearly loss caused to the world crop by the grain-rusts is estimated at about 250.000.000 Doll. The annual loss of the United States of North America through the potato blight is estimated at about 36.000.000 Doll. and so on. The powdery mildew of the grape (*Oidium Tuckeri*), at first noticed in Europe (England) about 1845, is said to have reached every European vineyard before 1851. The downy mildew of the grape (*Plasmopara viticola*) made its first appearance in Europe in 1870 and within ten years reached all grape-growing countries of that continent. In 1895, this parasite caused in Hungary a loss of about 12.000.000 of hectolitres of wine. The annual loss caused by the diseases to the grape of the whole world is estimated at about 2.500.000.000 Doll.

The idea of an international collaboration in order to control the most destructive diseases of cultivated plants was made public for the first time, in Vienna in 1890 [SORAUER (1); ERIKSSON (1)]. Later the same question was presented to international meetings: 1900 in Paris [ER. (3), (4) and (5)]; 1903 [ER. (6) and (7)], 1905 [ER. (8)] and 1907 [ER. (10)] in Rome and [ER. (11)] in Vienna; 1909 [ER. (12), (13) and (14)] in Rome; 1912 [ER. (15)] in Paris; 1913 [ER. (16)]; and 1914 [ER., (17)], 1920 [ER. (18)] and 1922 [ER. (19)] in Rome.

The establishment of the International Institute of Agriculture at Rome being decided, thoughts were turned towards this Institute as the centre of the collaboration. Plans for the organisation of the work according to these ideas were presented to several general assemblies of the Institute. At first the Institute took a fairly adverse position on the question, which was out of its program.

But gradually the position of the Institute towards the question grew more favourable, especially from the time of the International Pathological Congress at Paris in 1912. This Congress pronounced itself in favour of it. The consequence of this turning was a request addressed by the general assembly at Rome in 1913, to the French Government to invite all contributing states of the Institute to an International Phytopathological Conference at Rome. Such a conference was held there in 1914 from February 25 to March 4. At that conference were present 39 delegates from 31 States of which 20 were European and 11 non-European.

The chief aim of this conference was to organize an International Phytopathological Convention, acceptable to all States. The Convention was to establish the principles for the organization of a Phytopathological Service in different countries. After a long deliberation an *Acte final de la Conférence Internationale de Phytopathologie, fait à Rome le 4 Mars 1914*, was accepted by the delegates. This Act which contained twenty-one different articles, with forms of certificates, was to be submitted to the governments of the different States for consideration and approval.

It must be admitted freely that through the decisions of this Conference the question of an international collaboration in order to combat the diseases of plants was in some degree — at least on paper — solved. By professional inspection and control the principles are fixed for preventing, as far as possible, the spread of dangerous diseases from culture to culture, from land to land. In the following statement I give an account of which position the different States after that have taken up to this convention.

SCIENTIFIC RESEARCHES NOT ADVANCED.

However the struggle against the diseases of plants comprehends much more than the inspection and the control. There is also another matter — and this I think very important — that is the gaining of more effective means for combating the diseases. For obtaining such means no inspection or control legislation will avail. The only way to attain that end is continued research and continued experiments, in other words, a strengthening and development of scientific pathological work.

In a series of papers I have, since 1890, at several congresses, drawn attention to this fact. Of late I have done it by the reports of 1914 (15), 1920 (16) and 1922 (17).

From a careful consideration it will be obvious that this side of the phytopathological question is by no means forwarded through the arrangements made in Europa on account of the many congresses. Rather a regression of phytopathological research is to be feared. In several states, where a phytopathological service has been introduced, for instance in Italy and in Holland, this service is located at existing experimental stations [1]). The scientific part of the original and natural task of those stations, that is investigation and experimentation, must be by this arrangement seriously hindered. Misgivings

[1]) Since 1919 the Dutch service is entirely independent. — (ED.)

in that direction are also expressed from different countries. Such being the case, I took the liberty, after having conferred with several collegues, at the final session of the Conference (ER., 17b, p. 68), to say an frank word of warning against the danger here threatening. The want is not supplied by enlarged staffs and increased grants to those stations. The phytopathological Service is of a regulatory character, and ought to be organized separately and placed under administrative authority. The services of the scientific experimental workers ought not to be required, except in unusual cases, that is if the competency of the service is insufficient.

THE PRESENT STATE OF THE QUESTION.

To clear up the present situation of this question it seems to me to be the best way to give an account of the deliberations and the resolutions upon phytopathologic problems which took place at the General Assembly of the International Institute of Agriculture at Rome 1922.

Among questions of phytopathological bearing, reposing from the General Assembly of 1920 we have to observe in the first place *the ratification* in the different states in relation *to the Phytopathological Convention* of the 4th of March 1914, in which were established the principles for a phytopathological service, i.e. inspection of cultures and control of sendings.

Everyone who has this question may already a priori have thought, that it would be very difficult, if not impossible, to bring about a convention, which could gain sympathy and approbation in nearly all the countries of the world. The conditions of nature and climate, the composition of the vegetable kingdom, the views of the population, the systems of cultivation, the laws and edicts of authorities, — all these differ so essentially in the different countries, that natural impediments for the application of all precepts of the convention were to be foreseen. Moreover an unfavourable influence had grown up from the tendency to isolation and the disinclination for solidarity and collaboration between the different nations, which are the consequence of the great war.

That being so, it is scarcely surprising that — in spite of 10 years having passed after the approval of the convention — only a minority of states had ratified it. At the General Assembly the following information was given.

The phytopathological service was settled in a suitable manner and the convention was ratified or was on the point of being ratified in 9 States (Brazil, Bulgaria, Spain, France, Algeria, Morocco, Italy, Japan and Uruguay). On the other hand the authorities did not intend to ratify the convention, even where the phytopathological service was arranged, in 10 States (Belgium, Egypt, the United States of North America, French Western Africa, England, Scotland, British India, Mauritius, the Union of South Africa, Cyrenaica and Italian Somali). No definite position in the question was taken, nor was there any phytopathological service arranged in 8 States (Germany, Columbia, Denmark, Norway, the Netherlands [??-Ed.][1]) Rumania, Sweden and Switzerland). From the remaining 3 States, adhering to the International Institute in Rome, no answer whatever arrived.

Another adjourned question constituted the proposed creation of an *International Institute for Phytopathological Researches in Europe* (ER. 18a). The General Assembly of 1920 had charged the Permanent Committee of the Institute to execute and present at the next Assembly (1922) a documentation, collected from different countries upon the desirability as to the creation of such an Institute and to its plan as well as to the working system for it.

It was easy to suppose that concerning this question, in no smaller degree than with reference to the ratification of the convention of 1914, the disinclination for collaboration between the different nations, resulting from the great war, must make head against an agreement. This also was manifest through the answers given from the governments of the different states. These answers were reported partly by E. I. ROVIRA, delegate from Uruguay and special reporter for this question, elected by the permanent committee, partly by J. M. SAULNIER, chief of the Bureau for the Diseases of Plants at the Institute.

In a special paper I gave before the III Commission of the Assembly the 12th of May a general survey (ER. 19, b) upon all answers to hand besides a critical scrutiny of the motives that had been brought forward in the cases where there was a refusal. Through this paper it was obvious, that only 2 States had supported the creation of such an Institute. An attitude of waiting was taken by 5 States and a flat refusal was sent by 6 States. The great majority of States to a number of 48, did not answer at all.

After a long discussion, in which delegates of Sweden, the United States of North America, Uruguay, Canada, Italy and France took part, the III Commission resolved with 13 votes against 9 to express the wish that the Institute should call the attention of the different countries to the advantages, which might arise through an exchange of mutual experience between the phytopathological stations of the different countries.

On proposing the question to the general session on the 15th of

[1] The Dutch service was founded as early as 1899. — [Ed.]

May I took the liberty to point out (Er. 19 c), *that* the present question was a specially European question, *that* the plurality of the European States had taken a favourable position with regard to it, whereas the States outside Europe inclined to reject it, and *that* such an Institute, if realised, would also be of great advantage to the countries outside Europe.

My last words in this question were the following: „En ma qualité d'humble travailleur dans les recherches scientifiques, je désire exprimer mon vif regret et faire enrégistrer mes réserves quant à la solution à laquelle ma proposition a abouté."

It seems to have been with a certain hesitation that the Assembly proceeded to decide this question. I infer this conclusion from the words, with which the officiating president at the sitting, M. Raineri, former minister of Agriculture in Italy, closed the discussion. He said:

„Je crois que la déclaration faite par M. le Prof. Eriksson doit être relevée. Evidemment tout le monde connaît la situation éminente qu'occupe M. le Prof. E. dans la science phytopathologique, et, certainement, la résolution prise par la Troisième Commission ne doit pas être considérée uniquement au point du vue de l'importance de l'idée exprimée par M. E.

Je me permets d'entrer dans le domaine des discussions de la Troisième Commission et je pense que ce qui a décidé celle-ci à prendre sa décision ont été des raisons d'opportunité, des raisons financières. Mais que l'on a pleinement apprécié toute l'importance de la phytopathologie et toute la valeur de l'homme de science qu soutenait cette idée devant la Commission.

Je crois que ce sentiment sera partagé par tous les membres de cette haute Assembleé et qu'ils s'uniront à moi pour faire une démonstration de reconnaissance et d'hommage à M. le Prof. Eriksson."

Then the President declared the proposal of the Commission accepted.

The subject was, if not rejected, at any rate put off for an unlimited space of time.

It can scarcely be doubted, that not the ideas which I have pronounced in several pamphlets from time to time, especially in the motion of 1920 [Er. (18)], have found willing ears in different places of late and have conduced to arrangements for starting more thorough-going scientific researches upon the most destructive plant diseases. I conclude this having observed that of late in several states national phytophathological institutions, planned on the principles set forth in the cited papers, have been founded.

This was done for the United States of North America through resolutions at the sittings of the American Phytopathological

Society in St. Louis from the 29th of December 1919 to the 2nd of January 1920 [Er. (18)]; for Great Britain through the establishment of a Phytopathologic Investigation Institute in Rothamsted; for France through certain already in 1920 by the Parliament assigned means for the organisation of a Central-Office for scientific investigations upon plant diseases; for Germany through essential expansion and division of the Biological Station in Dahlem near Berlin; and for Uruguay through the organisation of the Institute Fitotécnico y Semillero Nacional, Estanzuela. All these Institutes are of a national character, intended only for the interests of the country where the Institutes have been founded.

We may hope, I believe, that the harmony between nations in a time not too remote will be restored, so that one of the newly established Institutes may be willing to extend its program so far as to open its doors according to room and at a fixed charge to scientists of foreign nationality, duly qualified, for working at the Institute.

From the General Assembly of 1920 also other matters of a phytopathologic nature were reposing.

One of these questions concerned *the fight against the ravages of the locusts* in the countries where they occur. On the 31st of October 1920 a convention had been drawn up in Rome for regulating such a fight, and the General Assembly of the same year had resolved to urge the governments, which were represented by the approval of the convention to ratify it as soon as possible. To the Assembly of 1922 there was given a report, by which it was evident that the plurality of the interested mediterranean countries had accepted or would accept the convention.

Another question referred to *the fight against the olive fly* (*Dacus Oleae*), which since a number of years had appeared more and more destructive in the olive cultivating countries. The General Assembly of 1920 had resolved on an inquiry in all infested states for obtaining complete information upon the different measures that had been taken for combating this destroying fly.

At the assembly of 1922 there was presented for distribution a special pamphlet, entitled „Enquête sur la lutte contre la mouche des olives (*Dacus oleae*) dans les divers Pays". This pamphlet contained not only several more or less detailed reports from Spain, France, Algiers, Marocco, the Union of South Africa and Italy, but also reviews of about ten new articles upon the fly, already published in other places. After long deliberations the Assembly resolved to charge the Permanent Committee with the taking of requisite measures for agreement between the countries interested, especially Spain, France with its colonies, Italy with its colonies, Portugal and Great Servia, for finding out the best utilization of the experience already gained, and to invite to a suitable meeting-place the entomologists interested, with a view to bringing this question to a successful issue.

On account of a proposal from the chief of the Bureau for Plant Diseases, L. M. SAULNIER, the Assembly of 1922 resolved to turn the attention of the Permanent Committee to the importance of collecting and publishing exact *statements as to the losses* of different countries through disease in, and damage to cultivated plants. Such statistics ought to open the eyes of the public to the importance of greater energy than hitherto shown in combating disease.

COLLABORATION LIMITED TO THE EUROPEAN STATES.

In the year 1915, i.e. in the year after the outbreak of the world war, I published in the American journal „Phytopathology" (Vol. V, No. 3, June) an article, entitled „*International Phytopatholigic Collaboration. Work begun in Europe — will it be prosecuted in America?*" In this article I pointed out that the continuance of an international phytopathological collaboration in Europe as a centrum was rendered impossible probably for a long time to come through the great war, and I made an appeal to American phytopathologists to take the initiative and the charge of an organized collaboration against the diseases of our cultivated plants. This address of mine has been left without the slightest notice.

Such being the case, and the North-American delegates in Rome 1922 having taken a decisive position against a common collaboration, I judge it suitable, if the Conference in Wageningen should be willing to re-open the question, to restrict it to *European Phytopathological Collaboration.*

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Prof. ERIKSSON's paper being the last one on the programme, the Chairman now thanked all readers of papers for their contributions and said, that now the time had come to institute something of permanent value. He therefore invited Prof. MANGIN to repeat his proposal of yesterday in a more elaborate form.

M. le Professeur MANGIN signale au Congrès le grave défaut de continuité des oeuvres des Congrès précédents. Ces derniers très intéressants par l'ensemble des questions traitées n'ont pas eu de lendemain car après la clôture du Congrès aucune disposition n'a été envisagée en vue de continuer l'oeuvre commencée et de coordonner les études relatives à certaines maladies graves des végétaux.

Il en résulte que l'oeuvre de chaque Congrès est à reprendre au Congrès suivant, la continuité des efforts n'ayant pas été assurée. Il y a donc là au point de vue économique une perte de temps et une perte d'argent.

Pour remédier à ces inconvénients M. le Professeur MANGIN propose:

1e. La nomination d'un bureau permanent chargé d'assurer la continuation des oeuvres du Congrès actuel et de la préparation du Congrès prochain;

2e. Ce bureau centraliserait tous les documents relatifs aux maladies des plantes ou aux ennemis des végétaux ainsi que ceux qui concernent les mésures de protection envisagées ou proposées. Il indiquerait les mésures nécessaires pour coordonner et continuer les recherches entreprises etc.

3e. En ce qui concerne la préparation du Congrès prochain l'expérience a montré les défauts de la discussion de motions imparfaitement connues des délégués et M. le Professeur MANGIN propose qu'à l'avenir toutes les propositions soumises au futur Congrès après approbation du bureau permanent seraient imprimées par ses soins avant ce Congrès et distribuées aux membres participants.

Cette procédure aurait l'avantage de gagner du temps et d'assurer à la fois plus de clarté dans les discussions et plus de netteté dans l'expression des notes.

4e. On obtiendrait ce résultat en demandant aux divers Etats représentés au Congrès une légère contribution en argent.

Si l'assemblée adoptait ces diverses propositions le bureau permanent dont les fonctions viennent d'être définies serait établi en Hollande; son president serait M. QUANJER et son secrétaire M. SCHOEVERS et il serait composé d'une douzaine de membres élus par le Congrès.

Prof. MANGIN's proposal was received with unanimous applause. After some discussion the Permanent Bureau was constituted as follows:

H. M. QUANJER (Holland), President.
T. A. C. SCHOEVERS (Holland), Secretary.
O. APPEL (Germany)
J. ERIKSSON (Sweden)
L. GARBOWSKI (Poland)
L. O. HOWARD (U. S. A.)
J. JABLONOWSKY (Hungary)
S. KUSANO (Japan)
P. MANGIN (France)
E. MARCHAL (Belgium)
P. MARCHAL (France)
L. PETRI (Italy)
C. L. SHEAR (U. S. A.),

and two British members to be appointed later. It is intended that each member is to represent a group of countries, allied either by the relationship of their population or by close neighbourhood, so e. g. Prof. ERIKSSON will represent the Scandinavian countries, Prof. JABLONOWSKI those of central Europe, Dr. HOWARD and Dr. SHEAR not only the U. S., but also the countries of South-America, etc.

This Bureau will have to carry out the program proposed by Prof. MANGIN. Furthermore it will have to prepare the next Conference and to fix date and place, where it will be held, probably in 1925. In case some difficulty or other has to be overcome the

Bureau will have the right to invite a delegate from the country in question to join its meetings. One of its duties will be to secure money for printing-purposes etc; in order to attain this end it will perhaps be the best plan, if in each country a national bureau could be instituted, to keep in connection with the International Permanent Bureau, not only concerning business of a pecuniary kind but also concerning all matters in the department of plant pathology and economic entomology.

The Chairman now raised the question of the name of the Permanent Bureau.

Prof. MANGIN proposes: „International Committee of Phytopathology and Economic Zoölogy".

Prof. P. MARCHAL prefers „Entomology" to „Zoölogy".

Prof. WESTERDIJK proposes: „International Committee for Plant-Protection", which expression covers all branches of the phytopathological department.

Several other members took part in the discussion; at last the Chairman put the question to the vote, with this result that the name used for the present Conference is also to be used for the Permanent Bureau; so the name will be: „INTERNATIONAL COMMITTEE OF PHYTOPATHOLOGY AND ECONOMIC ENTOMOLOGY".

This matter being settled the Chairman reopens the *discussion on plant-disease legislation* which discussion was begun on Tuesday at Wageningen after the papers read by Mr. GÜSSOW, Mr. GIBSON and Dr. REH.

Dr. L. O. HOWARD states, it is obvious to him that it was not generally understood, that none of the American delegates has anything to do with the Federal Horticultural Board. He also thinks, that Mr. GÜSSOW's intention was not clearly understood. In his opinion the point of view of Mr. GÜSSOW, who represents an importing country, is entirely justified.

Dr. W. A. F. WERY (Secretary of the Holland Plant Exporters' Association): [1])

International trade and the task of the phytopathologist.

1. As Mr. Güssow will have noticed, his address has caused a great alarm among the representatives of exporting countries. However when Dr. GIBSON had communicated the new regulations, which will be put into operation in Canada after September 1st and when I had through the kindness of the Secretary obtained a copy of

[1]) This paper was not actually read at the Conference; Mr. WERY exposed his views on the matter in several private interviews with members. To save time, he desisted from reading his paper and handed it over to be printed in the Report.

Mr. Güssow's address, I saw that this claim, for the greater part, was due to misunderstanding. I think that the cause of this misunderstanding was the word p r o t e c t i o n, which he often used, but not in the sense of e c o n o m i c p r o t e c t i o n, in the way we use it in Holland.

2. However, also in connection with the address of Mr. Güssow, I want to express the feeling of the trade about phytopathology and economic protection. As a matter of fact in the circles of the trade, phytopathology is more and more feared as a weapon between free trade and economic protection. It appears, that plantdiseases and plantpests can justify nearly every exclusion provided a country asks 100 % safety. As international trade does not only ask for clean crops, but also for crops which have some value on the international market, it is a question of the greatest importance, whether nations will continue to build Chinese walls around their frontiers on account of plant diseases or not.

Mr. Güssow has said that international co-operation against the spread of pests and diseases ought not to be regarded solely from a phytopathological aspect. However in my opinion for a phytopathologist there is no other aspect, otherwise he is working in a wrong sphere. It goes without saying, that I agree with Mr. Güssow that the economic circumstances perhaps make necessary different measures in different countries, but Mr. Güssow sees already a difference between the interests of an importing and of an exporting country which „necessarily clash". From this point of view a prime duty would be to help national industry and he cannot prevent finding himself between the devil and the deep sea. If a concise biological basis did not lead him to exclusion, the economic reason will induce him perhaps to ask no 99 % safety but 100 % safety for a better development of national industry.

Mr. R. KENT BEATTIE, phytopathologist in charge of foreign Plant Quarantines, Federal Horticultural Board, writes July 22nd 1921 in the American Nurseryman:

„One of your members who was cultivating 180 acres before Quarantine 37 was put into operation now cultivates 500 acres and all the plants he has imported can be grown on a single acre. That is development of American horticulture!"

Is it to be wondered at, when the disappointed exporter, importer or consumer does doubt, whether Mr. KENT BEATTIE only judges from a concise biological basis? And will it be possible when the plants now excluded, are proved to be reasonably clean to allow again foreign competition with the result that the 500 acres will have to decrease again to 180 and that the capital invested in the 320 acres will be lost?

In May 1922 the Federal Horticultural Board in the U. S. A. declared, that „the general principle underlying Quarantine 37 is as rapidly as possible to make this country independent of foreign supplies with the object of ultimately reaching a condition in which the entry of foreign plants will be limited to new plants and to such plants as are not capable of production in the U. S. A." Growers who ask economic protection could not express better this purpose, and at least we find here again a mingling of economic and phytopathological motives.

3. In this line of thought I see a double mistake. First an economic error about international trade, and secondly a wrong idea of the task of the phytopathologist.

As regards the economic value of international trade I entirely agree with Prof. KIELSTRA. There is no contrast of interests. When we import into Europe Ford-cars, American electric cleaners, corn, Californian fruit, etc. this importation is of equal value to us as the exportation is to America. Moreover we are only able to buy these goods, because of our being able to ship our export products to America. Hampering imports, means hampering exports. This simple economic truth can only be denied, if — as mercantilism did in the 18th century — an incorrect signification is attributed to the role of money as an intermedium in commerce.

I will confine myself further to the following quotation from the well-known American economist Mr. F. W. TAUSSIG, Professor of Economics in Harvard University: „Principles of Economics", 1918, Chapter 36.

„The main argument in favor of free trade between nations has been already indicated. It is a simple corollary from the principles of the division of labor. Exchange between individuals brings the same gain whether they live in the same village or in widely separated districts. Things are obtained by the exchange more easily and abundantly than they could be obtained by each person's producing for himself. The reasoning, which shows that it is advantageous for the farmer to deal with the village blacksmith, for Maine to deal with Florida, for New England with the Mississippi Valley makes out a strong prima facie case in favor of free exchange between the U. S. A. and England, between France and Germany. The burden of proof may be fairly said to rest on those who assert there is gain from the contrary policy."

We can see the working of a large quarantine in the U. S. A. Working as an economic protection it has resulted in favouring nurserymen but it is to the disadvantage of the public at large, which is among others expressed in: „An Appeal to every Friend of American Horticulture", drawn up by more than 30 American associations of amateurs, as consumers; in the protests of the florists, occurring in the Florists' Exchange and in the exorbitant prices, to be paid for various plants in America.

To illustrate these prices I give here an order f. o. b. European nurseries placed in the U. S. A. in 1921 for which however a special permit has been refused.

Quantity	Invoice value	
22	$ 5500	Acacia in varieties 5—6′ high x 3—5′ spread, in tubs.
4	„ 1400	Acacia in varieties 7—8′ high x 5—6′ spread, in tubs.
2	„ 550	Laurus Nobilis, Standards 3½—4½′ stem, 5—6′ heads, in tubs.
4	„ 900	Laurus Nobilis, Pyramids 10—12′ high x 3½—4′ in tubs.
6	„ 210	Laurus Nobilis, Ball shape 3—3½′ high x 2½′ diam., in tubs.
24	„ 1800	Azalea Indica 3½—4′ diam., assorted.
50	„ 400	Azalea Mollis Hybrids Assorted 24"—30" high, balled.
20	„ 360	Rhododendron Pink Pearl 3—3½′.
20	„ 320	Rhododendron Hybrids — forcing varieties 3—3½′, balled.
50	„ 400	Azalea Pontica 24″—30″, assorted.

Ask a nurseryman what the price of these plants would be in free international exchange!

4. The opinion often expressed in American circles that phytopathologists are controlling business not pests, undermines the confidence in the phytopathological service. Mr. Güssow has pointed out how various groups of those interested, insist that the Government Officer should go further in order to exclude foreign competition, which makes his position not an enviable one.

In Europe we begin to see the same. The English horticulturists, who rightly protest against the auction sales of plants and bulbs, expect apparently protection through the medium of the Destructive Insect and Pest Act. The French horticulturists, who suffer severe competition from German imports, applied a few months ago to their Government for restriction of imports in consequence of dumping and plant diseases. Neither American fruit nor seed can give 100 % safety and many people in Europe agree with the words of Mr. Lobjoit, spoken at the Washington Conference in 1922, who said:

„It is clearly preferable since risks must anyhow be taken to deal with a country open to English trade rather than with one which will not risk the English produce."

Dr. REH declared last Tuesday that the question of transport of insects was still a mystery. He stated further that HAMILTON had verified that from 156 beetles imported into the U. S. A. 60 had been imported on plants on which they live and 96 on packings.

With all these unlimited possibilities it is clear, that if the phytopathologist does not consider his task very limited, but if he also wants to use measures of total exclusion, then there is danger of the most arbitrary extension.

5. I have tried herewith to point to the following conclusion:

The task of the phytopathologist is fighting and preventing plant-diseases, but he has to take the greatest care not to hinder trade. Quarantines, restricting international trade, i. e. the geographical division of labour over the whole world, have the same bad effect for importing as for exporting countries. Insofar as also economic protection is aimed at by a quarantine, the phytopathologist is working in a wrong sphere. Being himself no economist, he works with technical arguments which are beyond the economist's control. Therefore we now see in international trade the greatest fear of phytopathological measures, as a weapon of groups that want economic protection.

The measure, which according to Dr. GIBSON, will come into force in Canada after September 1st, may be considered as an example of a good international regulation, namely that certificates of health will rightly be required for every shipment, with the right to control this shipment at the port of destination, and that moreover only a few plants or plant products especially named, are excluded.

I suppose, that it has been scientifically ascertained that these plants are the bearers of certain dangerous diseases new to, or until now not widely spread in Canada. I suppose further that if science should succeed in growing these plants reasonably free from disease or in new immune varieties, the importation will be granted again.

From this it is evident that I entirely agree with the regulations which Dr. GIBSON has made, undoubtedly in co-operation with Mr. GÜSSOW. So I have only to thank Mr. GÜSSOW for his having given me cause to express my opinion.

DR. E. V. SLOGTEREN:

Mr. Chairman, Ladies and Gentlemen,

I am very glad our Chairman is so kind as to give me an opportunity of speaking a few words that concern the foundations and vital interests of our Phytopathological Science.

We all want to co-operate for the advancement of that Science and we all agree with the ideas we have heard from Dr. SHEAR in his address to obtain that co-operation as well founded as it possibly can be.

We know however that phytopathology is an applied Science which has to take the interest of agriculture and horticulture to heart and that there is also an economic side to this question.

Dr. GÜSSOW has brought this forward in his address to us on Tuesday last in Wageningen.

I am not quite sure that there were not some who perhaps have misunderstood some of his words.

I had met Dr. GÜSSOW before and spoken with him on different problems in which we all are interested, and therefore I asked you on Tuesday last to postpone the discussions to this morning to give us all an opportunity of studying his very important paper.

And now Mr. Chairman I am very, very glad to have asked you for this postponement of our discussions.

For I have had *now* an opportunity to carefully study Mr. GÜSSOW's paper which he read to us last Tuesday and I am glad to say that on careful consideration I can only state that his ideas on this subject fully agree with our own, namely that the basis for international trade in living plants is essentially that degree of *reasonable* freedom from plant diseases or insect pests, that constitute the greatest measure of safety.

Such safety demands first of all certification of all the plant material exported. By these means inferior classes of plant material will be entirely excluded from export.

In view of the fact therefore that Dr. GÜSSOW invites the consideration of co-operated action, let me submit to you as the basic principle for all future relations along these lines the following resolution:

The representatives of all nations assembled at the International Phytopathological Conference of June 25—30 1923 in Holland desire to place themselves in record as in full agreement with the essentials of trade and commerce in living plants or plant products, namely reasonable freedom from all insect pests and plant diseases of all kinds of material imported into or exported from any country. — (Unanimous applause.)

DR. J. C. F. FRYER[1]):

From the discussions, both public and private, which have taken place during the past week it would appear that one of the basic difficulties in treating from the entomological and pathological

[1]) The note on p. 216 applies also to Dr. FRYER's paper.

point of view the subject of international commerce in plants is to define the extent to which the entomologist or pathologist should concern himself with economic factors. Doubtless he would prefer to judge all questions submitted to him solely from the point of view of his own subject but unfortunately this is impossible in practice, for plant import regulations have in themselves an economic end — the protection of valuable crops: they cannot be administered without greater or less interference with commerce and the controversy concerning them at the present time would hardly have arisen were it not for their economic effects. The phytopathologist or entomologist, therefore, is forced to take cognisance of economic factors, but on the other hand he is essentially a specialist and it is seldom that a man will be found who can claim specialised knowledge of two subjects so great and so unlike as entomology (or pathology) and economics. It is evident therefore that the entomologist or pathologist must decide his relationship with the science of economy in such a way as to prevent his taking responsibilities he is unfitted to assume. Committees and advisers may assist him in this but they will not enable him to evade the issue — for in every case he alone can estimate the dangers from the introduction of any pest and equally the extent of the protection given by any measure. The problem is thus a difficult one and its solution must to some extent depend upon the conditions prevalent in any particular country. In England, I think, the solution which would commend itself to most entomologists and pathologists is that they should first endeavour to obtain the fullest knowledge of the economic questions involved in the international trade in plants, and secondly that they should use this knowledge so as to reduce to the smallest possible extent (consistent with reasonable safety) the interference with commerce by plant import regulations. This, at all events, was in the minds of those responsible for drawing up the English regulations now in force, which we earnestly hope will contrive reasonable safety for England with the minimum interference with trade.

As I understand it, therefore, Dr. VAN SLOGTEREN's resolution embodies the principles accepted by the English Ministry of Agriculture as governing international trade in living plants and plant products. I have therefore the greatest pleasure in supporting his resolution which I sincerely hope will find acceptance by the Conference as a whole. —

The Chairman stated that, as no objection had been raised, Dr. v. SLOGTEREN's resolution was therefore considered as *accepted* unanimously.

As time was passing rapidly, he reminded the audience of the resolutions of Dr. Köck and Dr. BERNATSKY, already presented at Wageningen (see p. 44, 47 and 131); he supposed everybody would agree with them and therefore considered them too as *accepted*.

Dr. O. APPEL pointed out the urgency of supporting the collection of fungus cultures of the „Centraal Bureau" by forwarding cultures and asking for cultures from the collection, and by giving any support one is able to.

Prof. WESTERDIJK says, that first of all more money is needed; she proposes to recommend the support of the „International Bureau for fungus-cultures" to the care of the International Committee just named. — *Accepted*.

Dr. O. APPEL asks the Conference to point out the necessity for paying more attention to tuition in phytopathology than has been done hitherto. — *Accepted*.

Dr. E. GRAM presents the following resolution, in accordance with his paper read on June 25 (see p. 51).

„Whereas crop protection institutes, and scientists are served by a large number of abstracting journals not easily overlooked, of which none attempts a complete record of the progress, the Conference resolves that a committtee be appointed in order to:

1. improve the exchange of separates of original papers.
2. concentrate and simplify the abstract and registration service.
3. encourage, and contribute to the completeness of the annual bibliographs.
4. assign collaborators, so as to cover the principal divisions of the work, for the editing of annual or biennial progress reports. — *Accepted*.

Prof. J. ERIKSSON points out the necessity of collaboration in the rust-problem. His desire coincides with the following resolution, presented by Dr. Et. FOËX:

„Le Congrès émet le vœu:

1. que la possibilité sera examinée d'organiser entre les Pathologistes des divers pays des études concernées et coördonnées portant sur les Rouilles des céréales.
2. que les génétistes qui éprouvent la résistance que les céréales offrent aux rouilles adoptent tous l'échelle de résistance établie par les professeurs HAYES et STAKMAN."

As Prof. ERIKSSON's remarks were met with general approval, Mr. FOËX' resolution may be considered as *accepted*, although it was not actually presented to the Conference. This is also the case with a second resolution of Dr. FOËX, of the following contents:

Défense contre la dégénérescence de la pomme de terre.

Le Congrès considérant:

1. que le rendement de la Pomme de terre est fonction de l'état sanitaire et que la sélection constitue actuellement le seul procédé de lutte contre la dégénérescence;

2. que les parasites graves tels que le *Doryphora* et *Synchytrium* (maladie verruqueuse, chancre, galle noire) ont pris une grande extension dans certains pays et qu'il est de l'intérêt de tous de chercher à en limiter les dommages par l'emploi de mesures de protection:

Emet le vœu:

A. 1. que la dégénérescence soit méthodiquement étudiée dans tous les pays intéressés (production locale du plant, importation, exportation);
   2. que les méthodes de sélection soient vulgarisées et leur emploi encouragé dans tous les pays producteurs de semences;
   3. que soit généralisé le contrôle des cultures faites en vue de la production du plant.
   4. que soit étudiée dans chaque pays un système de certificat garantissant l'authenticité de la sélection.

B. 1. que les Pommes de terre de semences soient accompagnées de certificats d'origine attestant l'absence de parasites graves tels que *Doryphora* et *Synchytrium* dans la culture et son voisinage sur un rayon à déterminer après entente internationale;
   2. que dans tous les pays intéressés soient prises des mesures de défense appropriées (La France a déjà pris contre le *Doryphora* les mesures prescrites par la loi du 13 juillet 1922).

C. 1. que soit organisée chaque année une réunion internationale de spécialistes dans laquelle seront examinés et discutés les résultats obtenus, les méthodes employées, ainsi que tous les perfectionnements possibles pour tout ce qui concerne l'amélioration et la préservation.

The Chairman now wished to explain a proposition of his own, en said: PROF. ERIKSSON has on several occasions defended the idea of co-operation in scientific phytopathological research between na tions and the creation of an European Institute for international investigations. The great difficulty is, that under the present economic conditions, it will prove impossible to get the necessary funds from our Governments for realising this idea. But perhaps a more modest object might be reached if we ourselves try to collect a fund to encourage our younger students to do research work in plant diseases. Already at the lunch in my laboratory I drew attention to the pecuniary difficulty experienced by young men and women especially in Europe in continuing their studies, long enough to be able to accomplish valuable research-work. I should like to destine the moderate charge, which was asked from the participants of this conference for the refreshments our students served to them in my laboratory, to encourage investigations by graduate-students in Europe, not yet officially appointed nor receiving any remuneration. I propose that this conference proves its respect for the great investigator and champion for international research, who is in our midst, by adding their share to this first contribution of fl. 1.— in order to found an international „ERIKSSON *Prize*" for research in plant pathology and economic entomology. I should wish to ask Prof. ERIKSSON to propose the first subject of investigation, and I hope the second International Conference of Plant Pathology and Economic Entomology will receive sealed papers from young European investigators for this prize-subject to be judged by a committee appointed by its members. I hope further that the funds collected will suffice to promise a new reward for a new subject to be devised, and that the „ERIKSSON *Prize*" will in this way continue for ever to realise, at least to a small extent, the ideal of its god-father.

The members of the Conference proved by their enthusiastic applause their agreement with this idea, the execution of which to be the task of the permanent committee which will have to collect and control the funds, and to draw up a regulation for competition for the „ERIKSSON-*Prize*".

. The Chairman now stated, that the Conference had come to an end. Before closing it he wanted once more to thank all the members for their cordial co-operation. In his opinion the Conference had been a success throughout; he expressed the hope meeting the members again at the next Conference.

After having thanked MISS WESTERDIJK for her kind reception, the Conference had met with in her laboratory, he closed the Conference.

All the members met at the railway-station of Baarn, to travel together to the Hague. On arrival there they went to the Ministry of the Interior and of Agriculture, the rooms of which were gaily decorated with flowers and shrubs, kindly provided for this purpose by the Boskoop and Aalsmeer Growers Associations. The Minister Jonkheer RUYS DE BEERENBROUCK welcomed the members of the Conference, and said that he was glad, that at the end of the sessions they had accepted his invitation. It is said that the Hollanders are a hospitable people; His Excellency expected that, towards the members of this Conference, his fellow countrymen had proved the truth of that saying. Further he hoped that the foreign members would keep a pleasant memory of Holland, and that the results of the Conference would be of great importance in every way.

Prof. QUANJER responding on behalf of the guests, said that all the members felt that the conference had been a success; he hoped that some seed of concord had been sown; the support of His Excellency might tend to the germinating of that seed and its growing up to a strong tree, which in future might bear an abundant crop of fruit.

In the hall, also beautifully decorated with flowers, tea and refreshments were then served.

On leaving the Ministery the company went to Scheveningen, where in the Kurhaus Hotel nearly all members with their ladies, and several Dutchmen with their ladies, assembled at dinner. Prof. QUANJER presided to welcome the guests from abroad; Dr. HOWARD answered on their behalf and proposed to send a telegram to H. M. THE QUEEN OF HOLLAND to tender the homage of the Conference to H. M.; this proposal was greeted with enthusiastic applause and the plan was at once carried out.

Several other members spoke, and the time for parting came only too soon. Some members left Holland the same night, several others stayed a few days longer to join in the trip to the Westland (p. 232), to visit some museums, to do sight-seeing etc.

Owing to Dr. APPEL not being able to forward his manuscript at an earlier date, it was not possible to have his lecture printed on p. 132. It arrived just in time however to be inserted here.

DER PFLANZENSCHUTZ IM UNTERRICHT

VON

DR. O. APPEL

Meine Damen und Herren!

In allen Kulturländern hat sich die Ueberzeugung durchgerungen, dass mit der steigenden Kultur auch der Pflanzenschutz eine immer grössere Bedeutung erlangt; denn nur, wenn es für uns möglich ist, die Ernten, die wir mit Hilfe besserer Bodenbearbeitung sowie entsprechender Düngung und Benutzung hochwertiger Sorten steigern, vor Schädigungen und Verlusten bewahren, können wir einen vollen Erfolg erzielen. Der Anwendung des Pflanzenschutzes stehen aber z.Zt. noch eine Reihe von Hindernissen entgegen. Vor allem ist es die mangelnde Kenntnis von der Bedeutung des Pflanzenschutzes in den breiten Massen der landwirtschaftlichen Bevölkerung und der Mangel an geeigneten Kräften, die den Pflanzenschutz ausüben. Zwar werden überall in den landwirtschaftlichen Vorlesungen der Hochschulen die pflanzlichen und tierischen Schädlinge erwähnt; aber eine eingehende Berücksichtigung können sie in diesem Rahmen nicht finden, da die Fülle des sonstigen Materials für ihre Darstellung nicht genügend Raum lässt. Die Folge davon ist, dass die Landwirtschaftslehrer und die an den Hochschulen ausgebildeten Landwirte nicht ausreichende Kenntnisse für eine umfangreiche Betätigung auf diesem Spezialgebiete erlangen. Daher scheint mir auch die Anregung, die vielfach gegeben wurde, nämlich die wichtigsten Beispiele aus dem Pflanzenschutze in den niederen Schulen zu bringen und dadurch das Interesse zu wecken und positive Kenntnisse zu verbreiten, so lange nicht gangbar, als die Lehrkräfte, die einen solchen Unterricht erteilen sollen, nicht ausreichend vorgebildet sind. Es ist daher notwendig, dort, wo dies noch nicht der Fall ist, an allen Hochschulen, an denen landwirtschaftliche Vorlesungen stattfinden, auch Vorlesungen über Pflanzenschutz direkt einzuführen. Es kommt aber noch etwas weiteres hinzu, was hierzu zwingt: Das sind die Fortschritte auf dem Gebiete des Pflanzenschutzes, die in allen Kulturländern seit einigen Jahrzehnten in steigendem Masse gemacht werden. Diese auszuwerten und durch eigene Forschungen zu ergänzen, ist gerade der Hochschullehrer am ehesten in der Lage.

Durch einen solchen Unterricht aber wird es auch möglich sein, einen Stamm zu schaffen, der, entsprechend den Human- und Veterinärmedizinern, die Phyto-Medizin vertritt. Ebenso wie man zum kranken Menschen und zum kranken Tiere den Arzt ruft, muss es in Zukunft möglich werden, auch beim Auftreten von Pflanzenkrankheiten den Pflanzenarzt zu Rate zu ziehen, der in der Lage ist, die vorliegende Krankheit richtig zu beurteilen und der, so weit es sich um die wichtigsten und häufigsten Krankheiten handelt, auch die Anordnungen zu treffen vermag, die eine Heilung oder weitere Ausbreitung verhindern. Er muss noch weiter in der Lage sein, auch vorbeugend zu wirken, etwa so, wie es in der menschlichen Medizin durch Massnahmen der Hygiene erfolgt. Das schliesst natürlich nicht aus, dass in besonderen Fällen ein Spezialist zu Rate gezogen wird, denn dei der Vielseitigkeit der Natur unserer Kulturpflanzen und der Ursache ihrer Schädigungen ist es ganz selbstverständlich, dass man auch auf dem Gebiete der Phyto-Medizin Spezialisten nicht entbehren kann. Bis jetzt war eigentlich der Weg ein umgekehrter. Es haben sich vielfach Spezialisten gebildet, die entweder nur die tierischen oder die pilzlichen Schädigungen kennen. — [See on this subject p. 48—51. — Ed.]

Ehe ich nun auf die Ausgestaltung dieses Unterrichtes eingehe, möchte ich ein Wort über ihre Hilfsquellen sagen. Die Grundlage jeden Unterrichtes ist neben der Wiedergabe fremder Erfahrungen und Forschungen die eigene Forschung. In erster Linie muss man, wenn man Krankheiten entgegentreten will, die gesunde Pflanze kennen. Viele Krankheiten sind bis jetzt übersehen worden, weil man ihre Symptome aus Mangel an Kenntnis der gesunden Pflanze nicht bemerkte. Ich erinnere nur an die Frage der Blattrollkrankheit, bei der noch heute viele Praktiker, aber auch Wissenschaftler, die Anfänge nicht zu sehen vermögen, weil sie die gesunde Kartoffelpflanze nicht genügend kennen. Weiter ist aber auch die Kenntnis der Kultur der Pflanze nötig; denn es kommen vielfach Schädigungen durch Mängel in der Kultur vor, ebenso aber auch haben wir in kulturellen Massnahmen Mittel an der Hand, die, richtig angewendet, vorbeugend und heilend wirken.

Die Pflanzen-Medizin ist in einer schwierigeren Lage als die menschliche und Tier-Medizin insofern, als sich die Zahl der Pflanzenschädlinge aus viel verschiedeneren Gruppen rekrutiert als die des Menschen und der Tiere. Vor allem sind sie auf die zwei grossen Naturreiche der Tiere und der Pflanzen in gleicher Weise verteilt. Deshalb ist die Kenntnis dieser Pflanzenschädlinge und ihrer Biologie neben der Kenntnis der gesunden Pflanzen und ihrer Kultur die wichtigste Grundlage. Die Kenntnis dieser schädlichen Organismen wird aber am besten erforscht durch den Botaniker und den Zoologen. Hinzu kommen allerdings noch der Bakteriologe und der Chemiker; ersterer zur Erforschung der Bakterienkrankheiten, letzterer zur Erforschung der Krankheiten, die auf chemische Einflüsse zurückzuführen sind. Diesen Verhältnissen hat die Biologischen Reichsanstalt für Land- und Forstwirtschaft in Berlin-Dahlem Rechnung getragen, indem sie in ihrer naturwissenschaftlichen Abteilung je ein Laboratorium für Botanik, Zoologie, Bakteriologie und Chemie enthält. Dazu kommt noch ein Forschungslaboratorium für angewandte Vererbungslehre, da auch dieser Wissenszweig Spezialkenntnisse verlangt. So wie dies an dem genannten Forschungsinstitut eingeteilt ist, so werden auch im Hochschul-Unterricht diese Wissenszweige die Grundlage schaffen müssen für ein richtiges Verständnis der Pflanzenkrankheiten. Dazu kommt aber noch, dass auch in der Betriebs- und Düngerlehre ebenfalls auf den Pflanzenschutz eingegangen werden muss.

Die auf diese Weise den Hörern vermittelten grundlegenden Kenntnisse müssen aber weiter vertieft und ausgebaut werden durch eine besondere Vorlesung über Pflanzenschutz, in dem nach meiner Auffassung die Diagnostik und die Heilmethoden besonders hervorgehoben werden müssen.

Die Diagnostik der Pflanzenkrankheiten ist bis jetzt recht stiefmütterlich behandelt worden. Wenn wir unsere Handbücher vornehmen, so finden wir meistens, dass zwar der Schädling gut beschrieben, dass aber das Krankheitsbild dem gegenüber in den Schatten gestellt ist. Der Versuch, aus dem Krankheitsbilde die Diagnose zu stellen, wie dies noch bei Mensch und Tier ganz allgemein üblich ist, ist noch wenig gemacht worden. KIRCHNER hat in seinen „Krankheiten und Beschädigungen der landwirtschaftlichen Kulturpflanzen" diesen Weg in der Weise beschritten, dass er für jede einzelne Kulturpflanze das äussere Krankheitsbild zum Auffinden der Ursache der Krankheit benutzt. Auf allgemeinere Grundlage haben diese Idee erst APPEL und WESTERDIJK gestellt und den Versuch zu einem System der Diagnostik zunächst für die Pilzkrankheiten gemacht. Das System stellt sich wie folgt dar [1]):

1. FÄULEN:
   - a. Samenfäulen.
   - b. Keimpflanzenfäulen.
   - c. Wurzelfäulen.
   - d. Knollen-, Zwiebel- und Rhizomfäulen.
   - e. Stengelgrundfäulen.
   - f. Allgemeine Sprossfäulen.
   - g. Knospen- und Blütenfäulen.
   - h. Fruchtfäulen.
   - i. Holzfäulen.
   - k. Rindenfäulen.
   - l. Dürren.
2. FLECKE:
   - a. Trockenflecke.
   - b. Brenner.
   - c. Rindenbrand (einschl. Krebs)
   - d. Wurzel- und Knollenflecke.
3. PILZAUFLAGERUNGEN:
   - a. Mehltau.
   - b. Schwärzen.
   - c. Russtau.
   - d. Massenüberzüge.
4. NEUBILDUNGEN:
   - a. Hexenbesen.
   - b. Gallen.
   - c. Blüten- und Fruchtumbildungen.
5. GEFÄSSKRANKHEITEN.

Beide Autoren haben in ihrer Tätigkeit als Hochschullehrer dieses System nun seit mehreren Jahren durchgeprüft und durchaus brauchbar gefunden. Ein solches System hat den grossen Vorteil, dem Hörer das Krankheitsbild viel näher zu bringen, als es bei einer Gliederung des Stoffes nach den Erregern der Krankheiten der Fall ist. Dazu kommt, dass dadurch natürliche Gruppen entstehen, die auch in der Bekämpfung im allgemeinen gleichartig sind. Der scheinbare Mangel, der dadurch entsteht, dass manche Krankheitserreger verschiedene Krankheitsbilder hervorrufen, wie z.B. *Monilia cinerea* Fäulen und Zweigsterben verursacht, ist leicht dadurch auszuschalten, dass man die Krankheit bei dem wichtigsten Merkmal umfassend bespricht und bei dem anderen Merkmal auf diese Besprechung verweist. Derartige Ausnahmen sind natürlich bei jedem System vorhanden; ich erinnere nur daran, dass bei Benutzung des Pilzsystems als Grundlage gleichartige Erkrankungen in ganz verschiedenen Gruppen erscheinen, je nachdem von einem Pilze nur eine imperfekte Form oder auch eine höhere Fruchtform bekannt ist.

Hat man auf diese Weise dem Hörer ein klares Bild der Diagnostik gegeben, so ist die zweite Aufgabe der Vorlesung des Pflanzenschutzes die Bekämpfungsmassnahmen in einheitlicher Weise darzustellen. Ich benutze dazu folgende Gruppierung:

[1] See also Dr. DE JACZEWSKI's paper, p. 244. — (ED.)

A. Bekämpfungsmittel.

a. Vernichtung des Schädlings vor der Erkrankung der zu schützenden Pflanze, z.B. Vernichtung des Zwischenwirtes der Berberitze beim Schwarzrost sowie Vernichtung von Sporen und ihrer Keimschläuche durch Bespritzen.

b. Vernichtung des Schädlings an oder in der erkrankten Pflanze unter ihrer Erhaltung, z.B. Absammeln von tierischen Schädlingen oder Heisswasser- oder Heissluftverfahren gegen Flugbrand von Weizen und Gerste.

c. Vernichtung des Schädlings under gleichzeitiger Vernichtung der erkrankten Pflanze, z.B. Extinktions-Verfahren gegen die Reblaus.

d. Biologische Bekämpfungsmethoden, z.B. durch Verbreitung der natürlichen Feinde des Schädlings.

B. Schutzmittel.

a. Einrichtungen, die die Schädlinge abhalten, z.B. Färben des Getreides gegen Krähenfrass.

b. Bodenverbesserung, z.B. Be- und Entwässerung gegen das Auftreten von gefässbewohnenden Pilzen und im Kampfe gegen bestimmte Unkräuter, sowie Bodenlockerung und -düngung gegen das Auftreten Keimlings- und Fusskrankheiten an der Kartoffel.

c. Wahl der Saat- und Pflanzzeit, z.B. Aussaat von Getreide vor oder nach der Flugzeit schädlicher Insekten.

d. Auswahl der richtigen Frucht und Fruchtfolge, z.B. häufiger Fruchtwechsel zur Vermeidung der Anreicherung des Bodens mit bestimmten Schädlingen.

e. Auswahl gesunder Pflanzbestände oder einzelner Pflanzen zum Nachbau sowie Auswahl und Züchtung widerstandsfähiger Sorten, z.B. Auslese gesunder Kartoffelstauden gegen die Verbreitung der Blattrollkrankheit, Züchtung von lager- und rostwiderstandsfähigen Getreidesorten.

Die Beispiele lassen sich natürlich beliebig vermehren und werden bei der Vorlesung nach jeder Richtung hin durchgesprochen und mit Material veranschaulicht. Hat man auf diese Weise bei den Hörern ein allgemeines Verständnis für die Pflanzenkrankheiten und ihre Bekämpfung wachgerufen, so kann dann mit grösserem Vorteile als ohne diese Vorbereitung die Besprechung der Krankheiten der einzelnen Kulturpflanzen folgen. Die dafür aufzuwendende Zeit muss mindestens 2 Wochenstunden 1 Jahr lang betragen. Ich persönlich habe die Einteilung in der Weise gemacht, dass ich den allgemeinen Pflanzenschutz in dem kürzeren Sommersemester, den speziellen Pflanzenschutz, d.h. die wichtigsten Krankheiten der Kulturpflanzen, und ihre Bekämpfung, in dem längeren Wintersemester lese.

Für diejenigen, die sich aber eingehender als der praktische Landwirt mit den Pflanzenkrankheiten beschäftigen wollen, sind ausserdem Uebungen mit ausgiebigen Demonstrationen unerlässlich, die am besten wöchentlich einmal mehrere Stunden zu erfolgen haben.

Haben die Studierenden in den naturwissenschaftlichen Vorlesungen die richtigen Grundlagen erhalten, so können sie durch eine derartige Vorlesung im Pflanzenschutz so weit gebracht werden, dass sie in der Praxis ihr Fach gut vertreten können, fähig sind, sich weiter zu bilden, und auch mitwirken können an der allgemeinen Entwickelung des Pflanzenschutzes.

Ein Teil derjenigen, die diesen Unterricht genossen haben, geht hinaus als Lehrer an die Landwirtschaftsschulen. Diesen fällt nun die Aufgabe zu, die erworbenen Kenntnisse in die breiteren Massen der jungen Landwirte zu bringen und bei ihnen das Verständnis für die Wichtigkeit des Pflanzenschutzes zu wecken. Sie sind auch befähigt, an den Bildungsstätten für Volksschullehrer Unterricht zu erteilen, der dann wieder die Grundlage bilden kann, die Bestrebungen des Pflanzenschutzes in die breitesten Massen der Bevölkerung zu tragen.

Ein Wort möchte ich noch sagen über die Lehrmittel. Das gegebene Lehrmittel ist natürlich die gesunde und kranke Pflanze. Da sie aber nicht immer zur geeigneten Zeit vorhanden ist, muss man sich bildlicher Darstellungen bedienen. Bei uns in Deutschland gibt es eine ganze Reihe von grossen Wandtafeln, so z.B. die von von Tubeuf herausgegebenen, die für Vorlesungszwecke sehr geeignet sind. Ausserdem erscheint demnächst eine Sammlung etwas kleinerer Tafeln von Appel und Riehm, die ebenfalls im Unterricht Verwendung finden können und von denen Sie in der Ausstellung einige ausgelegt finden. Endlich ist eine neue Erfindung, nähmlich die Herstellung von plastischen Abbildungen, in den Dienst unserer Sache gestellt worden, indem die Deutsche Hochbild-Gesellschaft m.b.H. in München begonnen hat, die wichtigsten Krankheiten plastisch darzustellen. Auch von dieser Sammlung sind einige Exemplare in der Ausstellung vorhanden. Für den Unterricht für Fortgeschrittenere ist natürlich eine Sammlung mikroskopischer Objekte sowie eine gut ausgewählte Literatur unerlässlich.

Gehen wir auf diesem Wege vor, so bin ich überzeugt, dass wir in nicht zu ferner Zeit ganz wesentlich dazu beitragen, unsere Ernten zu erhöhen, und damit den Beweis erbringen für die Notwendigkeit unserer Wissenschaft und ihrer Anwendung.

TRIP TO THE WESTLAND

A party of about 25 members joined in a trip lead by the SECRETARY on Monday July 2 to the Westland. At 9 a. m. this party started in motor-cars from the Kurhaus and drove first to Loosduinen, afterwards to Honselersdijk, Poeldijk, Naaldwijk and via Monster back to Scheveningen. The party was conducted by Mr. BARENDSEN, president of the Westland Union and Messrs VALSTAR, RIEMENS, KUYVENHOVEN en VAN DER HOUT. Some large tomato-houses were visited at Loosduinen; at Honselersdijk the biggest grape-farm of Holland was inspected with great interest. At Poeldijk the auction of potatoes was in full swing; in the shed fruit and vegetables were waiting their turn. There was ample opportunity to examine the peaches, plums, tomatoes, red and white currants, cauliflowers, carrots etc., just in the state they are in when being sold.

At Poeldijk the Union Westland offered a profuse luncheon, flowing with the excellent products in which the Westland abounds. Mr. BARENDSEN, who presided, expressed his pleasure in welcoming a party of the members of the International Conference in the Westland; he hoped they would take with them a favourable impression of this part of Holland. Mr. VALSTAR and Mr. KUYVENHOVEN also spoke; Dr. BEWLEY and the SECRETARY answered on behalf of the guests.

In the afternoon some typical Westland gardens of a very mixed industry were visited; here the same owner often grows peaches and grapes in glass-houses, tomatoes also under glass in so-called warehouses, cucumbers and melons under flat glass, strawberries, fruit-trees and -bushes, potatoes and vegetables etc. in the open; some beds of bulb-flowers may even be found.

Disease- and pest-combating is practised to a great extent in the Westland; most grape- and peach-trees are sprayed in winter with $7^{1}/_{2}$ % (for peaches 5 $^{0}/_{0}$) carbolineum against the scale insects *Lecanium corni* and *Pulvinaria betulae*, with most satisfying results. Against insects in summer, such as caterpillars, handpicking is often relied on, although spraying with contact- and stomach insecticides is well-known and often practised. This is also the case with fungicides, such as Bordeaux mixture and lime sulphur against apple and pear scab; the latter is used against leaf-mould of tomato. Sulphur is also employed on a large scale to combat the mildew of the grape chiefly by dusting; lately it is also atomized by means of a vaporizer or a so-called generator. An officer of the Phytopathologic Service is stationed at Naaldwijk and gives his aid and advice in disease and pest-control. Resultant on the continuous warfare against diseases and pests only some very common diseases and very few common and not very dangerous insects were to be found; they were diligently chased by the entomologists of the party, but the spoil was rather small.

This very last day of the Conference was by no means the least interesting; the members who had joined in this trip were glad that they had added another day to their stay in Holland for the purpose of visiting the Westland.

THE FOLLOWING ARE PAPERS WHICH CAME TO HAND TOO LATE TO BE READ DURING THE CONFERENCE.

THE EFFECTS OF PARTIAL STERILISATION OF THE SOIL

BY

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It has long been known that organic residues of plants, animals, etc., break down in the soil to form nitrates and other substances of importance in plant nutrition, but it is only within the last 50 years that the real interest of the process has been discovered. It was shown by SCHLOESING & MUNTZ in 1879 that the final stage of the process is brought about by bacteria and from that time onwards an increasing volume of investigation has revealed larger and larger numbers of micro-organisms concerned in the decomposition. It was at first thought that the whole process was brought about by bacteria and fungi, and that the conditions would not allow of the existence of other organisms in numbers sufficient to play any significant part in the soil economy, but later work has caused this view to be changed.

An interesting experiment described by SCHLOESING consisted in placing soil in a closed vessel and watching the absorption of oxygen by means of a water gauge. SCHLOESING showed that the surface soil absorbed more oxygen than the subsoil, and the present writer, using more precise methods, was able to demonstrate that the rate of oxidation of soil was directly related to its fertility when a series of similar soils was considered.

In general the absorption of oxygen was very much reduced if the soil was heated sufficiently highly to kill all living forms and spores; a temperature of 120° C. being desirable for this purpose. On one occasion, however, it was not possible to use the autoclave and the soil was heated only in a steam oven in which the temperature did not rise sufficiently high to kill the spores. A surprising result was obtained: the rate of oxidation was greatly increased and not diminished as was expected. And, moreover, the heated siol possessed an increased productiveness corresponding with the increased rate of oxidation.

Investigation showed that the effect of heat on the soil was complex, bringing about a decomposition of organic matter whereby the oxidation would in any case be facilitated, but also causing an increased bacterial activity. The disturbing effect of decomposition was minimesed by treating the soil with volatile antiseptics such as toluene, carbon di-sulphide, etc., instead of heat: the increase in bacterial activity was still observed. Detailed investigation by Dr. HUTCHINSON and the writer afforded evidence that the bacteria were not, as had been hitherto supposed, the only important living organisms in the soil, but that others are present which tend to keep down their numbers. The soil population was therefore divided into two broad classes, some of which, such as the bacteria, were beneficial to plant growth, while some were detrimental either directly or indirectly by keeping down the numbers of the useful organisms. It was supposed that this detrimental group is more easily killed than the useful bacteria and they are therefore put out of action by antiseptics or by heat. The detrimental organisms were identified as protozoa.

The investigation then fell into two great divisions: an attempt on purely empirical lines to exploit the fact that partial sterilisation of the soil increases its productiveness, and a scientific investigation to discover, if possible, the causes at work. It was not imagined of course that farmers could ever afford to heat field soils, but it was known that some of the growers under glass were pursuiing very intensive methods and obtaining high crops and in their cases some practical application might be found. Soils intended for glass-house culture were heated to steam heat and were found to give considerable increases in crops: treatment with toluene also led to increased productiveness.

These facts were demonstrated to some of the tomato and cucumber growers in the Lea Valley district, north of London, and practical methods of application were deviced. Toluene and volatile antiseptics were soon found to be impracticable owing to their combustibility, but the phenols were distinctly useful. Economical methods of steaming the soil were also sought.

It was soon found however, that the increased productiveness brought about by partial sterilisation was of the same order as was obtained from the application of 1 to 2 cwt. nitrate of soda or sulphate of ammonia per acre. As it was not possible to carry out partial sterilisation at the price of this quantity of fertiliser it seemed as if the method could not be used on the large scale. The investigation was then somewhat widened. Growers had long been seriously troubled with numerous soil pests which severely handicapped them in their attempts to obtain the heavy crops without which their costly glass-houses never could be made to pay. In some cucumber houses it was not infrequently necessary to cart out the whole of the soil and to replace it by fresh turf brought in from outside, a costly and wasteful proceeding as the whole of the valuable manurial residues were lost. Attempts were therefore made to combine a partial sterilising agent with a soil insecticide and fungicide. Considerable trouble arises in the Lea Valley from attacks of eelworm and wireworm, while fungi capable of attacking the root or the stem often cause serious losses.

It was soon found, however, that the sterilising substances used were very selective in their action; formaldehyde cleared the soil of injurious fungi, but was not particularly effective against eelworm, while cresol considerably reduced the numbers of eelworm but had little action on fungi. This observation showed that it would be necessary to analyse the soil population and discover which should be put out of action, then to discover agents suitable for the purpose.

Heat, on the other hand, is perfectly general in its action, destroying practically everything inimical to the plant and leaving the soil in the clean healthy state in which the grower would like to have it. The easiest method of heating the soil is to fork it over, allow it to become dry, lay down on it wooden trays $2^1/_2$ metres long by $1^1/_2$ metres wide, then to drive steam under the trays from a portable boiler. In an hour the soil has become so well heated to a depth of 10 to 12 inches that even the eelworm lodging in the fragments of roots in the soil become killed.

However it is done heating is costly. The maximum amount of soil which can be heated by 1 ton of coal or coke is only 130 to 250 tons of moist soil, and by no means can this theoretical limit be exceeded. In practice the efficiency obtained is not very high and it is usually necessary to burn 15 tons of coal or coke to sterilise an acre (4840 sq. yds.) of soil, which weighs about 1000 tons; this corresponds with 67 tons of soil per ton of fuel, an efficiency of 30% of 40%.

Chemical agents offer the possibility of much cheaper methods. There is no limit to the smallness of the dose that could be used if a sufficiently effective poison could be found, and this seems to be a matter of chemical investigation only. The starting substance on the large scale was cresol, sold in commerce under the name of Pale Straw-coloured Carbolic Acid, and obtainable cheaply from the large London gas works near the Nurseries. One part of this carbolic acid is mixed with 40 parts of water, it is then poured on the soil or watered well in. Flooding is necessary because cresol is absorbed from its solutions by soil and therefore tends to remain in the surface layer only. Sometimes a second dose of phenol is given; the quantity used is generally 40 gallons to a house of 720 sq. yds. but in some cases double this quantity is given.

The demand for cresol has had the natural effect of forcing up its price, which of course has put the chemist on his mettle and stimulated him to find other and cheaper effective sterilising agents. The search is proceeding in two ways. Promising fractions of various distillates are studied if there is sufficient material available to satisfy any extensive demand, and a series of derivatives is prepared on perfectly systematic lines, their effectiveness against certain organisms being then studied. It is realised, however, that this empirical method of testing fractions is not completely satisfactory; distillates may be available at one period and not at another, or a slight change in the process may alter its composition completely. Nevertheless the method has given results and several compounds which are now being investigated seem quite promising; these include certain blast furnace oils and some of the fractions obtained in producer plants, and there is now no reason why the grower should confine himself to the carbolic acid obtained from gas works. Formaldehyde is also being examined and would be very useful if it could be obtained cheaply, but unfortunately its price is very high; more so than appears to be necessary. It is very effective against many of the fungi that cause trouble in glass-houses, and it has given beautiful clean roots in soils which when untreated carried plants with brown decayed roots and decayed stems.

The second and scientific method of systematic study of derivatives is far safer. It is attended with two difficulties: (I) substances are specific in their action, e.g. cresol is potent against eelworm, but not against fungi. Perhaps it is not true to say that every single organism has its most appropriate poison, but it does seem that several chemical agents would be needed for an adequate chemical control of the soil population.

(II) The second difficulty is that the plants also are liable to be killed by the sterilising agents, a substance toxic to fungi being usually toxic to plants. Fortunately this difficulty is less serious than might appear, since organic poisons disappear fairly quickly from the soil, for reasons which will be discussed later.

It is too early to speak of progress in this direction as yet, but already exponents have demonstrated that the chlor-cresols and chlor-nitro-benzene derivatives are much more effective than cresol itself if they could be prepared sufficiently cheaply to be of practical value. Chlorpicrin, or chlor-nitro-methane, is one of the most effective and useful of soil sterilising agents that we have found and has the advantage that it is easily distributed in the soil. It is, however, inconvenient to handle.

These substances are being tested in commercial nurseries and information is gradually being obtained as to their effectiveness under conditions of actual practice.

While all this empirical work is proceeding laboratory investigations are in progress to discover the reasons for the increased productiveness of the soil and, if possible, to explain exactly what happens when the antiseptic is added. This work is still continuing, but the action is known to be very complex; several distinct effects have already been discovered. There is a distinct chemical action when a volatile antiseptic such as benzene, toluene, carbon-disulphide, is added to the soil, which shows itself in an increase in the amount of ammonia and of soluble matter. The nature of this change is unknown.

There are also biological changes of at least two kinds. The soil population is considerably simplified, some of the members being killed. This simplification leads to permanent increase in the numbers of bacteria, and there is also an increase in the amount of nitrate production. Detailed examination is being made in the case of phenol and cresol.

Many of the agents used for sterilisation, however, can serve as sources of food or energy to certain specific soil organisms, and addition of the antiseptics causes rapid multiplication of these particular organisms, which continues as long as any of the poison remains in the soil, after which the numbers fall off. It does not appear that these organisms produce nitrate; on the contrary, they assimilate nitrates from the soil. This, it may be pointed out, usually happens when organisms derive their energy from non-nitrogenous compounds; more ammonia is consumed than is produced, so that the stock of nitrate decreases. Ammonia production seems to occur only when organisms obtain their energy largely from nitrogen compounds; in this case they produce more ammonia than they consume.

One effect of these special organisms is to remove the poison quickly from the soil. Sometimes this action is so rapid that the poisons have insufficient time to act and pests escape destruction, even where there seemed ample material to kill them. This practical difficulty is being obviated by introducing some group into the molecule which retards decomposition and therefore lengthens the time during which the substance remains unchanged in the soil.

The net result of these diverse actions appears to be somewhat as follows. When the poison is added to the soil it immediately kills the organisms to which it is fatal, including the special disease organisms or pests for which it was applied. It is also attacked by certain soil bacteria which have the power of utilising it as food or as energy material and as these bacteria multiply it is removed from the soil with increasing rapidity, until finally there is little of it left.

These special bacteria meanwhile multiply to so great an extent that they have to draw on the stocks of nitrate in the soil for their nitrogen supplies. When, however, the poison has all disappeared the special bacteria fall in numbers and the more normal population begins to act; owing to the simplification of the soil population considerably more nitrates can now be produced than was possible before. The soil is therefore left free from plant pests with a higher power of producing plant food than it had before treatment.

The soil population is now known to contain not only bacteria, but also protozoa, fungi, algae, nematodes, etc. The functions of these organisms are in the main unknown, but they are being studied at Rothamsted. It has been shown there that the soil amoebae are detrimental to the soil bacteria. What part other members of the soil population play in the production of plant food is not yet known, but the information will it is hoped be given by the investigations which have now been commenced.

RÉSUMÉ HISTORIQUE DU DÉVELOPPEMENT DE LA PHYTOPATHOLOGIE EN RUSSIE

PAR

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Dans un pays aussi essentiellement agricole comme la Russie, les maladies des Plantes ne pouvaient manquer d'attirer l'attention générale, et les recherches à ce sujet ont commencé à une époque relativement ancienne, quand il n'était encore nullement question d'un service phytopathologique régulier. On peut considérer comme le fondateur de la Phytopathologie en Russie Mr. WORONINE, qui appliqua à ses études les principes biologiques introduits par DE BARY en Mycologie et fit des recherches restées classiques sur l'hernie du choux et la rouille du tournesol. Ces travaux datent des années soixante du siècle passé, et furent suivis d'une série d'autres recherches intéressantes sur la biologie de certains champignons parasites. A peu près à la même époque on peut encore citer les travaux de ROSANOV, mort trop prématurément, et ceux de SOROKINE, qui fit de nombreuses investigations phytopathologiques au Caucase et dans la Russie orientale. Mais le développement régulier et l'on pourrait dire, l'épanouissement de la Phytopathologie en Russie, datent de la dernière décade du 19e siècle. A ce moment on peut tout d'abord noter la première tentative de l'intervention de l'Etat ayant en vue l'organisation d'un service phytopathologique qui se manifeste par la fondation dans les régions viticoles de Comités phylloxériques. Ces Comités, au nombre de trois (Comité de la Tauride, d'Odessa et du Caucase), indépendamment de leur fonction initiale, suffisamment indiquée par leur nom, avaient aussi pour mission l'étude des maladies des plantes cultivées en général et l'organisation de la lutte contre ces maladies; il est juste de dire qu'ils ont rendus certainement de grands services sous ce rapport, et si actuellement l'application des traitements aux sels de cuivre et au souffre est d'un usage courant dans les vignobles du Sud de la Russie, c'est bien à leur activité qu'on le doit. Du reste leur influence ne s'est pas bornée à cela, et notamment le Comité du Caucase fit preuve d'une initiative qui lui fait le plus grand honneur, par la fondation du premier laboratoire mycologique de province au Jardin Botanique de Tiflie, et dont le premier directeur fut Mr. SPESCHNIEV. A peu près à la même époque, l'Université de St. Petersbourg, grâce à l'activité du Professeur GOBI devenait une pépinière de premier ordre pour la Mycologie et la Phytopathologie par la fondation d'un laboratoire spécial de Cryptogamie d'où sortirent par la suite un certain nombre de spécialistes de renom, tels que Mrs NADSON, TRANSCHEL, WORONOCHINE, SERBINOV, DEKKENBACH, NAOUMOV, SIEMASCHKO etc. En même temps commence un période d'exploration mycologique et phytopathologique de différentes régions de la Russie, qui fournit des matériaux très intéressants et variés, permettant d'établir avec précision la dissémination des parasites fongiques dans notre pays. Bientôt une Station de Pathologie Végétale centrale est fondée à St. Petersbourg au Jardin Botanique, dont l'objectif, en dehors des investigations scientifiqus de toute sorte, est précisément de centraliser les renseignements sur les maladies des plantes, ce qui se manifeste entre autres par la publication d'un annuaire spécial.

Le premier cours de phytopathologie en Russie fut fondé par le Professeur S. ROSTOVZEV dans les dernières années du siècle passé, à l'Institut Agronomique de Petrovsko-Razoumovskoie près de Moscou. Peu après des cours pareils furent institués à St. Petersbourg à l'Institut Agronomique pour femmes du nom de Stebout et à l'Ecole Supérieure Agronomique. D'autre part les éléments de mycologie et de phytopathologie étaient enseignés à l'Ecole Polytechnique de Riga, de sorte que les connaissances en phytopathologie commencèrent à se répandre parmi le personnel agronomique d'une façon assez générale. En 1907 fut fondé le Bureau de Mycologie et de Pathologie Végétale du Comité Scientifique du

Ministère de l'Agriculture, qui devint bientôt un centre important d'études mycologiques et phytopathologiques en même temps qu'une pèpinière pour spécialistes de ce genre. Mais il devenait de plus en plus évident que des Laboratoires situés dans la capitale ne pouvaient suffire à tous les besoins de la province et une décentralisation s'imposait, qui peu à peu s'effectua dans les 15 dernières années sous l'impulsion des Congrès de Phytopathologie, qui indiquèrent les grandes lignes du Service Phytopathologique tel qu'il est organisé actuellement. Les principes de cette organisation sont les suivants:

1. Le centre administratif du Service Phytopathologique est représenté par une division de l'Administration supérieure de l'Agriculture, auquel incombe le soin de la répartition des crédits, de la nomination du personnel, de l'acquisition des fungicides, insecticides et autres objets nécessaires, ainsi que la direction générale de tout le service et l'organisation des mesures ayant pour but la lutte en masse contre les parasites particulièrement dangereux tels que les sauterelles etc.

2. La haute direction scientifique du service appartient aux Congrès d'Entomologie appliquée et de Phytopathologie, qui se réunissent tous les ans vers la fin de l'année et prennent connaissance des rapports annuels des Laboratoires et Stations de Pathologie Végétale et de leurs programmes de recherches pour l'année suivante. Tous les projets d'ordre général concernant le service phytopathologique passent à l'examen de ces Congrès, qui ont un Bureau permanent chargé de veiller à l'exécution des dispositions prises par les réunions et de préparer les travaux pour la session prochaine.

3. Le Service Phytopathologique proprement dit comprend trois types d'institutions:

a. Un Institut Central de Mycologie et de Pathologie Végétale, qui est représenté par le Laboratoire de Mycologie et de Phytopathologie du Comité Scientifique et dont les fonctions se résument dans la concentration dans la mesure du possible de tous les matériaux bibliographiques et autres ayant trait à la Mycologie et à la Phytopathologie, afin de faciliter les recherches; c'est en quelque sorte un Laboratoire auxiliaire pour les Laboratoires de province où ces derniers peuvent toujours trouver les matériaux qui leur sont nécessaires et où leur personnel poursuit et complète ses recherches et vient de temps à autres rafraîchir ses connaissances. L'Institut est aussi le centre d'échanges de matériaux d'herbier et de cultures pures. Les recherches personelles du Laboratoire Central ont pour objet les questions mycologiques et phytopathologiques d'un ordre général, et principalement l'étude de la distribution de champignons et des maladies des plantes en Russie, la mycogéographie et l'oecologie mycologique ainsi que la biologie des champignons. Une de ses fonctions consiste dans la préparation des spécialistes Mycologues et Phytopathologues.

b. Des Laboratoires de recherches mycologiques et phytopathologiques auprès des Stations d'essais agricoles régionales, qui ont pour mission l'étude de la flore mycologique et de l'état phytopathologique de la région et les investigations concernant les maladies des plantes ayant un interêt local. Les Stations d'essais agricoles existent dans chaque région suffisamment caracterisée au point de vue de son histoire naturelle et de cette façon il est possible d'obtenir des matériaux fort précieux sur la mycogéographie et l'oecologie des champignons et sur la distribution des maladies des plantes sur notre territoire.

c. Des Stations dites de Défense des Plantes, qui sont plus spécialement chargées du côté pratique de la question, ayant pour mission d'effectuer la lutte contre les maladies des plantes et de populariser les mesures propres à diminuer les pertes que causent ces dernières. Le programme élaboré par les Congrès Phytopathologiques comporte la création de Stations semblables au moins dans chaque gouvernement, mais les questions de budget d'une part et le manque de personnel d'autre part, n'ont pas encore permis de réaliser ce projet dans toute son ampleur; cependant les Stations de Défence des Plantes sont déjà assez nombreuses et il y a lieu d'espérer que leur nombre s'accroîtra peu à peu.

Les Stations de Défense des Plantes comportent deux divisions unies au point de vue administratif, mais tout à fait indépendantes quant à leurs travaux: la Division de Phytopathologie qui s'occupe des maladies des Plantes et des parasites appartenant au règne végétal, et la Division d'Entomologie pratique, ou appliquée, qui a pour mission l'étude des parasites appartenant au règne animal. Le même parallélisme existe du reste dans les autres institutions et aux Stations d'essais agricoles il se trouve généralement un Laboratoire d'Entomologie pratique, et le Comité Scientifique possède également un Institut d'Entomologie appliquée, qui est considéré comme un Laboratoire Central.

Les travaux aux Stations de Défense des Plantes sont dirigés dans le but d'obtenir des résultats immédiatement applicables pour la pratique. Ceci n'exclut pas du reste les recherches d'ordres scientifiques qui doivent former la base de la lutte, et en premier lieu les Stations procèdent à l'étude detaillée de la Flore Mycologique et de la Faune Entomologique de la localité et sont tenues de faire des observations phénologiques concernant les parasites et de tenir compte des particularités biologiques de ces derniers; elles ont aussi à faire des expériences variées avec les fungicides et les insecticides afin d'établir lesquels d'entre eux sont les plus applicables en tenant compte des conditions locales. Toutes ces recherches doivent avoir pour résultat de donner la possibilité aux Stations de porter une aide efficace à la population dans la lutte contre les maladies des plantes, ce qu'elles exécutent par tous les moyens en leur pouvoir, soit en publiant des brochures populaires, ou en faisant des conférences et des cours populaires par l'entremise d'instructeurs spéciaux, soit en établissant des parcelles démonstratives avec application des moyens les plus pratiques pour la lutte, soit en fin en effectuant les traitements chez les cultivateurs de la région.

Cette organisation qui prévoit la répartition du travail entre les différentes Institutions semble assez adaptée au but que l'on se proposait et il est juste de dire qu'elle a rendu déjà des services importants. Le trait d'union entre les diverses Stations et Laboratoires, représenté par les Congrès annuels donne en quelque sorte une forme compacte à toute l'organisation et établit l'harmonie et la régularité dans les recherches.

Indépendamment de ce système de Laboratoires fixes, l'administration supérieure organise encore dans certains cas des expéditions spéciales pour la destruction de parasites dangereux dont l'apparition en masse devient un danger sérieux pour l'agriculture dans une région donnée. Ces expéditions sont préalablement examinées et approuvées par les Congrès annuels, qui en indiquent les grandes lignes. Ainsi dans ces dernières années de grands travaux de ce genre ont été effectués, principalement dans le Sud-Est de la Russie d'Europe et dans la Russie d'Asie pour la destruction des sauterelles et des rongeurs, contre lesquels entre autres on a employé avec succès les gazs asphyxiants en usage dans la dernière guerre. Jusqu'à ces derniers temps les expéditions de ce genre avaient en vue exclusivement la lutte avec les représentants du règne animal mais précisément cette année on a commencé à appliquer le même principe contre les parasites végétaux dont l'apparition en masses constitue une menace sans cesse grandissante. Notamment le charbon des céréales s'est répandu ces dernières années dans des proportions inquiétantes et il importait de prendre des mesures énergiques pour prévenir sa dissémination. A cet effet des expéditions ont été projetées ce printemps dans la Sibérie occidentale et dans un certain nombre de Gouvernements de la Russie d'Europe pour effectuer en masse la stérilisation des graines de céréales à l'aide du formol. Les résultats de cette première entreprise ne tarderont pas à se manifester et il y aura lieu d'apprécier si ce moyen de lutte pourra être appliqué dans l'avenir et peut-être contre d'autres parasites.

Une des préoccupations importantes de l'heure présente, c'est la création d'un cadre de spécialistes phytopathologues et entomologistes. Les dernières années tragiques ont crées de grands vides parmi les spécialistes de tout ordre et le personnel manque même pour les Stations qui fonctionnent actuellement; ceci est d'autant plus grave, qu'il est indispensable comme on l'a vu plus haut de fonder de nouvelles stations. Dans la plupart des Hautes Ecoles d'Agriculture il existe actuellement des chaises de Pathologie végétale et d'Entomologie appliquée, mais il est évident que les étudiants sortant de ces Ecoles n'ont que des notions fort générales en phytopathologie et ne peuvent être considérés comme des spécialistes. Quelques uns d'entre eux font il est vrai un stage à l'Institut de Pathologie Végétale de St. Pétersbourg et deviennent de bons spécialistes, mais le nombre de ces stagiaires est forcément assez limité. L'idée s'imposait donc de fonder un Institut spécial pour la préparation de Phytopathologues et d'Entomologistes, et l'honneur de son exécution en revient au directeur de la Station de Défense de Plantes de St. Pétersbourg, Mr. N. N. Bogdanov—Katjkov, qui sût avec une énergie rare vaincre les difficultés peu habituelles des temps présents, et fonder en 1922 l'Institut d'Entomologie appliquée et de Phytopathologie qui fonctionne actuellement et donnera bientôt, il faut l'espérer un premier contingent de spécialistes phytopathologues et entomologistes. Les jeunes gens des deux sexes y sont admis seulement après avoir fini une Ecole supérieure et y suivent un cours de deux ans et demi, d'après un programme très complet. L'institut comporte deux facultés parallèles: la faculté de Phytopathologie et la faculté d'Entomologie appliquée. Le premier semestre les études se font en commun pour les deux facultés en ce qui se concerne l'Entomologie, la Mycologie, la Phytopathologie générale, la Microbiologie, la Physiologie végétale, etc. Ensuite vient la spécialisation et les facultés ont désormais leur programme spécial. Le dernier semestre d'été est consacré à un stage dans une Station locale, pendant lequel l'étudiant est tenu de travailler à une dissertation sur un sujet spécial.

Le développement de la Phytopathologie en Russie et l'organisation du service dont nous avons présenté ici une esquisse, a donné des résultats qui se résument dans un grand nombre de travaux parus dans l'espace d'une trentaine d'années, grâce auxquels nous pouvons dire que la flore mycologique et l'état phytopathologique d'une grande partie de la Russie a été assez bien exploré, mais il reste naturellement beaucoup à faire et il faut espérer que les malheureuses circonstances qui ont paralisé tout progrès finiront par s'évanouir, et une atmosphère plus propice à un travail intellectuel nous permettra de pénétrer plus avant dans la connaissance des richesses mycologiques et phytopathologiques de notre pays.

ESSAI DE CLASSIFICATION DES PHÉNOMÈNES PATHOLOGIQUES CHEZ LES VÉGÉTAUX

PAR

A. DE JACZEWSKI

Bien que la Phytopathologie soit une discipline spéciale, dont le développement a fait de grands progrès, surtout dans les derniers temps, il faut reconnaître qu'elle ne s'est pas encore affranchie et en quelque sorte cristallisée comme sa soeur ainée, la pathologie humaine. Dans la pratique elle se confond absolument avec la Mycologie et l'Entomologie, et ne sort pas ou presque pas du cadre de ces sciences, n'entrant que très incidemment dans le domaine de la Bactériologie et encore moins dans celui de la Physiologie. En somme la Phytopathologie telle qu'elle est comprise actuellement est plutôt un cours de parasitologie, qui peut être consideré comme une annexe de la Mycologie et de l'Entomologie, et dont elle suit les grandes lignes. Il est de fait que dans les descriptions des cas pathologiques toute l'attention est concentrée sur le parasite et sur la place qu'il occupe dans le système de classification usité dans le groupe auquel il appartient, tandis que les phénomènes pathologiques qu'il produit dans les tissus infectés passent presque inaperçus ou sont décrits d'une façon très élémentaire et pour la plupart du temps insuffisante. Il est clair qu'il y a ici quelque chose d'abnormal et si en pathologie humaine le même principe avait été appliqué, la médecine serait dévenue une comparse de la Bactériologie. La base de toute pathologie doit être, évidemment, l'étude approfondie des modifications et lésions produites dans l'organisme par le cas morbide indépendamment de sa cause. En Phytopathologie, en partie en vertu du développement historique de cette Science, il s'est produit une certaine déviation de ce principe, et l'étude de la plante malade a été quelque peu négligée au profit des investigations sur la cause du mal. Grâce à cela nous n'avons pas jusqu'à présent de groupement des maladies d'après les symptômes pathologiques et les classifications usitées se bornent à ranger les cas morbides, soit selon les plantes nourricières, soit en se conformant aux systèmes adoptés en Mycologie ou en Entomologie.

Cet état de choses peu conforme à l'importance de la discipline ne pouvait manquer d'attirer l'attention des spécialistes et l'on peut déjà constater plusieurs essais de remédier à l'insuffisance indiquée, notamment ceux de COULTER (Fundamentals of Plant Breeding. Chicago, 1914), de STEVENS (Problems of Plantpathology, Bot. Gazette, 1917, p. 279), et plus récemment de O. APPEL et J. WESTERDIJK (Die Gruppierung der durch Pilze hervorgerufenen Pflanzenkrankheiten; Zeitschrift für Pflanzenkrankheiten, XXIX, 1919, p. 176)[1]. Il n'entre pas dans mon idée de faire ici la critique de ces essais, fort intéressants du reste, et qui ont chacun leur avantage, mais il faut remarquer qu'ils ne résolvent pas encore la question dans toute sa plénitude, car ils ne tiennent compte toujours que des parasites, et n'embrassent par conséquent qu'une partie de la Pathologie végétale. En se plaçant au point de vue de la Phytopathologie pure la classification des maladies doit avoir pour base uniquement les symptômes morbides, abstraction faite de la cause qui les détermine, en tenant compte des réactions provoquées dans les tissus de l'organisme affecté. Dans cette conception le pivot central est représenté par la plante malade et il importe tout d'abord d'établir ce que l'on pourrait appeler le caractère clinique de la maladie et son cours progressif, avec toutes les modifications qu'il comporte successivement. Il est évident, que des causes différentes peuvent amener des effets parfaitement semblables, et d'autre part des éléments analogues peuvent déterminer des effets pathologiques fort divers; c'est ce que l'on constate fréquemment dans la nature. Mais il n'est pas moins nécessaire de fixer la nature des processus morbides qui se développent dans l'organisme de la plante malade, et de tenter de les grouper d'après des caractères symptomatiques. C'est le rôle de la Pathographie générale, dont on n'a pas assez tenu compte en Pathologie végétale, bien qu'elle soit d'un grand interêt scientifique et qu'elle doive être considérée comme la base de cette Science. Nous ne voulons pas dire par là qu'un groupement d'après les caractères symptomatiques doit remplacer ou exclure toute autre classification en vigueur. Il s'agit tout simplement de répartir les phénomènes pathologiques entre différents types conformément aux modifications externes ou internes qu'ils provoquent dans les tissus végétaux. Ceci n'est certainement qu'une des étapes à parcourir dans l'étude de la Phytopathologie, et en passant à l'étiologie, qui forme l'étape suivante, on aura à s'occuper des causes primordiales des maladies, et à ce moment il sera nécessairement indiqué de recourir aux classifications courantes pour la détermination spécifique des champignons, bactéries, insectes, acariens etc., ou bien de tenir compte des théories admises en Météorologie, Physiologie végétale etc.

Déjà en 1910, dans le premier tome de mon ouvrage „Les Maladies des Plantes (St. Petersbourg, 1910)", j'avais tenté de généraliser et de systématiser les phénomènes pathologiques observés dans les Plantes d'après leurs caractères symptomatiques. Le développement de cette idée devait être poursuivi dans le second tome, qui selon

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[1]) See Dr. APPEL's paper. p. 226. — (ED.)

toute probabilité, étant donné les événements, n'est plus destiné à paraître. L'influence des phénomènes morbides se manifeste d'une part par des symptômes extérieurs, tels que l'apparition de corps étrangers, des variations morphologiques plus ou moins considérables, de nouvelles productions de tissus ou d'organes, ou une désorganisation plus ou moins profonde. D'autre part, il se produit en même temps que ces changements externes, ou, quelquefois tout à fait indépendamment de cela, des modifications internes, caracterisées soit par des anomalies anatomiques, soit par des transformations chimiques dans les tissus ou dans certaines cellules. Malgré la variété de ces changements, qui se complique encore par le fait que les sujets d'investigations, c'est à dire les plantes sont par elles-mêmes très diverses, selon la place qu'elles occupent dans la classification, il est tout de même possible d'obtenir un groupement naturel, car nous retrouvons ici la même régularité, dont Mr. VAVILOV a fait un tableau si précis en établissant le principe de l'homologie des variations. De même que dans une plante normale ou peut retrouver dans l'amplitude de ses variations une certaine régularité et un parallélisme constant avec les variations dans d'autres unités taxonomiques fort éloignées au point de vue phylogénétique, de même, les phénomènes pathologiques paraissent régis par les mêmes lois d'homologie. Ainsi, par exemple l'hypertrophie des cellules se retrouve aussi bien dans les hyphes des champignons, que dans les bâtonnets des Bactéries, les filaments des algues ou les tissus des végétaux supérieures.

Il en est de même pour l'hyperplasie ou d'autres phénomènes morbides, tels que la dégénérescence graisseuse etc. que l'on retrouve dans les tissus des plantes les plus diverses, tant les plus simples (levûres), que les plus compliquées par leur structure. Dans chaque cas spécial ces phénomènes peuvent acquérir certaines modifications en rapport avec les caractères spécifiques de l'organisme pris comme sujet, mais indépendamment de ces fluctuations, l'homologie peut être suivie et la similitude du type général de la variation se conserve. Dans certains cas, il se produit une complication sous forme d'accumulation des caractères, quand un processus pathologique détermine l'apparition successive ou même simultanée de symptômes différents et fort distincts. D'autre part, un cas pathologique peut être produit par l'action simultanée de plusieurs causes, ce qui amène la production d'une anomalie souvent fort complexe. Il est tenu compte de tout cela dans le système proposé, qui permet de suivre la marche progressive des phénomènes morbides dans la plante, conformément au cours de la maladie. C'est ainsi que lors de l'infection d'une plante par une *Urédinée*, par exemple, on notera tout d'abord l'apparition de taches sur les feuilles, ensuite une hyperplasie plus ou moins prononcée, jointe à des phénomènes métaplastiques, tels qu'une pigmentation souvent très caractéristique et une accumulation de fécule. Dans d'autres cas il s'y joindra une atrophie partielle et peut être des déformations. On obtient de la sorte un tableau complet de la marche de la maladie et une détaillisation plus parfaite de ces phénomènes permettra sans doute de trouver des points de repère suffisamment distincts pour la caractériser pleinement; cette détaillisation s'impose certainement, mais il serait peut-être encore trop tôt de l'entreprendre, car nous possédons encore trop peu de matériaux à cet effet, et il convient de les accumuler en prenant pour exemple les beaux travaux de KUESTER (Pathologische Pflanzenanatomie, 1e édition 1903, 2e édition 1916). Pour le moment on pourrait établir seulement les grandes lignes d'un groupement général tel que nous le présentons ici. En y procédant il a fallu tenir compte à la fois des variations physiologiques et morphologiques, ce qui pourra paraître au premier abord difficilement conciliable. Mais précisément en Pathologie végétale, les deux principes se confondent ou plûtot s'harmonisent, car tout cas pathologique a pour origine une action physiologique qui amène comme résultat inévitable une anomalie morphologique plus ou moins prononcée.

A. Présence de corps étrangers à la surface des organes de la plante malade.
   a. Présence à la surface des organes affectés de la plante (racines, branches, tiges) de parasites végétaux supérieurs, qui provoquent souvent au point d'insertion une hyperplasie plus ou moins prononcée (Voir B. a.).
      Exemple: *Orobanche* sur les racines, *Cuscute* sur les tiges, *Gui* sur les branches.
   b. Enroulement autour de la plante entière ou de certaines de ses parties de corps étrangers recouvrant simplement sa surface, ou plus ou moins incrustés.
      1. Formation de coussinets verts.
         Exemple: *Mousses*.
      2. Formations de croûtes plus ou moins étendues, disposées librement à la surface ou plus ou moins incrustantes.
         Exemple: *Lichens, Algues parasites (Mycoidea)*.
      3. Incrustations membraneuses, subéreuses ou en masses pulvérulentes, souvent recouvertes dans ce dernier cas de cristaux d'oxalate de chaux.
         Exemple: *Thelephoracées, Polyporacées* (*Poria*), *Myxomycetes*.
      4. Formation d'un duvet araneux blanc, devenant par la suite quelquefois brun.
         Exemple: *Erysiphées* (Voir C. *c*. 5. *a*.).

5. Formation de pellicules membraneuses noires plus ou moins étendues à la surface des organes.
   Exemple: *Fumagine.*

c. Apparition à la surface des organes des plantes (Racines, tiges, troncs, branches, feuilles) de corps étrangers boursouflant l'épiderme et recouverts par lui ou paraissant à l'extérieur.
   1. Boursouflures de l'épiderme, restant recouvertes ou se crévessant au sommet.
   Exemple: *Pyrénomycètes* sur les branches, *Melanconiées.*
   2. Apparition de coussinets noirs ou colorés, ou bien de cupules, sortant des crevasses, ou formés à la surface.
   Exemple: *Pyrénomycètes, Discomycètes, Tuberculariées.*
   3. Apparition de corps gélatineux plus ou moins volumineux.
   Exemple: *Tremellinées, Gymnosporangium.*
   4. Formation de corps charnus, volumineux en forme de console ou de parasol.
   Exemple: *Polyporacées, Agaricinées.*

B. Modifications d'ordre progressif dans les tissus.

a. Métaplasie. Modifications internes dans la composition du contenu de la cellule ou de sa membrane, ne comportant pas de changement appréciable excepté, dans certains cas, une différence de couleur.
   1. Formation de pigments inusités dans la cellule.
   Exemple: *Rougeôle.*
   2. Changements chimiques du contenu des cellules.
   Exemple: *Accumulation de fécule; élaboration de principes amers (Concombres amers, pommes amères), ou d'éléments toxiques (Seigle énivrant).*
   3. Changements chimiques de la membrane des cellules.
   Exemple: *Subérisation, lignification, épaississement total ou partiel des parois.*

b. Hypertrophie. Augmentation de volume d'une ou de plusieurs cellules sans multiplication.
   Exemple: *Etiolement, formation de thylles, formation de galles simples unicellulaires, grandissement des lenticelles, oedème, intumescences, croissance du callus.*

c. Hyperplasie. Augmentation de volume des cellules avec multiplication intense.
   1. Croissance éxubérante des tissus.
   Exemples: *Enflures, tumeurs, zoocécidies, mycocécidies, bactériocécidies, fasciation.*
   2. Nouvelles formations.
   Exemple: *Buissonnement, balais de sorcières.*

d. Transformations d'ordre progressif.

Exemple: *Pistillodie.*

C. Modifications d'ordre régressif dans les tissus. (Hypoplasie).

a. Diminution du volume des cellules dans l'organisme ou une des ses parties.
Exemple: *Epuisement par défaut de nourriture; amoindrissement du volume des tubercules chez les plants de pomme de terre atteints d'enroulement.*

b. Diminution du nombre des cellules dans les tissus.
Exemple: *Nanisme; amoindrissement des organes.*

c. Modifications d'ordre regressif à l'intérieur des cellules.

1. Diminution ou disparition totale de la chlorophylle dans les organes normalement verts.
Exemple: *Chlorose, Mosaique, Albinisme.*
2. Diminution ou disparition totale des pigments.
Exemple: *Virescence.*
3. Diminution ou disparition de la fécule dans les cellules.
Exemple: *Influence du refroidissement du milieu ambiant sur les feuilles.*
4. Diminution ou absence totale de produits d'élimination.
Exemple: *Absence des cristaux d'oxalate de chaux dans les feuilles atteintes de Zoocécidies.*
5. Mort prématurée de la cellule (Nécrose).

α. Taches sur les feuilles, les fruits, les rameaux, sans détachement des parties attaquées.
Exemple: *Phyllostictose, Septoriose, Erysiphacées.*

β. Taches sur les feuilles avec détachement des parties attaquées, ce qui produit des trous dans les tissus.
Exemple: *Phyllostictose, Cercosporiose. Clasterosporiose.*

γ. Nécrose accompagnée de brunissure ou de noircissement des tissus.
Exemple: *Brûlures par les rayons de Soleil; bactérioses de l'écorce.*

d. Modifications d'ordre régressif affectant le contenu et la membrane de la cellule.

1. Pourriture humide. Gélification des membranes.
Exemple: *Pourriture des semis; pourriture grise par le Botrytis.*
2. Pourriture sèche. Résorption de la substance intercellulaire et dislocation des tissus.
Exemple: *Pourriture du bois, Fusariose des tubercules de Pomme de Terre.*
3. Transformation partielle ou totale des tissus en substances muqueuses.
Exemple: *Ecoulement muqueux des arbres; gommose; résinose.*
4. Momification. Dessication et ratatinement des tissus.

Exemple: *Moniliose; maladie de l'encre.*

5. Chancres.
   Exemple: *Gloeosporiose des feuilles, des fruits et des tiges ou branches; dartroses; chancres des arbres fruitiers et d'autres plantes; Fusarioses et Venturioses.*
6. Absence ou retard de différenciation dans les tissus.
   Exemple: *Structure des feuilles se développant dans l'obscurité.*
7. Infraction des rapports normaux dans la production des tissus.
   Exemple: *Structure des tumeurs.*

e. Régression dans la structure et oblitération des systèmes vasculaires (Vasculariose), Gélification ou durcissement de leur paroi.
Exemple: *Nécrose du Phloême; pourriture du collet (pied noir) des semis; Fusariose du lin, du cotonnier, du Sésamier.*

f. Atrophie totale ou partielle. Réduction ou disparition de certains organes.

1. Atrophie générale.
   Exemple: *Filosité de la Pomme de Terre.*
2. Atrophie partielle.
   α. Réduction ou disparition simple de certains organes.
   Exemple: *Arrêt de développement des organes floraux chez les plantes malades; réduction des feuilles; pochettes des prunes.*
   β. Atrophie accompagnée de transformations d'ordre régressif.
   Exemple: *Chloranthie; viviparité; phyllodie; sépalodie; staminodie; pétalodie.*
   γ. Atrophie provenant du remplacement des tissus par des formations étrangères.
   Exemple: *Ergot des céréales; charbon des graines (Tilletia), des étamines (Ustilago violacea).*

D. Les tissus et les organes conservent leur forme et leur volume, mais subissent des modifications d'aspects.

1. Dessication subite de plantes entières ou de certaines parties.
   Exemple: *Coup de soleil; effets du brouillard sec.*
2. Dessication lente et progressive de certaines parties des plantes.
   Exemple: *Pourriture grise der cerisiers.*
3. Boursouflure de la cuticule.
   Exemple: *Le plomb des arbres et arbrisseaux.*
4. Recrocquevillage des feuilles.
   Exemple: *Enroulement des feuilles de la Pomme de terre.*
5. Déformation des organes.

Exemple: *Courbure des pousses de Pins atteints de Melampsora pinitorquum.*

6. Lésions traumatiques (Plaies et blessures).
   Exemple: *Frottements; gélivure; roulure; lunure; effets de la foudre.*
7. Soudure des cellules.
   Exemple: *Formation de cellules géantes dans les tissus à plusieurs noyaux.*
8. Hétérotopie. Formation de cellules et de tissus normaux à des endroits anormaux.
   Exemple: *Formation de tubercules aériens dans la Pomme de terre; bourgeons adventifs.*
9. Hétérochronie. Formation de cellules et de tissus normaux à un temps anormal.
   Exemple: *Double couches annuelles du bois; floraison répétée la même année.*

MOYENS D'ÉVALUATION DES DOMMAGES CAUSÉS PAR LES PARASITES CRYPTOGAMES

PAR

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I. Considérations générales.

On sait que les maladies des plantes peuvent souvent atteindre un degré de développement considérable; par consequent les dommages causés sont representés par des chiffres énormes. Mais malgré l'étendue des connaissances actuelles sur les causes des maladies, on n'est pas arrivé à en évaluer les consequences d'une manière précise, et un moyen pratique, simple et exacte d'en déterminer les dégâts est encore à désirer.

Or pour évaluer les pertes pécuniaires on devrait connaître préalablement le degré de l'intensité de l'attaque, et c'est encore une lacune à combler, car les moyens qui ont été employés jusqu'ici sont arbitraires ou accidentels et ne sont basés sur aucun fonds scientifique. Nous nous proposons de nous occuper ici de cette dernière partie de la question, partie qui devrait être logiquement la première, en abandonnant à d'autres la détermination du rapport entre le degré de l'attaque et les dommages pecuniaires.

Les moyens à recommender de déterminer l'intensité de l'attaque doivent satisfaire aux conditions suivantes: donner des résultats exactes et comparables les uns aux autres, non seulement aux yeux du même observateur, mais d'une manière générale; ainsi l'erreur personnelle devrait en être éliminée autant que possible; ils doivent enfin être pratiques, simples, peu encombrants; toutefois la simplicité ne devrait étre achetée au prix de l'éxactitude. Une methode simplifiée pourrait trouver un emploi dans le vaste domaine de l'agriculture appliquée, tout en étant basée sur les mêmes principes.

Toutes les fois qu'il s'agit de définir l'intensité de l'attaque en général on se heurte à des difficultés, dont la source est dans le fait, que les limites de cette notion sont mal définiés. Tantôt on entend par ce nom le degré de l'attaque des fruits d'un seul arbre, tantôt on le rapporte à un verger donné; ou bien on prend pour unité l'intensité de developpement du champignon parasite sur chaque fruit pris à part, etc. En cas de rouille des céréales la confusion est des pires, et le choix de l'unité de la mesure de l'invasion dépend uniquement des préférences et des goûts de l'investigateur. Le chemin le plus sûr de se débrouiller dans cette idée complexe est de se mettre d'accord sur les dénominations.

La fréquence de l'hôte (N) dans un lieu donné est une quantité dont on n'a pas à s'inquiéter dans le cas des plantes cultivées, puisque leur nombre est égal a l'infini (comme pour les céréales) ou il peut être évalué approximativement ou d'une manière précise, si cela est nécessaire.

Que l'on se représente l'ensemble des plantes de la même espèce qui servent d'objet à notre investigation; nous pourrons établir le nombre des plantes atteintes (n); le rapport n : N représentera la fréquence de l'attaque; souvent cette indication peut déjà nous satisfaire; mais le désir de précision et d'exactitude, de même que les particularités du parasite ou de la plante elle même, nous forcent d'aller au delà, et d'établir le nombre (x) et la fréquence (x : m) de l'invasion des organes similaires de la plante (m étant le nombre total de ces organes), comme par exemple des fruits dans le cas des maladies des arbres, ou des feuilles dans le cas de la rouille, etc. Remarquons que les notions que nous venons de citer sont des quantités.

Enfin, de la comparaison de l'invasion des parties similaires on déduit la notion du degré de l'attaque; cette dernière conception, contrairement aux précédentes, n'est plus une quantité, mais une intensité. Tandis que l'établissement de l'expression de la fréquence de l'attaque de la plante et de celle des parties similaires n'offre aucune difficulté, il n'en est pas de même pour le degré de l'attaque. Nul doute que suivant les cas on devra recourir à des symboles divers, que l'on choisira d'après les particularités de la maladie ou des caractères spéciaux du parasite et de l'hôte. Remarquons encore que dans certains cas le degré de l'attaque peut acquérir une valeur constante et invariable; ainsi, le degré de l'attaque du charbon et de la carie du blé offre toujours une valeur constante et limite, puisque ces maladies, toutes les fois qu'elles apparaissent dans un épi, l'altèrent uniformement et complètement (sans faire mention des cas rares et sans importance où l'épi est atteint partiellement). Dans le cas de l'ergot, au contraire, cette intensité peut acquérir une valeur numérique plus ou moins grande, parce que l'ergot rend stérile un nombre d'épillets variable.

En résumé, l'idée complexe de „l'intensité de l'attaque" se réduit à une série de conceptions subordonnées, notamment, la fréquence de l'attaque de la plante, celle des parties atteintes et le degré de l'attaque.

L'étude des types variés des invasions des plantes par les cryptogames permet d'entrevoir les rapports qui existent entre ces conceptions.

Supposons un cas que l'on trouve parfois réalisé, quand la culture dont on s'occupe est constituée d'une série de parcelles offrant une résistance inégale; chaque parcelle consiste en un nombre suffisamment grand d'individus de la même variété et tous susceptibles au même degré; supposons ensuite que les conditions du milieu extérieur agissent uniformément en tous les points du champ (les cultures des céréales offrent l'exemple de rapprochement à un cas pareil); on verra en examinant ces parcelles qu'à mesure que diminue le degré de l'attaque des parties données de la plante, le nombre des parties atteintes baisse aussi; bien plus, le nombre des plantes envahies subit lui-même un décroissement; d'où l'on déduit la règle que la fréquence de l'attaque des individus donnés dépend d'une certaine façon de la fréquence de l'attaque des organes, et que cette dernière dépend également du degré de l'attaque. En résumé, n est fonction de x, et x est fonction de d.

Les rapports exactes de ces facteurs, qu'on vient d'entrevoir à peine, sont encore à établir; ils doivent faire l'objet d'une étude spéciale que nous abandonnons aux mathématiciens, puisque la question se résoud en un simple problème de mathématique dont l'objet seul est du domaine de la Pathologie végétale; sans y insister davantage, nous croyons possible d'admettre l'hypothèse qu'entre les facteurs nommés, exprimés en moyennes, il existe un rapport direct. Notre problème se décompose en une série consécutive de questions partielles, conformément au nombre des facteurs ($d, x, m, N.$). On peut se représenter le plan du problème dans sa forme la plus générale comme il suit; nous ferons observer toutefois que pour se servir des indications obtenues ici, il est indispensable de se mettre préalablement d'accord sur certains points essentiels, savoir: établir d'avance le degré de précision désiré pour calculer chacun des résultats partiels; assigner une valeur numérique au symbole de l'échelon inférieur (le degré de l'attaque).

La forme la plus générale de la proposition se présente ainsi à notre avis: sont données comme connues: *d*, *x*, *m*, *N*, etc. La quantité à trouver est „le degré de l'attaque de la culture" (d'un champ par exemple, etc.).

Eléments connus	Eléments à trouver
1. Degré de l'attaque d'une partie donnée (par ex. nombre de pustules d'urédo sur une feuille donnée) . p 2. Nombre des feuilles atteintes x	Degré de l'att. de la feuille en moyenne $= \frac{p_1 + p_2 + p_3 \cdots + p_x}{x} = F$
3. Nombre total des parties (feuilles) atteintes . . . . m	F: Degré de l'att. de l'individu en moyenne $= \frac{F \cdot x}{m} = P$
4. Nombre des plantes atteintes dans une parcelle (champ) donnée . . . . N′ 5. Nombre total des plantes . . . . N	P: Degré moyen de l'att. d'une parc. (champ) $= \frac{F \cdot x \cdot N'}{m \cdot N} = \frac{P \cdot N'}{N} = A$

En continuant de raisonner de la même manière, il sera probablement possible de déterminer, le degré de l'attaque moyenne pour une série de parcelles: $\frac{A.Q'}{Q.}$, Q étant le nombre total des parcelles, et Q′ le nombre des parcelles atteintes.

Si toutes les plantes sont infectées, $N^1 = N$, et A devient égal à $\frac{F.\ x}{m} = P$. Si toutes les feuilles sont infectées, $x = m$, et $P = F$: la valeur moyenne du degré de l'attaque de la plante est égal à la valeur moyenne du degré de l'attaque de la feuille; de plus, A devient égal à F: le degré de l'attaque d'un champ est égal à la valeur moyenne de l'infection de la feuille.

II. Moyens de déterminer la valeur du degré de l'attaque (d)

L'étude des maladies des plantes du point de vue qui nous intéresse ici nous conduit à admettre l'existence de deux groupes de maladies: *1er groupe*, où l'effet du parasite sur la plante est tel qu'il n'y a aucun rapport direct entre le degré de l'attaque et les pertes qu'on en souffre; ici viennent se ranger la rouille, les maladies dues aux *Peronosporées* (en majorité), aux *Erysiphées*, aux *Exoascées* (sauf les pochettes) et à la multitude des champignons causant des „taches" des feuilles. Bref, dans ce groupe tout notre interêt est porté à déterminer la valeur de *d*.

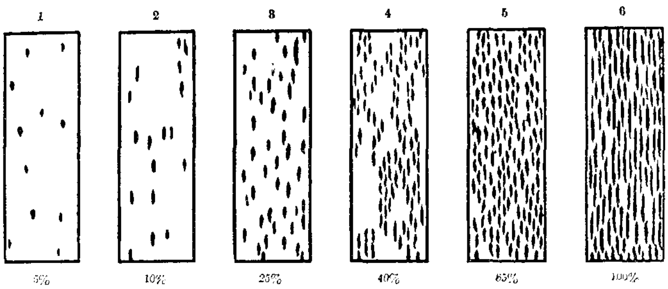
2me groupe, où la plante est atteinte d'une telle manière que les pertes qui dérivent de l'attaque dépendent de la quantité des organes atteints. Exemples: la carie, le charbon, l'ergot, le piétin, etc. Bref, dans ce groupe la valeur de *d* est constante et ce qui nous intéresse ici, s'est la fréquence de l'attaque des organes et leur nombre, ainsi que la fréquence de l'infection des individus ($x : m$; x; $n : N$).

Nous nous occuperons dans ce chapitre des maladies du I er groupe et des moyens d'en déterminer le facteur en question (d).

Parmi les méthodes proposées celle des „échelles" (scales) est celle qu'on emploie le plus souvent. Le principe consiste, comme on le sait, a évaluer „l'attaque" en la comparant aux échelons d'un étalon fixe; ce procédé est analogue à celui des quincaillers qui, pour déterminer l'épaisseur des feuilles de tôle ou le diamètre du fil de fer emploient des calibres fixes. Des échelles ont été proposées en pathologie végétale par ERIKSSON (1898) et par MELCHERS et PARKER (1922); celle d'ERIKSSON fut modifiée en 1907 par M. A. DE JACZEWSKI et en 1912 par M. N. LITWINOFF. Toutes ces échelles souffrent d'un défaut commun, d'être peu souples: en effet, elles tendent à caractériser les cas innombrables et infiniment variés que nous offre la nature, en les rangeant dans un nombre restreint (4 à 9) de catégories, ce qui est beaucoup trop peu. On comprend le désir de M. LITWINOFF d'augmenter le nombre des degrés de l'échelle d'ERIKSSON jusqu'à 9, mais en le faisant il n'a pas osé abandonner les chiffres 0—4, devenus classiques, ce qui l'a forcé à se servir de symboles encore moins pratiques, comme „0—1", 2"—3", etc.

Si l'on se demande la manière dont on doit se servir de ces échelles, on obtiendra une réponse indécise; en effet, doit on rapporter le degré qui est indiqué dans l'échelle aux feuilles d'une et même plante, ou à toutes les feuilles du même étage, ou bien à la plante entière ou à un groupe donné de plantes? Ceci est fort peu précis. De plus, l'emploi de toutes ces échelles laisse une large place à l'erreur personnelle, et les résultats obtenus sur un même lot de plantes par différents expérimentateurs peuvent différer considérablement. Enfin, les points cardinaux de ces échelles sont peu précis: on trouve à la base l'indication „O", cas qui nous offre le moins d'intérêt; l'opposé est représenté par le chiffre „4", ce qui signifie l'extrême degré d'invasion; mais ne peut-on pas se représenter une attaque dont le degré sera supérieur à ce „4"?

L'échelle de MELCHERS et PARKER (1922), extrèmement artificielle, est basée sur une série de conventions; les figures de la distribution des pustules qu'elle représente sont arbitraires; d'où une certaine indécision dans le choix des numéros à prendre et le manque de précision dans les résultats obtenus. En outre le point cardinal supérieur en est fort mal défini: on désigne d'une manière tout arbitraire du chiffre de 100 p. c. (le n°. 6 dans la fig.) le cas quand les 37 p. c. de la surface totale de la feuille sont couvertes de pustules de rouille; les points intermédiaires prennent leur origine de celui-ci; ainsi, N 5 est celui où les 65 p. c. de la surface représentée par le n° 6 sont couvertes de rouille; puis viennent les numéros 4 (équivalant au 40 p. c.), 3 (25 p. c.) 2 (10 p. c.) et 1 (5 p. c.).



L'échelle proposée par M. LITWINOFF a certains avantages. Non seulement est-elle plus détaillée, mais elle est mieux fondée dans son ensemble; elle est basée sur un fait qui aurait droit à être appelé règle: „dans l'attaque du blé par la rouille, l'intensité de l'attaque des feuilles augmente de haut en bas: ainsi, chaque feuille donnée est infectée moins que toutes celles qui lui sont inférieures, et plus que celles qui lui sont supérieures". (V. supplement à la communication, p. 257). Les resultats obtenus par cette méthode sont comparables les uns aux autres.

Outre des échelles on peut employer divers autres procédés, dont nous citerons un ou deux. Le premier consiste à prendre comme unité le nombre de pustules par feuille (pour P. *triticina*, P. *dispersa*, etc.). C'est le moyen le plus compliqué et le plus sûr. Un oeil exercé peut pourtant facilement estimer le nombre des pustules sans les compter, à une dizaine près; on obtient de cette manière une espèce d'échelle, ou les degrés ne sont nullement arbitraires mais dépendent intrinsèquement de l'intensité de l'invasion; elle est libre des inconvénients que présentent les échelles fixes. Pour la rouille jaune (*P. glumarum*) on pourrait nommer intensité de l'attaque la superficie des parties atteintes de la feuille, exprimée en parties de la superficie entière du limbe. Dans d'autres maladies il sera nécessaire d'exprimer la valeur de *d* d'une manière différente, suivant les particularités de l'invasion.

III. Moyens de déterminer la fréquence de l'attaque.

Dans la deuxième catégorie de maladies établie plus haut la valeur qui sert à en caractériser la force est ce que nous appelons la fréquence de l'attaque. Il suffit pour l'établir de déterminer le nombre des parties atteintes ou celui des plantes attaquées. Souvent on a recours aux deux quantités simultanéments. Nous choisirons comme exemple de maladies de ce groupe celle qui est produite par l'*Urocystis occulta.*

On choisit dans le champ à étudier un nombre suffisamment grand de parcelles. En partant du nombre des plantes qui s'y trouvent, on voit que leur superficie ne peut être inférieure à 1 mètre carré; nous nous sommes servis le plus souvent de parcelles rectangulaires, ayant 2 M. de long sur $^2/_3$ de large. Des parcelles moins grandes donnent des resultats moins sûrs; le plus souvent ces résultats sont supérieurs aux vrais chiffres. La forme étroite des parcelles recommendées offre l'avantage de faciliter la recherche des chaumes malades. Dans chaque parcelle on établit les quantités suivantes: le nombre total des plantes (N), celui des plantes atteintes (n), la quantité des chaumes malades (x), le nombre total des chaumes (m), enfin le nombre des chaumes sains dans les plantes infectées (k). Il suffit de noter sur place le nombre total des chaumes pour chaque pied séparément (1re colonne) et celui des chaumes infectés (2me colonne), d'où l'on déduit facilement les quantités citées, ainsi que plusieurs autres éléments ayant de la valeur pour l'investigateur, comme le nombre de pousses par pied, etc.

SUPPLÉMENT

Echelle de Litwinoff *(pour les rouilles du blé, P. triticina et P. glumarum).*

1.	Absence totale de pustules	0
2.	Pustules isolées sur les feuilles inférieures	0—1
3.	Pustules isolées sur les feuilles des zones plus élevées, et plus nombreuses sur les feuilles inférieures..........	1
4.	Quatrième feuille d'en haut envahie au plus haut degré..	1—2
5.	Troisième feuille d'en haut envahie au plus haut degré..	2
6.	Deuxième feuille d'en haut envahie complètement......	2—3
7.	Pustules abondantes sur la feuille supérieure............	3
8.	Pustules très abondantes sur la feuille supérieure........	3—4
9.	Infection totale de la feuille supérieure................	4

ESSAI D'ÉVALUATION DES PERTES CAUSÉES AUX ESPÈCES FORESTIÈRES PAR LES CHAMPIGNONS PARASITES

PAR

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Pour obtenir une notion exacte des pertes causées par les champignons parasites espèces forestières et sous une forme utilisable pour la statistique forestière, il faut nécessairement évaluer le nombre de ces parasites sur une surface donnée et déterminer l'étendue et le caractère du dommage produit.

L'évaluation quantitative du dommage du aux champignons dans les forêts a été entrepris maintes fois et depuis longtemps, mais les méthodes d'estimation étaient fort primitives et basées sur des calculs approximatifs à vue d'oeil. D' autres fois les auteurs pratiquaient une méthode rigoureusement exacte mais peu pratique pour les grandes surfaces, notamment le compte de tous les arbres.

En 1916 j'entrepris l'estimation quantitative des parasites dans différentes formations forestières et je me servis à cet effet des parcelles d'essai en usage chez les forestiers. Cette méthode fort simple et suffisamment exacte, donne des résultats tout à fait satisfaisants et pourrait être recommandée en Phytopathologie. Une condition importante dans ce cas c'est l'uniformité d'âge et de conditions écologiques de la forêt prise en observation, en un mot ce que les botanistes géographes comprennent sous le mot de formation et les forestiers considèrent comme „type".

Après un examen sommaire de l'unité forestière que l'on désire étudier, la présence de champignons parasites établie, on procède à la fixation de parcelles d'essai d'un demi hectare de surface (85 × 64 mètres); le nombre de ces parcelles doit être en rapport avec la surface totale de l'unité de façon à représenter de 5 à 10 % de cette surface. Sur chacune de ces parcelles il faut dès lors faire le compte exact de tous les arbres attaqués par les champignons parasites, en établissant des listes à part pour chaque espèce de parasite. Il convient de caractériser chaque arbre malade par des annotations concernant son diamètre à 1,3 mètre du sol, le nombre des fructifications du champignon et leur disposition, soit, la hauteur moyenne à laquelle elles se trouvent au dessus du sol.

La moyenne du % d'infection obtenue par le calcul des parcelles d'essai donne la caractéristique de l'infection de l'unité forestière prise en observation.

Pour obtenir l'évaluation de la perte matérielle produite par les champignons parasites dans l'unité forestière, il importe encore, outre l'énumeration des arbres malades dont il a été question plus haut, de faire la description detaillée de la parcelle d'essai d'après les méthodes en usage dans la taxation forestière (voir: ORLOV-Taxation forestière, St. Petersb. 1923), c'est à dire, qu'on est tenu d'indiquer la composition de l'unité, son age en moyenne, sa hauteur moyenne, le diamètre moyen des arbres qui la composent et enfin sa densité. Toutes ces indications peuvent être portées sur le tableau ci-après.

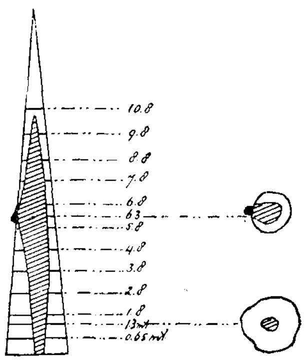
La seconde question d'évaluation qualitative des arbres atteints, dans la mesure qui correspond au problème posé, commence seulement maintenant à attirer l'attention des spécialistes. Jusqu'à présent les investigations concernant la désorganisation du bois chez les arbres malades, se bornaient à la méthode de R. HARTIG, telle qu'elle est indiquée dans les travaux de ce savant et en particulier dans son ouvrage „Les maladies des arbres", c'est à dire qu'on faisait la description macroscopique et microscopique de la pourriture du bois, sans procéder à l'analyse detaillée des parties malades dans les parties ligneuses. Des analyses de ce genre furent entreprises pour la première fois par les américains, et parmi ceux-ci, E. P. MEINECKE (Forest Pathology in Forest regulation, 1915) et J. R. WEIR (A study of heart-rot in Western hemlock, 1918) se signalent par des recherches approfondies à ce sujet. Il convient toutefois de faire remarquer que bien antérieurement, le Professeur TOURSKI dans la traduction russe de l'ouvrage de R. HARTIG (Moscou, 1894, p. 158) fit une première tentative de description de la propagation de la pourriture produite par le *Polyporus salicinus Fries* dans le tronc du Peuplier Tremble.

Dans les travaux mentionnés plus haut, les hauteurs donnent le nombre des fructifications du parasite sur chaque arbre, leur hauteur sur le tronc à partir de la base, le volume de la partie ligneuse infecté, l'âge présumé auquel l'infection a eu lieu, enfin le nom de l'agent destructeur.

La méthode d'évaluation de la propagation de la pourriture et du volume qu'elle occupe, n'est pas indiquée, mais d'après certains indices, il parait probable que c'est une méthode analogue à celle dont il va être question tout à l'heure, et qui correspond en somme à „l'analyse du tronc" tel qu'il est pratiqué dans la taxation forestière. Le principe de cette analyse consiste en ce que le tronc est divisé en tronçons du milieu desquels on découpe des ronds en forme de plaques minces. Pour l'étude de la pourriture, on scie l'arbre atteint à la base, on le débarasse des branches, ensuite on découpe de minces plaques horizontales dans le tronc, d'une épaisseur de 5—6 centimètres, à distance de la base de 65 centimètres, 1 mètre 30 cent., 1 mètre 80 cent., et ensuite de mètre en mètre à partir de la troisième plaque. Outre cela on découpe des plaques pareilles à l'endroit où sont fixés les fructifications du parasite. Toutes ces plaques servent à l'analyse du mode de propagation de la pourriture dans les troncs. En mesurant sur chacune de ces plaques à la surface le diamètre de la zône malade dans deux directions perpendiculaires, et étant donné que l'on connaît la hauteur respective de chaque plaque sur le tronc, il est facile de tracer un dessin schématique de la propagation horizontale et longitudinale dans le tronc de l'arbre.

Fig. 1

Figure schematique d'un arbre de Bouleau atteint par le Polyporus igniarius Fries.



Age 50 ans.
Hauteur 17 mètres.
Diamètre 16,5 cent.
Volume 0,18 mètres cubes.
Volume du bois pourri, 0,09 m. cubes.
Déchet 50 %.

Bois pourri.
Fructification du Polyporus igniarius Fr.
Bois normal.

D'autre part, avec l'aide des formules en usage dans la taxation forestière, on obtient aisément le calcul du volume de la partie du bois endommagé. La formule la plus rationelle dans le cas qui nous occupe, sera celle du diamètre moyen (voir: ORLOV, loc. cit. p. 27 et aussi ROULLEAU, Cubage des bois, 1905), soit: $V = gH$.

Sur chaque parcelle d'essai on prend pour cette analyse par un arbre de chaque degré d'épaisseur, l'intervalle entre chaque degré étant considéré de 5 centimètres. Ces arbres sont choisis parmi ceux chez lesquels les fructifications du parasite se trouvent à une hauteur moyenne pour chaque degré. Il faut aussi prendre pour l'analyse des arbres chez lesquels il apparaît plusieurs fructifications et dans ce cas le choix de ces arbres se fait d'après les mêmes principes que précédemment.

Indépendamment de cette méthode exacte applicable seulement à un certain nombre d'arbres, il convient encore de procéder à une analyse plus sommaire de chaque arbre dans la parcelle d'essai au moyen du forêt de PRESSLER, à l'aide duquel on peut, sans couper l'arbre, déterminer la limite inférieure de la propagation de la pourriture dans le tronc et son diamètre à l'endroit ou se trouve fixé l'appareil fructifère du parasite. Ayant toutes ces données, il est facile de calculer le volume moyen de la cubature du bois infecté pour les arbres de chaque degré d'épaisseur.

Connaissant cette cubature moyenne et l'évaluation quantitative de la propagation d'un parasite dans une unité forestière, on peut dès lors, à l'aide des méthodes en usage dans la taxation forestière, établir avec une exactitude suffisante le dommage matériel causé par un parasite donné dans une unité forestière. A cet effet les parcelles d'essai sont utilisées pour établir avec les tarifs de cubage (voir: HUFFEL — Les arbres et les peuplements forestiers, 1893; ORLOV, M. M. — Manuel forestier, St. Petersbourg 1917), et en se basant sur l'âge et la hauteur moyenne des arbres, le volume du bois en mètres cubés (W) dans toute l'unité. Ensuite on calcule la cubature du volume de la pourriture pour chaque degré d'épaisseur (V). en multipliant le volume moyen obtenu pour chaque degré (v) par le nombre d'arbres de cette dimension (n). La somme de ces cubatures (E) donne le chiffre absolu du dommage sur les parcelles d'essai. En établissant la proportion entre E.W. et la cubature totale de tous les arbres de la parcelle selon la formule $100 \frac{EV}{W}$ on obtient le % du dommage sur la parcelle. Les chiffres obtenus sont ensuite généralisés pour toute l'unité forestière.

Pour servir d'illustration à ce mode d'évaluation du dommage, je me permettrai de présenter ici un exemple d'estimation du mal causé par le *Polyporus igniarius Fries* à une formation de Bouleaux dans un marais du district forestier de Romanovsk dans le gouvernement de Tambov. Les calculs ont été faits en 1918.

1. Surface de la formation	70 hectares.
2. Composition	9 de bouleaux 1 de Pins.
3. Age moyen	50 ans.
4. Hauteur moyenne des arbres	16.8 mètres.
5. Diamètre moyen des arbres	17.6 centim.
6. Densité de plantation	0.8
7. Cubature de tous les troncs de bouleaux sur toute la surface de la formation ...	9125.6 mètres cubes (d'après les tables du Prof. ORLOV).

Moyenne des données obtenues sur quatre parcelles d'essai de $^1/_2$ hectare chacune.

1. Nombre des arbres .... 418.
2. Nombre des arbres attaqués par le *Polyporus igniarius Fries* .... 25.
3. Cubature de tous les arbres........ 70.3 mètres cubes.
4. Cubature de la pourriture d'un tronc .. 0.68 mètres cubes.
5. Cubature de la pourriture sur un demi hectare .... 1.70 mètres cubes.
6. Infection .... 5.9 %.

Dommage matériel pour toute la surface (70 hectares)

1. Dommage matériel absolu .... 238.0 mètres cubes.
2. Dommage en %.................... 2.6 %.

TABLEAU

A. Caractéristique de la Formation.

1. Composition de la Formation ....
2. Age moyen des arbres ....
3. Hauteur moyenne des arbres ....
4. Diamètre moyen des arbres ....
5. Densité de la plantation ....
6. Nombre d'arbres selon les espèces ....

B. Arbres infestés par le champignon X.

Espèce forestière.......

Degrés d'épaisseur	5 centm.		10 centm.		15 centm.	
Nombre des arbres avec une fructif. du parasite	Nombre d'arbres	Hauteur moyenne de la fruct.	Nombre d'arbres	Hauteur moyenne de la fruct.	Nombre d'arbres	Hauteur moyenne de la fruct.
Nombre des arbres avec plusieurs fruct.						

Nombre total des arbres avec une seule fructification du parasite ....

Nombre total des arbres avec plusieurs fructifications du parasite............

C. Arbres infestés par le champignon Y.

Comme précédemment.

LA POURRITURE ANNULAIRE DU CHÊNE, PRODUITE PAR LE VUILLEMINIA COMEDENS MAIRE

PAR

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La seule indication qui existe dans la litérature au sujet du parasitisme possible du *Vuilleminia comedens* a été faite par ROSTRUP, qui a reconnu le fait sur le chêne et sur l'aune [1]. Plus communément on le trouve sur les branches desséchées de chêne, de coudrier, d'aune et d'autres espèces à feuilles [2]. En 1918 au cours de mes investigations sur les parasites des essences forestières du district forestier de Romanovsk dans le Gouvernement de Tambov, je remarquai dans les futaies de chêne pur environ 3 % de jeunes chênes dans l'âge de 10 à 20 ans, ayant un diamètre d'environ 5 centimètres en train de périr à cause du développement du *Vuilleminia comedens*. La plupart de ces arbrisseaux étaient encore en vie, mais on remarquait nettement les traces de dépérissement qui se caractérisaient par la dessication des branches latérales et souvent par un commencement de dessication des cimes. On pouvait toujours voir facilement les fructifications du champignon sous forme de croûte se développant sous l'écorce, de couleur jaune ochracée ou gris jaunâtre occupant une longueur d'environ 35 centimètres et à peu près une moitié ou les trois quarts de la circonférence du tronc (Fig. 1 et 2).

Vuilleminia comedens Mre.

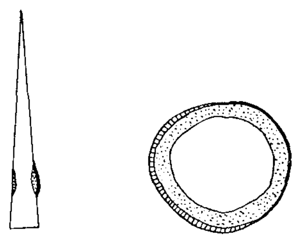

Fig. 1 Fig. 2

Bois attaqué.
Ecorce normale.
Hyménophore.
Bois normal.

La pourriture produite par ce parasite a l'aspect suivant: sur une coupe transversale du tronc elle se manifeste sous forme d'un anneau blanchâtre de 0,5—1 cM. de diamètre situé à la périphérie du tronc (Fig. 2). Cet anneau se distingue très nettement sur le fond jaune ochracé du bois. Sa consistance est un peu plus molle que celle

[1]) LUDWIG. F. Lehrbuch der niederen Kryptogamen. 1892.
LIND. J. Danish Fungi as represented in the herbarium of E. ROSTRUP. 1913.

[2]) JACZEWSKI. A. DE. Les parasites des espèces forestières russes. St. Petersbourg. 1897 (en russe).

du bois normal dans la même région. Dans l'anneau, et principalement dans sa partie périphérique, on peut fort bien distinguer, même à l'oeil nu, le mycélium du champignon sous forme d'un feutre blanc remplissant le gros tissu vasculaire de printemps. La présence de ce mycélium donne en partie l'explication de la coloration blanche de la pourriture provoquée par ce parasite. Sur les branches plus grêles, le parasite ne forme généralement pas d'anneau, mais envahit toute la branche. L'examen microscopique montre que le mycélium envahit d'abord le liber et passe ensuite de là progressivement dans le bois. Sur une coupe microscopique transversale on observe bien des hyphes incolores, très ramifiées, de 2—2,5 de diamètre, remplissant abondamment les tissus vasculaires périphériques et plus lâches dans les vaisseaux situés plus au centre. Sur une coupe longitudinale, il est facile de voir que les hyphes attaquent assez légèrement les parois des vaisseaux, dont les épaississements internes seuls disparaissent. Dans les autres élements du bois on ne trouve guère de grand amoncellement des hyphes du parasite. Les conditions de développement dans la localité étaient propices au parasite. Les plantations de chêne dans le district se trouvent sur un emplacement élevé et le chêne y vient dans de bonnes conditions. [1]) Il n'y a donc pas lieu de supposer comme le fait LIND (Loc. cit.) que le *Vuilleminia comedens* ne devient parasite que lorsque les arbres végétent dans un terrain humide.

LE HYDNUM SEPTENTRIONALE, PARASITE DES ARBRES À FEUILLES

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(Pl. XIII)

Dans la litérature contemporaine, le *Hydnum septentrionale* est indiqué comme parasite des arbres à feuilles (voir A. DE JACZEWSKI), mais on ne trouve pas de description detaillée du champignon ni de la pourriture qu'il produit (voir RANKIN), et NEGER, dans son nouveau travail sur les maladies des arbres forestiers ne le mentionne pas. Néanmoins le champignon a une aire de dispersion assez étendue, car il a été signalé en Suède, Finlande, Allemagne, ainsi qu'en

[1]) VANINE. E. Les parasites des espèces forestières dans les différentes plantations du district forestier de Romanovsk dans le Gouvernement de Tambov en 1918. St. Petersbourg. 1922. (En langue russe).

Amérique boréale et dans la Russie septentrionale. En Automne 1922 le *Hydnum septentrionale Fries* se montra sur un grand nomb e d'érables (Acer platanoides L.) et d'Ormes (Ulmus effusa Willd) vivants dans le parc de l'Institut Forestier de St. Petersbourg et dans ses environs. Ce fait attira l'attention du Professeur A. DE JACZEWSKI, qui me pria de faire l'analyse du bois infecté par le champignon. A cet effet, je choisis un érable de 90 ans, de 22 mètres de hauteur sur 30 centimètres de diamètre à hauteur d'homme. Le volume du tronc sans les branches fût évalué à 1 mètre 80 cent. cubes. L'Hyménophore du champignon se trouvait situé à une hauteur d'environ 1 mètre 50 centim. au dessus du sol; un peu plus bas on pouvait retrouver les traces de l'hyménophore de l'année précédente. Les dimensions de l'hyménophore étaient de 25 cent. de haut sur 17 de large. L'ensemble de la fructification était constitué par des chapeaux minces très nombreux, disposés en étages superposés (Pl. XIII, fig. 1). A l'état frais, la surface supérieure du chapeau est blanche, hirsute, et elle jaunit à la dessication. Les aiguillons sont blancs, ténus, de 1 centimètre de longueur. Les spores sont ellipsoides, de 8/3,7; les cystides longues, coniques, rares. Une particularité a noter, c'est que les basides, après le détachement des basidiospores, continuent à se développer d'une façon végétative et au bout d'un certain temps les aiguillons se trouvent recouverts de houppes en pinceaux divergents qui leur donnent un aspect très singulier.

Pour étudier l'altération du bois l'arbre fût coupé à la base et partagé en quartiers de 70 centimètres de haut. Ceci permit d'établir le tableau schématique ci-dessous (p. 266) de la distribution de la pourriture dans le tronc. Comme on le voit, la pourriture du bois se propage vers le sommet de l'arbre jusqu'à une hauteur de 9 arschines (6 mètres 30 cent.), et vers le bas jusqu'à la base du tronc. Le calcul fait d'après les formules en usage dans la taxation forestière, donna un volume de 60 cent. cubes pour le bois pourri, soit environ 30 % du volume total. La pourriture se propage du centre, et seules les parties periphériques, en forme d'anneau restent pas endommagées. Sur une coupe horizontale, la pourriture se présente comme principalement développée dans la partie centrale, qui est séparée des parties intactes périphériques par un anneau de bois dur, coloré en brun, constituant ce que l'on connaît d'après la nouvelle terminologie allemande (voir MÜNCH, RUDAU) comme „Wundkern" (fig. 2, pag, 266 et pl. XIII, fig. 2). Cependant tout le corps central ligneux n'est pas attaqué uniformément. Au milieu des zones annulaires et des taches d'un jaune blanchâtre, on aperçoit des îlots de bois sain de couleur un peu foncée. La désorganisation la plus avancée se manifeste dans les fibres ligneuses et les cellules parenchymateuses qui se trouvent entre les rayons médullaires, et le long de ces derniers on aperçoit des fissures longitudinales, qui sont bientot tapissées de minces membranes mycéliennes d'un blanc laiteux. Dans les dernières phases de destruction le bois se désaggrège aisément en plaques minces. Il se forme aussi des fissures concentriques disposés dans la direction des anneaux annuels.

Hydnum septentrionale Fries.

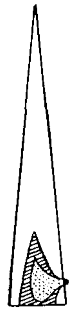

Fig. 1

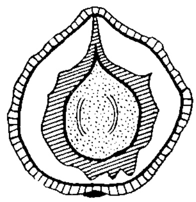

Fig. 2

Bois normal. — Hyménophore.
Bois pourri. — Ecorce normale.
Wundkern.

L'examen microscopique du bois corrodé indique que les rayons médullaires résistent le plus longtemps à la destruction. Dans tous les tissus attaqués on retrouve des hyphes ramifiées de 1,5—3 de diamètre. Les membranes des fibres ligneuses et des fibres vasculaires, qui contiennent des hyphes du parasite, se colorent par la phloroglucine additionnée d'acide chlorhydrique beaucoup plus faiblement que les mêmes éléments de même ordre qui ne contiennent pas d'hyphes. Ceci indique évidemment que les membranes des fibres attaqués par le champignon commencent à se désorganiser et que les substances ligneuses dont elles étaient incrustées commencent à se résorber.

L'anneau du „Wundkern" constituant la zone limite de désagrégation du bois montre au microscope la présence d'une matière colorante qui est principalement concentrée dans les rayons médullaires et dans les fibres ligneuses qui entourent les gros vaisseaux de printemps, sous forme de corps arrondis de couleur d'un jaune-brunâtre. Les membranes des cellules contenant ces corps sont également colorées. Pour déterminer la nature de la matière colorante, de petits copeaux de „Wundkern" furent traités avec différents dissolvants (Eau, alcool, chloroforme, éther, acide chlorhydrique, acide nitrique, potasse caustique). Il en résulta que la matière se trouva dissoute seulement dans l'acide nitrique bouillant. L'eau se colorait en jaune paille; quand aux autres dissolvants, ils restèrent sans effets. La solution aqueuse traitée par l'alcool, $FeCl_3$, ou le sulfate de cuivre, donna avec ce dernier réactif un précipité brunâtre. Ces réactions indiquent que la matière colorante dont il est question appartient au groupe d'éléments connus actuellement sous le nom de „Kernstoff" (Gomme de blessures, „Wundgummi", „Schutzgummi" des anciens auteurs), qui d'après MÜNCH est un produit d'oxydation du contenu des cellules tuées par le parasite.

Pour terminer, je me permettrai de noter que le *Hydnum septentrionale* a été retrouvé cette même année sur des tilleuls dans le parc du château impérial de Peterhof près de St. Pétersbourg par le Professeur A. DE JACZEWSKI.

SUR LE DEVELOPPEMENT MENAÇANT DU TILLETIA SECALIS KÜHN EN RUSSIE PENDANT LES DERNIÈRES ANNÉES

PAR

A. DE JACZEWSKI

Parmi les *Ustilaginées* qui provoquent le charbon des céréales, le *Tilletia secalis* est certainement l'espèce la plus rare et la moins répandue au point de vue géographique. Elle fût décrite comme on sait pour la première fois en 1848 par CORDA sous le nom d'*Uredo secalis*, dans un ouvrage peu connu et encore plus difficile à retrouver maintenant „HLUBEK, Oeconomische Neuigkeiten" (I, 9, Tabl. 1). Le parasite provenait de Bohême, mais déjà l'année suivante il fût signalé en Allemagne par RABENHORST (Flora 1849, p. 209), sous le nom de *Uredo secalis Rabh.*, et réparti sous ce nom dans la XIV Centurie de KLOTZSCH Herbarium Mycologicum, parue en 1850 (Numéro 1399), sans indication de provenance, mais avec la date 1847. CORDA avait décrit le mode de développement des spores, qui correspond parfaitement au genre *Tilletia*. En 1876, KÜHN décrivit à nouveau le *Tilletia secalis* (Landwirth. Zeit. XIX, N 81 et Hedwigia 1876, p. 120), mais il crût devoir distinguer le type de RABENHORST, qu'il rapporta au genre *Ustilago (Ust. secalis Kühn)*, à cause des dimensions des spores données par RABENHORST (12,2

μ) et l'absence supposée d'odeur de hareng si caractéristique généralement pour les espèces du genre *Tilletia*. Ceci créa une confusion qui se manifesta par le fait que depuis ce temps on trouve dans les ouvrages concernant les *Ustilaginées*, notamment dans la Monographie de ce groupe par FISCHER DE WALDHEIM, un *Tilletia* et un *Ustilago secalis*. Or cette dernière espèce, comme fondée sur une erreur d'appréciation ne peut être conservée, car l'examen des échantillons de KLOTZSCH montre bien que c'est un *Tilletia*, avec des spores de 16,5—20 μ de diamètre, ayant des réticulations de 1,8 μ de haut, formant réseau. A ce propos je ferai remarquer que Mr. VAVILOV (L'Immunité des plantes. Moscou, 1919, p. 145) a trouvé en Perse sur seigle un vrai *Ustilago*, qu'il identifie avec l'*Ustilago tritici*, dont il ne diffère pas morphologiquement. La même année 1876, Mr. le Professeur COHN faisait connaître par un article à la Neue Freie Presse de Vienne l'apparition du *Tilletia secalis* en Silésie, et presque en même temps Mr. G. NIESSL (Hedwigia 1876, p. 193) le signalait en grande quantité en Moravie. Les dégats dans ces deux provinces furent comme il paraît fort considérables. Tous les auteurs cités plus haut ne semblent pas avoir eu connaissance de l'article de KOERNICKE sur le même parasite paru encore en 1872 (Verhandl. des Naturhist. Vereins für Rhein und Westphalen, 29, Sitz. 98). Ce dernier confirme (Hedwigia, 1877, p. 29) qu'il fût le premier à donner le nom de *Till. secalis* au champignon, et il est de fait que la priorité appartient de droit à KOERNICKE. Cet auteur entre autres, estime, très judicieusement du reste, que l'absence d'odeur ne peut servir de caractère à la délimitation des espèces, car on constate sous ce rapport une grande amplitude de variations dans les limites d'une même espèce. Ainsi le *T. tritici* présente dans un même épi des grains avec une forte odeur et d'autres totalement inodores ou à très faible odeur. Ceci tient, évidemment, à un développement plus ou moins considérable de triméthylamine dans les grains infectés, et je puis confirmer absolument l'opinion de KOERNICKE sur la foi de l'examen d'un grand nombre d'échantillons provenant de différentes localités et appartenant au type spécifique de *T. tritici*. Mr. KOERNICKE fait remarquer dans le même article dans Hedwigia, que le *T. secalis* semble avoir été très répandu en 1876, et signale entre autres son apparition en Styrie dans les environs de Salzbourg, où il fut constaté par Mr. KLEE. Une citation fort intéressante de KOERNICKE semble indiquer que le *T. secalis* prenait quelquefois une grande extension dans les temps anciens ainsi qu'en témoigne HALLER (Hist. Stirp. Indig. II, p. 207, 1768).

KOERNICKE signale la ressemblance du *T. secalis* avec le *T. decipiens Kce.* et *T. hordei Kce.* Toutes ces formes et aussi le *T. controversa*

Kühn, connu généralement sur Agropyrum repens et trouvé aussi en Russie sur Triticum sativum (vulgare) dans le gouvernement de Podolis, sont en effet du même type et la distinction n'est guère possible que par des expériences biologiques d'une part, et par des mesures biométriques d'autre part. Ces dernières, entreprises au Laboratoire ont donné pour une série d'espèces les courbes représentées dans les diagrammes ci joint qui démontrent clairement qu'il s'agit bien de formes distinctes [1]. En ce qui concerne les expériences biologiques, nous ne possédons encore que celles de BUBAK relatives à l'infection réciproque du blé et du seigle, qui montrent aussi que le *T. secalis* et le *T. tritici* sont distincts.

Il est donc établi par ce qui a été dit plus haut, que dans la dernière moitié du siècle passé, il y a eu trois foyers principaux ou le *T. secalis* a produit des dégats assez considérables. Mais le mal n'a pas semblé s'accroître et il est même assez curieux de constater que bien qu'aucune précaution ne fut prise alors pour combattre le parasite, celui ci, non seulement ne gagna pas du terrain, mais ne semble même pas avoir conservé ses positions. En effet, SCHOETER (Pilze Schlesiens, I, p. 278), affirme catégoriquement, que le *T. secalis* n'a pas reparu depuis 1876 en Silésie. Dans la période relativement assez longue de 1877 à 1923, il n'est presque pas question du *T. secalis*, et des dégats plus ou moins graves sont constatés seulement en Bohême en 1910, ou jusqu'à $50^0/_0$ de la récolte fut annulé, et en Bulgarie ou le parasite est considéré comme fort dangereux. Ce dernier pays est donc un nouveau foyer d'infection relativement récente, mais il est digne de remarque que dans les autres pays, aussi bien en Europe que sur les autres continents, le champignon n'a pas attiré l'attention. En Italie RABENHORST l'a indiqué en 1847, mais il ne parait pas avoir été retrouvé depuis. Aussi dans les flores mycologiques le *T. secalis* n'est signalé qu'accidentellement. Ainsi MASSEE (Diseases of cult. Plants, 2e édition, N. Y., 1915, p. 347) le mentionne seulement comme synonyme du *T. decipiens*. Sur les autres continents on ne trouve qu'une seule indication, celle de PAMMEL (Fungus Diseases of grasses, Bull. N. 1, Jowa, Geological Survey, Des Moines, 1901), mais cette communication n'a pas été confirmée semble-t-il, car dans aucun travail mycologique ou phytopathologique américain on ne trouve mention de ce parasite. Dans le travail de STAKMAN et LEWINE (Rye Smut; Minnesota Bulletin 1916) il n'est question que de l'*Urocystis occulta Rabh.*

Ce court aperçu historique démontre suffisamment que le *T. secalis* est bien une espèce rare, dont les foyers d'infection, assez rares du reste, n'ont pas pris une grande extension, et qui dans tous

[1]) The printing of the many diagrams could not be defrayed. — Ed.

les cas n'a pas eu une importance économique considérable. Cependant ce calme est trompeur et l'exemple de la Russie est assez concluant pour en déduire combien il faut être sur ses gardes avec les parasites des grandes cultures qui paraissent au premier abord inoffensifs et prennent ensuite inopinément une importance aussi considérable qu'inattendue.

La première indication concernant la trouvaille du *T. secalis* en Russie se rapporte à l'année 1884, quand TRAUTVETTER le signala dans le Gouvernement d'Orel. Ses échantillons se trouvent à l'herbier de Jardin Botanique de St. Pétersbourg. La même année il est aussi signalé par KARSTEN en Finlande (Rost och Brandsvampar Finnlands, 1884, p. 100). En 1885 Mr. SELIVANOV le retrouve dans le district de Zaraisk du Gouv. de Riazan. Ce n'est que 9 ans après que Mr. ISSATSCHENKO le découvre dans le district de Nicolaiev du Gouv. de Cherson. Après cela survient un nouveau répit, et ce n'est qu'en 1905 qu'il apparait dans un champ d'essai du Gouv. de Kursk. Il est vrai qu'à cette époque le service Phytopathologique était loin d'être organisé en Russie comme il le fut depuis, mais il est hors de doute, que si le *Tilletia secalis* avait été répandu dans une province quelconque de l'Empire, on l'aurait certainement remarqué, comme ce fut le cas pour le *T. tritici, Fusarium roseum* et tant d'autres parasites. Il faut donc en conclure que le parasite se trouvait alors à l'état latent, plus ou moins sporadique, et n'avait certes aucune importance économique. Enfin en 1907 l'agronome KOUSKOV indique que dans le district de Kamyschine du Gouv. de Saratov, le parasite se trouva en grande quantité dans les champs de seigle d'un arrondissement. Une enquête faite à cet effet amena à la conclusion que le parasite n'existait pas au paravant dans la localité, mais qu'il fut importé avec les semences de seigle, de provenance orientale, distribuée à la population par les autorités locals. Des mesures radicales furent entreprises pour empêcher la dissémination du champignon et de fait ce foyer d'infection parut complètement éteint. Trois ans après, en 1910, un nouveau foyer d'infection se déclara, cette fois à l'Ouest dans le Gouv. de Podolie au district de Yampol. Ici d'après l'estimation de Mr. KAZANOVSKI, les pertes atteignirent le chiffre énorme de 90 %. En même temps d'autres foyers se manifestaient, entre autres dans le Gouv. de Kursk (10%), les districts de Bielev et de Toula du Gouv. de Toula, ou les pertes furent de 50 %, et enfin dans le district de Loutsk du Gouv. de Volhynie. A partir de cette année le *T. secalis* se retrouve deci delà presque tous les ans, bien qu'en petites quantités, notamment, en 1911 dans le Gouv. de Toula, en 1912 dans celui de Voronèje (en petit nombre), de Poltava (1—3 %) d'Oufa dans le district de Strelitamak, en 1913 dans les environs de Grobine en Courlande, dans les

Gouv. de Toula, Kalouga, Voronèje et Simbirsk. Dans cette dernière province, tout le district de Syzran se trouva assez sérieusement infesté et dans certaines communes, les pertes furent évaluées à 40 %. La même année le parasite reparut dans le district de Kamyschine. En 1914 il est indiqué comme fréquent dans le district de Zlatooust du Gouv. d'Oufa et enfin en 1915, Mr. NAGORNY le signale dans le Gouv. de Stavropol. A partir de ce moment les données relatives à la dissémination des parasites et en particulier du *T. secalis* manquent totalement, et ce n'est qu'en 1920 que quelques renseignements sont fournis par Mr. MOURASCHKINSKI pour la Sibérie Occidentale ou le champignon se retrouve dans les districts de Kainsk et d'Enisseisk du Gouvernement d'Enisseisk et dans le district de Yaluotorovsk du Gouv. de Tobolsk ou le % d'infection ne dépassa pas 1. En 1921 le parasite est de nouveau signalé dans une proportion de 1—2, 4 % dans les mêmes localités et dans le district de Tarsk ou il atteint déjà 8,2 %. Sa présence est aussi présumée dans le district de Koltchetavsk de la province d'Akmolinsk. Dans la région d'Omsk l'infection ne dépasse pas 1,3 %. Ces chiffres ne sont pas précisément élevés, excepté pour le district de Tarsk, mais il est de fait, que le *T. secalis* se retrouve dans un grand nombre d'échantillons pris pour l'analyse et ceci a une grande importance si l'on considère que pendant ces dernières années les semences de seigles et d'autres céréales étaient confisquées par les autorités, ensuite réunies en masse sans aucun triage et réparties indifféremment par tout le territoire de la Russie d'Europe comme semences. Il est évident que ce système n'a pas peu contribué à la propagation du parasite et c'est en grande partie à lui que nous devons la formidable infection notée dans toute une série de localités en 1922. En effet cette année là le *T. secalis* se retrouve dans les Gouv. de Nijninovgorod, Simbirsk, Saratov, Penza, Charkov (jusqu'à 40%), Poltava, Koursk, Orel, Toula, Kaloga, Voronèje, Riazan et Tver. Il est aussi indiqué dans les Gouv. d'Oufa et d'Orenbourg. Dans la plupart des localités, le degré d'infection varie de 10 à 50 et même quelquefois à 60 %, ce qui constitue évidemment un grand danger pour l'avenir. En outre quelques épis infectés furent trouvés en 1922 dans le district de Peterhof du Gouv. de St. Pétersbourg. On voit que le rayon d'infection a pris une extension considérable, la limite septentrionale atteignant le 60e parallèle près de St. Pétersbourg, la limite méridionale jusqu'ici formée par le 44e parallèle (Le Gouv. de Stavropol), et la limite occidentale s'étendant jusqu'au 21e degré de longitude. Si l'on peut tirer quelque conclusion sur l'origine des maladies des plantes en se basant sur la provenance des plantes nourricières, ce qui est certainement parfaitement logique, il est fort probable que le *T. secalis* de même que le *T. tritici* sont tous les deux d'origine asiatique, provenant des régions d'où se sont répandues les céréales. Vu la rareté relative du *T. secalis*, il est plus facile de suivre sa marche qui est nettement accusée de l'Est à l'Ouest ce qui correspond bien à l'importation des graines de seigle qui a pris de grandes proportions ces dernières années, et il n'y a rien d'étonnant que le parasite se soit multiplié et que les foyers d'infections se soient multipliés. De plus le parasite semble s'acclimater maintenant, car auparavant il apparaissait pour disparaître, tandis que maintenant on peut noter une dissémination intense sur une grande partie du territoire, notamment dans le centre. Il n'est donc pas étonnant que le Service Phytopathologique se soit ému de ce fait, et déjà lors des semailles d'automne, dans certains Gouv. comme celui de Kursk par exemple, les Stations de Défense des Plantes ont procédées à une désinfection en masse des semences de seigle au moyen du formol.

SUR LES MOYENS DE COMBATTRE LE CHARBON DES CÉRÉALES A L'AIDE DES TEMPÉRATURES ÉLEVÉES

PAR

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Depuis que le fait d'hibernation du mycélium de l'*Ustilago tritici* fut demontré irréfutablement par une série d'auteurs (Maddox, 1896; Nakagava et Vamada, 1897; Hecke, 1904; Brefeld et Falck, 1905), l'attention des investigateurs s'est naturellement portée à la découverte des méthodes pour combattre la maladie en paralysant la force germinative du mycélium sans altérer celle des graines. Divers procédés furent proposés à cet égard. Tout le monde connaît les expériences de Jensen (1888) sur l'action de la chaleur sur les *Ustilaginées*, et sa methode à l'eau chaude est devenue populaire dans certaines regions. Ce procédé fut modifié depuis par Appel et Gassner; puis, Appel et Riehm ont substitué l'air chauffé à l'eau chaude, cependant la semence à stériliser devait quand même subir préalablement une immersion plus ou moin longue dans l'eau tiède.

Ces méthodes où la semence est traitée par la chaleur au contact de l'eau présente certains inconvénients resultant de ce que les graines sont extrêmement sensibles à l'action de la chaleur dans ces conditions et perdent facilement leur faculté germinative. De plus, en gonflant, elles imbibent une grande quantité d'eau qu'on a de la peine à en chasser plus tard. L'emploi de l'eau chaude exige donc certaines précautions à prendre, pour éviter les consequences néfastes d'un séjour trop prolongé dans l'eau ou celles de l'action d'une température trop élevée.

Ces considérations m'ont suggéré l'idee de résoudre la question des hautes températures dans une voie différente; je me suis demandée si l'on ne pouvait se servir de la chaleur à sec, eliminant complètement l'eau du procédé. La connaissance du travail de M. N. NAOUMOFF sur la lutte contre le *Gibberella Saubinetii*, cause du seigle énivrant (1912—1915), m'a guidé dans mes recherches, et dans le choix des températures à prendre je me suis arrêtée en premier lieu à celles qui fûrent recommandées par cet auteur, notamment les températures de 60° à 66°.

Comme les appareils pour chauffer les graines qui étaient à ma disposition ne permettaient de chauffer qu'une quantité de semence fort limitée, je me suis bornée à 100 grammes de blé pour chacune des modifications de l'expérience.

Je pris en septembre 1920 du blé d'hiver d'une variété locale, de la récolte de la même année et de l'année précédente, les deux lots infectés par le charbon; malheureusement, le degré d'infection n'était que faible, et mes tentatives d'obtenir préalablement une infection plus sévère en me servant de la méthode d'infection artificielle restèrent sans résultat. Les températures que je choisis furent 60° et 66° degrés centigrade, et la durée de l'expérience 12 h., 24 h., et 48 h.; j'essayai en outre de faite chauffer une certaine quantité de graines à 85° pendant une demi-heure, pour détérminer l'action des températures encore plus élevées. D'autre part, pour avoir une base de comparaison avec les méthodes connues, je répétai l'expérience de JENSEN, en faisant chauffer la semence dans l'eau à 55°—56°, après un séjour préalable de quatre heures dans un bain de 30°—35°. En déterminant *le pouvoir germinatif* des graines traitées par ces diverses méthodes, j'obtins les chiffres suivants:

Méthode à l'air chauffé:

1920	60°	24 h.	87 %
1920	60	48 h.	86
1920	66	24	100
1920	66	48	100
1920	85	30 min.	100
1919	60	24 h.	78
1919	60	48	51
1919	66	24	78
1919	66	48	74

1919	85°	30 min.	78 %
1920	60	12 h.	100
1920	66	12	100
1919	60	12	71
1919	66	12	80
1919	témoin		82
1920	témoin		89

Méthode à l'eau chaude:

1920	30—35	4 h.	48 %
	55—56	10 min.	

Dès que le blé dans mes semis se mit à fleurir, je pus détérminer les résultats de l'expérience. Il en résulte que toutes les méthodes employées ont un effet que l'on en attendait, et ont diminué le degré du charbon en comparaison des lots non traités; en particulier la temperature de 60° fut trouvée des plus favorables; quant à la durée de l'expérience, le chauffage pendant 48 heures n'a présenté aucun avantage en comparaison de celui de 24 h. L'âge de la semence, à ce qu'on peut en juger d'après nos données, n'a pour ces sortes d'expériences aucune importance appréciable. L'emploi de l'air chauffé à 85° pendant 30 min. a donné des resultats peu promettants, l'intensité de l'attaque ayant diminué fort peu ce que l'on pourrait expliquer par la trop courte durée de la chaleur. Enfin, la méthode de JENSEN, comme il était facile à prévoir, fut trouvée une des meilleures.

Comme les expériences citées ne donnent pas encore droit à des conclusions définitives, je refis en partie mes expériences en 1921. Les résultats pour les deux années, 1920 et 1921, sont représentés dans le tableau suivant.

Expériences de 1920.

Méthode à l'air chauffé:

1920	60	24 h.	0.21 %
1920	60	48	0.09
1920	66	24	0.56
1920	66	48	0.55
1920	85	30 min.	0.90
1919	60	24 h.	0.24
1919	60	48	0.61
1919	66	24	0.85
1919	66	48	0.94
1919	85	30 min.	0.65

Expériences de 1921.

Méthode à l'air chauffé:

1920	50	24 h.	0.5 %
1920	55	24	0.44
1920	60	24	0.34
1920	66	24	0.21
1920	témoin		0.71

Méthode à l'eau chaude:

30—35 4 h.

Expériences de 1920. Méthode à l'air chauffé:				*Experiences de 1921.* Méthode à l'eau chaude:			
1920	60	12 h.	0.28 %	1920			0.019%
1920	66	12	0.52		55--56	10 min.	
1919	60	12	0.49				
1919	66	12	0.86				
1919	témoin		1.38				

En résumé, on voit que dans l'emploi rationnel de l'air chauffé on peut avoir un moyen simple et efficace de lutte contre le charbon, moins encombrant et altérant moins le pouvoir germinatif que l'emploi de l'eau chaude.

Les expériences citées furent effectuées au gouvernement de Novgorod.

EXPÉRIENCES SUR L'EMPLOI DE LA SOUDE COMME FUNGICIDE CONTRE LES ERYSIPHÉES

PAR

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L'emploi de la soude comme fungicide a été préconisé il y a quelques années de cela contre le *Sphaerotheca mors uvae* B. et C., par Mr. DOROGUINE, et bien que ce parasite soit comme on sait très tenace et persistant, les résultats obtenus furent on ne peut plus satisfaisants et dépassèrent considérablement les essais tentés avec d'autres substances (Polysulfides, azurine, etc.).

Des essais faits avec la soude sur des spores de différents champignons en germination dans des cellules VAN TIEGHEM en 1921 au Laboratoire de l'Institut de Mycologie et de Pathologie végétale de St. Pétersbourg, confirmèrent ces données empiriques, ainsi qu'il résulte de mon travail à ce sujet publié dans les „Matériaux de Mycologie et de Phytopathologie de Russie (Tome V, Livr. I, St. Pétersbourg)". Ceci m'encouragea à continuer mes expériences dans le courant de l'année 1922, mais sur une plus large échelle et dans le but de constater l'influence de la soude sur le mycélium des *Erysiphées*. A cet effet, je me proposais de résoudre quatre questions: en premier lieu l'influence de la soude sur le mycélium en général. Secondement, d'établir une comparaison avec d'autres fungicides connus, en particulier avec les polysulfides. En troisième lieu, de vérifier le rôle des substances mécaniques indifférentes en cas de leur mélange avec la soude. Enfin d'étudier le degré d'adhérence de la soude à la surface des parties végétales traitées.

J'utilisai pour mes expériences des Alchemilla vulgaris infectés par le *Sphaerotheca macularis Magnus, forma alchemillae*. La soude, aussi bien que les polysulfides furent employés en trois solutions de concentrations différentes, notamment 62.4 grammes pour 12.5 litres (ce qui équivaut à 0.891 % de soude ordinaire ou à 0.33 % de soude déshydratée), 52.92 gr. (0.702 % et 0.26 %), et 24.96 gr. (0.351 % et 0.13 %).

Pour les essais avec les substances indifférentes, on utilisa les mêmes concentrations avec addition de 1 % du poids de verre pilé. Les pulvérisations furent continuées pendant six semaines, par une fois tous les huit jours. Les résultats obtenus permettent de conclure que la soude est un fungicide actif qui arrête décidément le développement du *Sphaerotheca macularis Magnus f. alchemillae*. Malheureusement, la soude n'a pas une grande adhérence et la solution est vite lavée par la pluie, ce qui oblige à répéter souvent les pulvérisations pour atteindre un effet désirable. [1]

Par rapport à la soude, les polysulfides, toutes proportions gardées, sont beaucoup moins actifs, et pour les solutions de moindre concentration on obtient des résultats indéfinis.

L'addition de verre pulverisé pour augmenter l'adhérence diminue considérablement le pouvoir fungicide des solutions.

En prenant pour unité la surface entière infestée par le parasite, on obtient le tableau suivant qui résume le résultat des expériences:

	Concentration 0.13 %	Concentration 0.26 %	Concentration 0.33 %
I. Soude déshydratée.			
Feuilles non traitées:	0.31	0.86	0.81
Feuilles traitées:	0.30	—	—
II. Soude déshydratée avec 1 % de verre pulvérisé.			
Feuilles non traitées:	0.63	0.50	0.82
Feuilles traitées:	0.30	0.13	0.09
III. Polysulfides.			
Feuilles non traitées:	1	0.59	0.82
Feuilles traitées:	0.30	0.13	0.09

[1]) See in connection herewith Mr. MAARSCHALK's contribution on p. 119/120 Ed.

OBSERVATIONS SUR L'INFLUENCE DES CONDITIONS METEOROLOGIQUES SUR LE DÉVELOPPEMENT DE LA ROUILLE DES CÉREALES

PAR

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Grâce a l'entrainement des mycologues pour la systématique, les questions purement biologiques, surtout l'influence des agents météorologiques sur le développement des maladies cryptogamiques furent longtemps négligées; de plus, les investigateurs manquaient de connaissance en météorologie agricole.

Du point de vue météorologique les maladies doivent être divisées en maladies des organes superficiels et des organes souterrains; il est surtout plus important et plus aisé d'étudier les agents météorologiques ayant une influence sur le premier genre de maladies car ces études pourraient verser quelque lumière sur les questions de météorologie agricole.

La rouille des blés est un réactif excessivement sensible aux particularités du milieu de son développement, limité par une couche étroite d'air, adhérant a la surface du sol, ou la température, l'humidité de l'air, les rosées, l'insolation directe sont très variables.

Ce développement dépend de plusieurs périodes critiques, les agents secondaires, comme par exemple l'entrainement des spores avec les grains, les engrais et les terraux ayant peu d'influence sur la méthode des recherches.

En ce qui concerne le procédé des investigations, il est nécessaire de:

1. Distinguer les régions du développement de la rouille, vu qu'il est nécessaire de se rendre compte des aréaux géographiques où les diverses espèces des rouilles sont répandues et des divers agents météorologiques, qui, selon la latitude et la longitude de l'endroit produisent des effets différents.

Ainsi, au sud-est une humidité relativement considérable, liée automatiquement avec une température modérée, favorise le développement de la rouille, tandis qu'au n.-est de la Russie la rouille est favorisée par un accroissement de température vu que dans cette region la température est minimale, et dans les régions maritimes au ciel souvent nuageux la rouille se développe pendant les périodes de sécheresse.

2. Distinguer l'influence directe et indirecte des conditions locales sur la maladie, ce qui est très difficile présentement (N. I. WAWILOFF).

3. Il est nécessaire de rapprocher autant que possible les conditions d'observation avec les conditions des essais en ce qui concerne la détermination et la précision des agents et des conditions des essais avec les conditions des observations pour rendre les essais aussi naturels que possible.

4. Il est nécessaire d'élaborer une méthode de météorologie agricole toute particulière, pour ainsi dire mycologique, parce que:

a. La méthode des unités moyennes n'est pas applicable aux questions de la météorologie agricole, le développement de la rouille présentant des dizaines de moments critiques.

b. La cabine anglaise, se trouvant éloignée de la zône ou se passent les procès vitaux symbiotiques de la plante et de la rouille et où le rôle des agents météorologiques est très différent, est peu appropriée aux observations.

c. La nuit et le grand matin représentent le plus grand intérêt, cependant selon l'Instruction de l'Observatoire Physique Central les observations ne se produisent point durant ces parties de la journée.

Dans le cours des observations il s'est démontré, qu'il était indispensable d'analyser l'importance de tous les agents météorologiques sur la base des données litéraires et des observations de l'auteur. Cette importance des agents est principalement étudiée dans la région de la Kamennaya Steppe et du sud-est en général.

Parmi les agents météorologiques les sédiments, l'humidité relative de l'air, la rosée et l'insolation directe me semblent être de la plus grande importance.

On attribue à tort une trop grande importance a la quantité des sédiments, surtout quand on opère avec le total mensuel sans faire attention à la force des pluies, à leur durée, à la partie de la journée ou elles tombent et à leur fréquence.

En ce qui concerne la rouille au sud-est de la Russie, le plus d'importance doit être attribué de droit aux conditions suivantes:

1. Les pluies qui tombent pendant la journée et dans la matinée sont peu efficaces, vu que l'humidité de l'air diminue visiblement deux heures après la pluie (5 Juillet 1921); au contraire, celles qui tombent vers la nuit (2 Juin) ont le plus d'efficacité.

2. Les pluies d'une certaine durée ont plus d'efficacité que les pluies d'orage.

3. Sont le plus favorables à la rouille les pluies fines mais fréquentes, surtout celles qui tombent le soir et la nuit, car, vu qu'elles donnent 2,5 mM. de sédiments à 3—4 reprises (21 Juin), elle sont capables de maintenir l'humidité de l'air pendant 14 heures au degrés de 95 à 100 % (29, 30, VI), même dans la cabine anglaise.

4. L'importance des pluies est directement proportionnée à la

quantité des sédiments, mais elle varie visiblement selon les trois points énoncés plus haut.

5. Une pluie tombant à plusieurs reprises ne permet pas aux spores de se dessécher et d'attaquer de nouvelles plantes.

6. Les pluies à grosses gouttes sont nuisibles à la rouille car elle entrainent facilement les spores.

L'importance des rosées au sud-est est énorme: elles donnent simultanement des gouttes d'eau pulverisée et une humidité relative de 100 %; il survient des années où elles sont très fréquentes, se tiennent pendant 7 à 11 heures et tombent pendant les heures de la nuit, qui sont favorables au développement de la rouille vu la diminution du vent et vu l'absence de l'insolation et de la haute température de l'air.

Au sud-est de la Russie l'humidité de l'air est donc l'agent le plus important et dont presque tout dépend. Une humidité relative de 100 % suffit pour la germination des spores même en l'absence d'eau liquefiée.

Dans les conditions de la Kamennaya Balka l'année a été surtout caractéristique pour le développement de la rouille à l'accroissement de l'humidité relative de l'air jusqu'à 100 %, vu que l'humidité a été l'agent en minimum.

Les differentes espèces de la rouille, telles que *Puccinia dispersa, Puccinia coronifera* et *Puccinia graminis*, apparaissaient consécutivement tous les 7 à 11 jours après la période ou l'humidité atteignait les 100 % et elles développaient en commençant par les parcelles qui la conservaient le plus longtemps (dans la direction du nord, nord-ouest et ouest des parcelles de bois), ensuite elles apparaissaient au sud et à l'est des parcelles des bois; plus tard la rouille apparut dans la steppe ouverte, ou l'humidité durant la nuit et le grand matin était moindre (rétard de 3 semaines).

La température est la cause d'une série de moments critiques au printemps (les fluctuations de la température étant indispensables pour la meilleure germination des spores) et en automne; tandis que dans la direction du sud des parcelles la rouille se développa avec beaucoup d'énergie, vers le nord, ou il y avait plus d'ombre, la force de la maladie fut affaiblie.

La litérature apprécie trop peu l'influence de la lumière, cependant c'est un agent qui doit surtout se faire sentir au sud-est.

Les essais préliminaires de 1921 ont démontré une réduction visible de la germination des spores, qui était deux fois plus faible qu'à l'ordinaire. C'est surtout pendant leur germination et leur dissémination que les spores sont le plus sensibles à l'action de la lumière.

Il est à remarquer généralement, qu'au sud-est le développement de la rouille est inférieur relativement au nord, ce qui est dû aux conditions météorologiques.

Les feuilles des étages inférieures sont attaquées les premières, la maladie monte consécutivement à peu d'exception. La cause principale de ce fait est l'accroissement de l'humidité optimale qui augmente de haut en bas, ou le vent des steppes à moins de prise, surtout la nuit, quand une couche active de radiations nocturnes va se former grâce à la grande distance parmi les plantules, si caractéristique au sud-est.

DIE PILZKRANKHEITEN DER UNGARISCHEN MEDIZINALPFLANZEN

VON

DR. GUSTAV VON MOESZ (BUDAPEST)

Seitdem das Kgl. ungarische Ackerbauministerium auf den Anbau der Medizinalpflanzen eine grössere Wichtigkeit legt, hat sich auch das Interesse für diese Gewächse bedeutend erhöht. Diesbezüglich haben sich die Kgl. ung. Medizinalpflanzen-Versuchsstation und das Medizinalpflanzen-Verkehrsamt zu Budapest wohlverdient gemacht. Das Ziel des ersten Institutes bildet hauptsächlich die wissenschaftliche Untersuchung der Medizinalpflanzen, die Prüfung ihrer Anbaubedingungen, sowie ihrer chemischen Zusammensetzung; das letztere hat die Aufgabe diese in Handels-Verkehr zu bringen und im allgemeinen die mit den Medizinalpflanzen in engem Zusammenhange stehende praktische Fragen zu fördern. Beide Anstalten besitzen Versuchsanlagen.

Die Leiter dieser Instituten: Dr. B. AUGUSTIN und Dr. F. DARVAS errichteten im Landwirtschaftlichen Museum eine sehr schöne und instruktive Ausstellung, die eigentlich das Museum der ungarischen Medizinalpflanzen, und deren Produkte darstellt. Die Förderung der Interesse der Medizinalgewächse bezweckt die von Dr. F. DARVAS redigierte Zeitschrift „Herba", deren Hefte allmonatlich erscheinen.

Dr. B. AUGUSTIN beobachtete in den Anlagen der Medizinalpflanzen-Versuchsstation Krankheiten, die eingehend untersucht wurden. Nun erwies sich als wünschenswert die Zusammenstellung, Beobachtung, Beschreibung und Abbildung der wichtigeren Krankheiten. Der Verfasser dieser Zeilen hat 41 von Pilzen verursachten Krankheiten der Medizinalpflanzen coloriert abgebildet, die an der Medizinalpflanzen-Ausstellung ausgestellt wurden. Wenn es möglich wäre die geplante Arbeit auf eine grössere Anzahl der Krankheiten zu erweitern, so würde für die mit den Arzneigewächsen sich befassenden ein derartiges Werk zur Verfügung stehen, welches so in wissenschaftlicher als auch in praktischer Hinsicht vielleicht eine Lücke auszufüllen bestimmt wäre.

Ohne mich in Einzelheiten einzulassen, will ich bei dieser Gelegenheit bloss jene Krankheiten der Medizinalpflanzen aufführen, mit denen ich Gelegenheit hatte mich eingehend zu beschäftigen und die von mir coloriert abgebildet wurden. Diese Abbildungen sind im Tafelformat verfertigt, genügend gross, damit das Habitus der kranken Pflanze gut ersichtlich sei und auch die mikroskopische Abbildung des Krankheit erregendem Pilzes ins Auge fällt. Im unteren Teil jeder Tafel befindet sich der erklärende Text.

Acorus calamus L.: *Ramularia aromatica* (Sacc) v. H. Scheint für die Pflanze nicht wesentlich gefährlich zu sein.

Agrimonia eupatoria L.: *Pucciniastrum agrimoniae (Diet.) Tranzsch.* macht die Blätter für Droguezwecke unbrauchbar.

Althaea officinalis L.: *Colletotrichum malvarum (A. Br. et Casp.) Southw.* Bisher nur aus Berlin, Schweden und Nord-Amerika bekannt gewesen. Verursachte bei Stockholm in den Eibischkulturen grosse Schaden. In Ungarn wurde die Krankheit im Jahre 1921 beobachtet bei Tolna-Ozora in Eibischkultur.

Althaea rosea (L.) Cav.: *Cercospora althaeina Sacc.* Auch eine seltenere Krankheit.

Artemisia vulgaris L.: *Cercospora ferruginea Fuck.* und *Puccinia absinthii D. C.* Besonders der zweite Pilz macht die Blätter unbrauchbar.

Asarum europaeum L.: *Puccinia asarina Kuntze* pflegt eine epidemische Krankheit zu sein.

Atropa belladonna L.: *Ramularia atropae Allesch.* Selten.

Berberis vulgaris L.: *Septoria berberidis Niessl.* Selten.

Calendula officinalis L.: *Sphaerotheca humuli (DC) Burr.*, macht die Blätter unbrachbar.

Cannabis sativa L.: *Septoria cannabis (Lasch) Sacc.* In den Kulturen fleckenweise epidemisch.

Chelidonium majus L.: *Septoria chelidoni Desm.* Allgemein verbreitet.

Chrysanthemum vulgare (L.) Bernh. (= Chr. tanaceti): *Puccinia tanaceti DC.* Scheint in Ungarn selten zu sein.

Colchicum autumnale L.: *Urocystis colchici (Schlechtd.) Rbh.* Selten.

Conium maculatum L.: *Puccinia conii (Str.) Fuck.*, und *Plasmopara nivea (Ung.) Schroeter.* Beide kommen hier und da massenhaft vor.

Datura stramonium L.: *Macrosporium solani Ell. et Mart.* (= *Alternaria solani Sorauer*). Verursacht eine Fleckenkrankheit, welche die Blätter total zu Grunde richtet. Kommt aber nur selten vor.

Equisetum arvense L.: *Stamnaria equiseti (Hoffm. Rehm.)* Selten.

Foeniculum capillaceum Gilib.: *Fusicladium depressum (Berk. et Br.) Sacc.* Der Pilz erschien in zwei Versuch-Anpflanzungen, Erscheint der Pilz im stärkeren Masse, dann vergilben die Pflanzen. Grössere Schaden verursachen die Pflanzenläuse, welche die Entwickelung der Blüten hemmen.

Glechoma hederacea L.: *Puccinia glechomatis* DC. Die Blätter werden unbrauchbar.

Helleborus niger L.: *Urocystis anemones (Prs.) Winter.* Selten.

Hyoscyamus niger L.: Es wurden in Ungarn an dieser Pflanze drie Parasiten beobachtet, und zwar: *Septoria hyoscyami Hollos,* Übergänge zeigend zu *Ascochyta hyoscyami. Pat., Erysibe cichoriacearum DC.,* endlich *Peronospora hyoscyami De By.* Der letzte Pilz ruinirt die Blätter am stärkesten.

Iris germanica L.: *Heterosporium gracile Sacc.* Scheint für die Rhizombildung nicht gefährlich zu sein.

Juglans regia L.: *Marssonina juglandis (Lib.) P. Magn.* Kommt meistens epidemisch vor und verursacht Flecken sogar auf der Fruchthülle. *Microstroma juglandinum Ber. — Leptothyrium juglandis Rbh.*

Ledum palustre L.: *Chrysomyxa ledi De By.*

Levisticum officinale Koch: *Septoria levistici West.* Bisher nur aus Belgien bekannt gewesen.

Malva silvestris L.: *Puccinia malvacearum Mont.* Kommt öfters epidemisch vor und macht die Blätter unbrauchbar. Andere Arten der Gattung Malva werden ebenfalls oft von diesem Rostpilze angegriffen.

Melissa officinalis L.: *Septoria melissae Desm.* Der Pilz war aus Ungarn bisher unbekannt. In den Kulturen zeigte sich der Pilz schädlich. Er greift erst die unteren Blätter an, streckt sich aber schnell auch auf die oberen Blätter aus. Die kranken Blätter bräunen sich.

Ononis spinosa L.: *Ramularia Winteri Thümen.* Selten.

Plantago lanceolata L.: *Ramularia plantaginea Sacc. et Berl.* Selten.

Ricinus communis L.: *Ascochyta vicinella Sacc. et Scalia.* Der Pilz war bisher nur als Saprophyt aus Portugalien bekannt. In Ungarn ist er aufeinmal in zwei Medizinalpflanzen-Versuchs-Anlagen als Parasit erschienen. Verursacht braune Flecken an den Blätter.

Saponaria officinalis L.: *Septoria saponariae (DC.) Savi et Becc.* Selten.

Scopolia carnidica Jacqu.: *Ramularia scopoliae Voss.* Selten.

Taraxacum officinale Web.: *Puccinia silvatica Schroeter* und *Puccinia taraxaci (Rebent.) Plowr.* Verbreitet.

Tilia platyphylla Scop.: *Cercospora microsora Sacc.* An Blättern ziemlich verbreitet.

Tussilago farfara L.: *Coleosporium tussilaginis (Pers.) Lev.* und *Puccinia poarum Nielsen.* Beide verbreitet.

Veratrum album L.: *Fusoma veratri All.*

Veronica officinalis L.: *Peronospora grisea Unger.* Selten.

Viola odorata L. *Ramularia lactea Desm.* und *Cercospora violae Sacc.* Beide verbreitet.

Was den Schutz gegen die schmarotzende Pilze anbelangt, sei bemerkt, dass das Bespritzen mit Kupfervitriol-Lösung bloss in Ausnahmefällen empfohlen werden kann, damit die als Arznei dienenden Pflanzenteile eventuell nicht mit Kupfervitriol infiziert werden.

LES CAPSIDES DU TABAC AU BRÈSIL

PAR

CARLOS MOREIRA

(Pl. XIII)

Les hemiptères capsides *Engytatus notatus* Dist. et *E. geniculatus* Reuter sont des insectes très nuisibles au tabac (*Nicotiana tabacum* L.) au Brésil et leur biologie n'a pas encore été étudiée complètement; ces capsides vivent en grand nombre sur cette plante principalement à la face inférieure des feuilles; en les piquant elles produisent des altérations que Woods appela stigmonose, les tachent avec leurs excréments, les inutilisant, ou reduisant de beaucoup leur valeur.

Ces petits hemiptères ont une vie courte; ils vivent à peine 18 à 20 jours de l'éclosion à la mort de l'imago, mais leurs générations se succèdent sans interruption, de façon qu'en peu de temps toute une plantation est infestée par ces insectes. Ces hémiptères ont été trouvés aussi au Mexique, aux Etats Unis, en Californie, Colorado, Florida, South Carolina et New Mexico (Mc Atee).

L'espèce plus petite *Engytatus notatus* à la tête noire avec une tache triangulaire jaune du coté postéro-interne de chaque oeil; les yeux sont brun rougeâtre; les antennes sont fuligineuses avec l'extrémité du second segment et l'extrémité distale du troisième jaunes; pronotum jaune verdâtre avec la face dorsale plus ou moins fuligineuse, les cotés et la marge postérieure noirs; scutellum verdâtre avec une bande longitudinale au milieu et le sommet noirs; l'abdomen vert jaunâtre est garni de poils courts et épars, aux extrémités et à la partie dorsale il est brun noir; les pattes sont jaune verdâtre avec des poils et des soies, les tibias et les tarses sont légèrement fuligineux. Les ailes antérieures jaunes légèrement fuligineuses, principalement la membrane, ont une tache noire à l'extrémité du cuneus et une autre près de l'extrémité du corium; les ailes postérieures sont hyalines avec des reflets irisés, la trompe est jaune clair. L'abdomen du mâle est cylindrique avec les derniers segments légérement courbés. (Voir Pl. XIII, fig. 4).

Longueur du front jusqu'à l'extrémité de l'abdomen 2,4 mM.

La femelle a la même couleur du mâle avec l'abdomen plus gros à la hauteur du sixième segment où s'articule l'oviscapte; elle est légèrement plus grande que le mâle, car elle a 2,5 mM. de longueur du front à l'extrémité de l'abdomen. Les ailes aussi bien du mâle que de la femelle excèdent en longueur l'abdomen.

L'oeuf et la ponte.

L'oeuf de cet insecte, dans l'ovaire prêt à être pondu a 0,67 mM. de longueur et 0,06 m.M. de grosseur; il est légèrement courbé, fusiforme avec l'extrémité tronquée et garnie de soies. L'oeuf pondu est blanc avec la coque finement reticulée, il a 0,7 mM. de longueur et 0.22 mM. de grosseur au milieu et 0,11 mM. à l'extrémité plus fine; l'extrémité où se trouve l'opercule par où se fait l'éclosion, est tronquée mais sans soies. La femelle ouvre l'oviscapte de derrière en avant et l'enfonce dans la nervure centrale du côté de la face inférieure de la feuille, contracte l'abdomen et avec un visible effort ponds l'oeuf qui glisse par l'oviscapte et pénètre dans la fente faite par celui-ci dans le tissu de la nervure (Pl. XIII, fig. 3).

L'oeuf reste incliné avec l'extrémité tronquée fixée à l'épiderme.

Douze heures après la fécondation la femelle commence à pondre deux à trois oeufs avec des intervalles de 12 heures.

La ponte dure au moins une minute, pendant ce temps l'insecte maintient l'oviscapte enfoncé dans la nervure de la feuille.

La ponte ne peut pas être faite que dans la nervure centrale, ou dans les grosses nervures secondaires, parce que seulement celles-ci peuvent loger l'oeuf comme il est pondu, incliné dans la position convenable, qui a besoin de tissus d'une épaisseur d'au moins 0,35 mM. Cet épaisseur se trouve seulement dans la nervure médiane, ou dans les grosses nervures secondaires; le limbe de la feuille entre les nervures a 0,1 mM. d'épaisseur et la nervure médiane d'une feuille petite a trois quarts de la longueur avec 1 à 2,5 mM. d'épaisseur. L'insecte cherche par cette raison instinctivement la nervure médiane où il peut loger l'oeuf. La femelle meurt 5 jours à peu-près après la ponte du dernier oeuf et le mâle dans 4 jours à peu-près.

Eclosion et Metamorphose.

Au septième jour après la ponte l'éclosion a lieu; la larve ou insect nouveau-né qui est aptère à 0,35 mM. de longueur, il est jaune, l'abdomen est plus clair et après l'ingestion d'aliments il devient plus sombre; les yeux sont brun clairs.

Après la première mue commencent à naître les rudiments d'ailes qui se développent jusqu'à la seconde mue, qui a lieu 3 jours après la première; après la seconde mue l'insect prend la forme ailé d'imago. Quatre jours après la dernière mue l'insect est prêt à la réproduction. Le mâle excite la femelle par titilation avec les antennes et par des assauts répétés, après ils s'unissent et restent unit plus de 20 minutes. Douze heures après la ponte commence; l'incubation dure 7 jours et de l'éclosion à la naissance de l'imago découlent au moins 9 jours; la vie de l'imago ou insect parfait compte 9 jours et la durée du cycle biologique complet de l'insecte 18 jours. La température oscilla de 26° à 32° C. pendant le temps que j'ai fait ces observations.

Dégâts produits par l'insecte.

Ce petit hemiptère, quand les conditions météorologiques (sécheresse et chaleur) sont favorables, se développe considérablement et s'agglomérant sur la face inférieure des feuilles, les insectes les piquent, produisant des altérations de la chlorophylle, et la feuille jaunit et sêche prématurément dans les places piquées. L'insecte piquant les feuilles et volant d'une à l'autre plante peut transmettre des maladies du tabac. Outre ces dommages l'*Engytatus notatus* défécant sur les feuilles les tache et les déprécie. —

Il y a une autre espèce de petite punaise capside un peu plus grande que l'espèce précédente qui produit les mêmes dégats: c'est l'*Engytatus geniculatus* Reuter. Cette espèce à la tête jaune avec un collier brun clair à la partie postérieure, les yeux sont brun noir, les antennes ont le premier article fuligineux et les extrémités jaune clair, les articles suivants sont fuligineux avec des poils et des soies, celles-ci plus sombres que ceux-là; la trompe a le premier segment de la base jaune, les suivants sont fuligineux; les ailes sont jaunes, les antérieures ont la membrane iridescente et les postérieures sont hyalines; les pattes sont jaune clair, les tarses fuligineux. Le corps est verdâtre; les deux sexes ont la même coloration; ils ont 3 mM. de longueur du front à l'extrémité de l'abdomen.

La biologie de cette espèce est plus au moins identique à celle de l'*Engytatus notatus* mais elle pond 7 à 8 oeufs du même type de ceux de cette espèce, un peu plus allongés et courbes avec 1 mM. de longueur et 0,4 mM. de grosseur. Cette espèce est plus agile et ses mouvements sont plus rapides.

Moyens de protection des plantes et de lutte contre l'insecte.

Les pépinières et les jeunes plantes doivent être protegées par des cages garnies de toile d'un mM. de maille aussi longtemps possible; après, quand les cages sont retirées, on traite les plantes avec des pulvérisations d'émulsion de savon et pétrole et du sulfate de nicotine.

J'ai essayé l'émulsion à deux pour cent de kerosene ou pétrole raffiné; celle-ci doit être bien preparée de façon que l'émulsion soit parfaite et qu'il ne reste du pétrole libre, autrement celui-ci brûlerait les feuilles de la plante.

J'ai employé la formule suivante:

Eau	1 litre
Savon dur	800 grammes
Pétrole	1 litre.

On dissout toute la pâte de l'émulsion dans 50 litres d'eau chaude, qu'on laisse refroidir avant de l'appliquer et alors ou ajoute 0,1 pour cent de nicotine, ou de sulfate de nicotine c'est-à-dire 50 cc. pour les 50 litres d'émulsion.

Cet insecticide tue à peu près 70 % des insectes atteints.

Les insectes ailés meurent en plus grand nombre parce que l'insecticide qui mouille les ailes de l'insecte reste plus longtemps en contact avec celui-ci et son action est ainsi prolongée, tandis que les larves ou jeunes insectes sont atteints par l'insecticide qui après les avoir mouillés, coule bientôt et agit ainsi pendant un temps plus court.

De 9 en 9 jours naissent des insectes ailés, le traitement doit pour cela être répété de 10 en 10 jours jusque les plantes soient complètement débarrassées des insectes.

Les plantes traitées par l'émulsion de savon et pétrole, après quelques jours n'ont plus d'odeur de pétrole; après des pluies elles sont tout-à-fait lavées et je crois que ce traitement ne peut pas être nuisible à la qualité du tabac.

AN ABSTRACT OF A REPORT OF THE „ENTOMOLOGICAL STUDY" AT DATNOW'S AGRICULTURAL COLLEGE, LITHUANIA, YEAR 1921—1922

BY

ST. MOSTOVSKY

Besides the practice with students this „Entomological Study" studies the biology of noxious insects.

Special interest have, as follows:

1. *Ips typographus L.* has in Lithuania bivoltinis double generation: beginning of the flying out 15/V; the first eggs were laid 24/V; first larvae 6/VI; the first nymphae 22/VI; the first imago 5/VII; the first beetles leave the tree 15/VII.

The second generation: flying out 15/VII; eggs laying 8/VIII; larvae 20/VIII; nymphae 5/IX; imagines 18/IX. Data of the year 1922. (Data of the year 1921 are to be seen in the table on p. 222 of the Report of the Study).

2. *Pityogenes chalcographus L.* likewise has two generations a year and its biology differs but little from that of *Ips Typographus*. See the table on p. 224.

3. *Hylesinus fraxini F.* See the table on p. 226. In addition to this a few other wood-beetles were observed; their biology is not to be cleared up as yet; for instance: *Polygraphus polygraphus L.*, *Eccoptogaster intricatus Panz.*, *Eccoptogaster scolytus* F., *Hylastes pallatus Gyll.*, *Xyloterus lineatus Oliv.*, *Eccoptogaster ratzeburgii Janz.*, *Myelophilus piniperda L.*, *Myelophilus minor Hart.*, *Ips laricis L.*

4. *Lophyrus rufus Kl.* very much injured the young pinetrees in the Shelshy district. 60% of the cocoons was infected by parasites from the family Ichneumonidae. Larvae began to make cocoons 14/VII. On August the 3rd from the smaller part of them imagines emerged, but the greater part of *Lophyrus* passed the winter in nymphal state [1]). So this insect seems to have only one generation a year.

5. *Clytus rusticus L.* is often to be seen around Datnow causing injury to aspens.

6. *Plusia gamma L.* in the year 1922 very much injured peas, flax and other plants. On August 4th most of the caterpillars metamorphosed into nymphae. On August 7th the first butterflies

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1) In Holland *L. rufus* passes the winter in egg-state. — Ed.

came out and on August 15th an immense quantity of butterflies flew about in the fields. For the first time one could observe butterflies 16/IX.

7. *Anthonomus pomorum L.* Beginning of the flight 16/IV; eggs 7/V; larvae 15/V; nymphae 30/V; imagines II/VI. Beetles left the injured flowers 22/VI; see the table p. 234. Data of the year 1922.

8. *Rhynchites equatus L.* is met with rather rarely.

The Study prepares biological collections of injurious insects, a list of which is given on the last page, 238, of the report of the Study.

EXPLANATION OF PLATES

PLATE I—IV.

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(For explanation of figures see p. 24—27.)

PLATE V—VI.

VON BREHMER: Die anatomischen und mikrochemischen Veränderungen des Kartoffelleptoms; p. 79.
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S. G. PAINE: Internal rust spot of the potato tuber; p. 74.

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M. W. POLAK: The furrowing-wheel for destroying leather jackets; p. 124.

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J. HUDIG: Diseases of crops on alcaline and sour soils; p. 136.

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C. MOREIRA: Les capsides du tabac au Brésil (Fig. 3, 4); p. 283.

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Fig. 4. „ „ „ antenne de l'estivalis aptère.
Fig. 5. „ „ „ antenne de l'estivalis ailé.
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(Dans toutes les figures, les échelles sont graduées en centièmes de millimètres).

H. Ramaer, fc.

Quanjer

H. Ramaer, fc. QUANJER

Pl. III

H. Ramaer, fc. QUANJER

Pl. IV

H. Ramaer, fc.

Quanjer

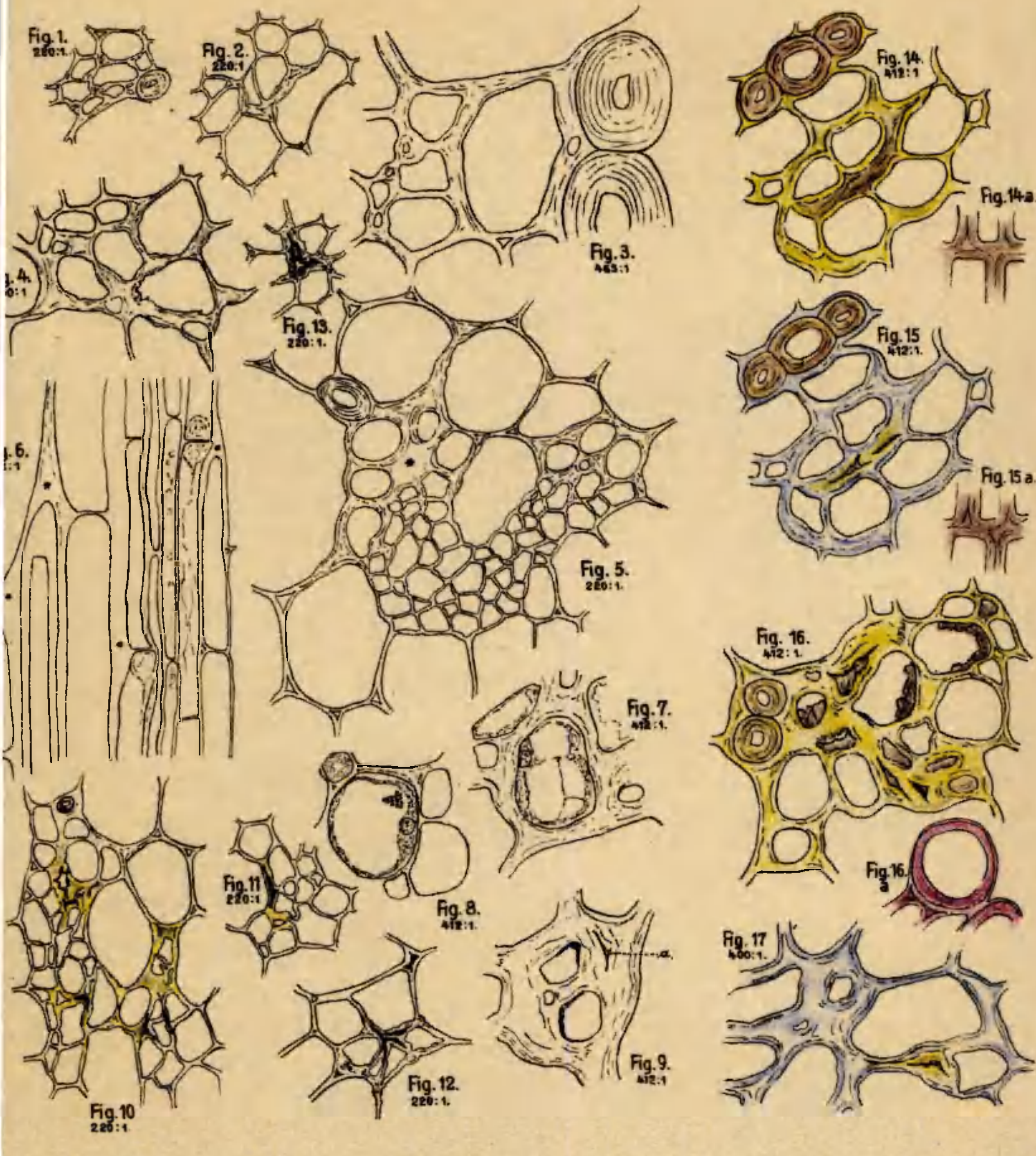

Fig. 1—9. **Nekrobiose.**

Fig. 1—6. Sorte Gloriosa. Fig. 1. Beginnende Aufquellung in den Zwickeln eines markständigen Leptombündels. Fig. 2. Fortschreitende Quellung der zwischen den Zwickeln liegenden Wandpartieen. Fig. 3. Starke Zwickelaufquellung eines oberirdischen Stengelteiles. Fig. 4. Starke Wandverquellung eines markständigen Leptombündels in unterirdischen Stengelknoten. Fig. 5. Markständiges Siebbündel mit starken Verquellungen an den älteren Siebteilen. Pig. 6. Verquollenes Phloembündel der Rinde im Längsschnitt (* stark verquollene Wände).

Fig. 7—9. Kernnachweis in den verquollenen Zellen. Fig. 8. Normale Siebröhre mit einseitiger schwacher Wandverquellung. Fig. 7. Stärker verquollene Siebröhre mit Kern. Fig. 9. Sehr stark verquollene Siebröhre ohne Kern mit abgestorbenem Plasma. *a.* Zusammengedrückte Zelle.

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Fig. 10, 11, 13. Sorte Gloriosa. Fig. 10. Markständige, nekrotische Leptompartieen des mittleren Stengels mit Gewebezerrungen und Gelbverfärbungen. Fig. 11. Vorgeschrittenes Nekrosestadium mit schwächerer Wandverquellung. Markständiges Siebgewebe eines unteren Stengelteiles. Fig. 12. Sorte Paul Krüger. Vorgeschrittenes Nekrosestadium im markständigen Siebteil. Stärkere Wandverquellung, stärkere Gewebezerrung, noch keine Gelbverfärbung. Fig. 13. Rindenständiges Siebgewebe mit starkem örtlichen Nekroseherd. Fig. 14—17. Sorte Gloriosa. Fig. 14 und 15. Blattrollkranke Stengelschnitte nach Behandlung mit Jodjodkalilösung und Schwefelsäure. Fig. 16. Nekrotisches Gewebe eines markständigen Leptombündels nach Behandlung mit Phloroglucin und Salzsäure. Fig. 17. Nekrobiotisches Gewebe mit Nekrosenest nach Behandlung mit Chlorzinkjodlösung.

v. Brehmer.

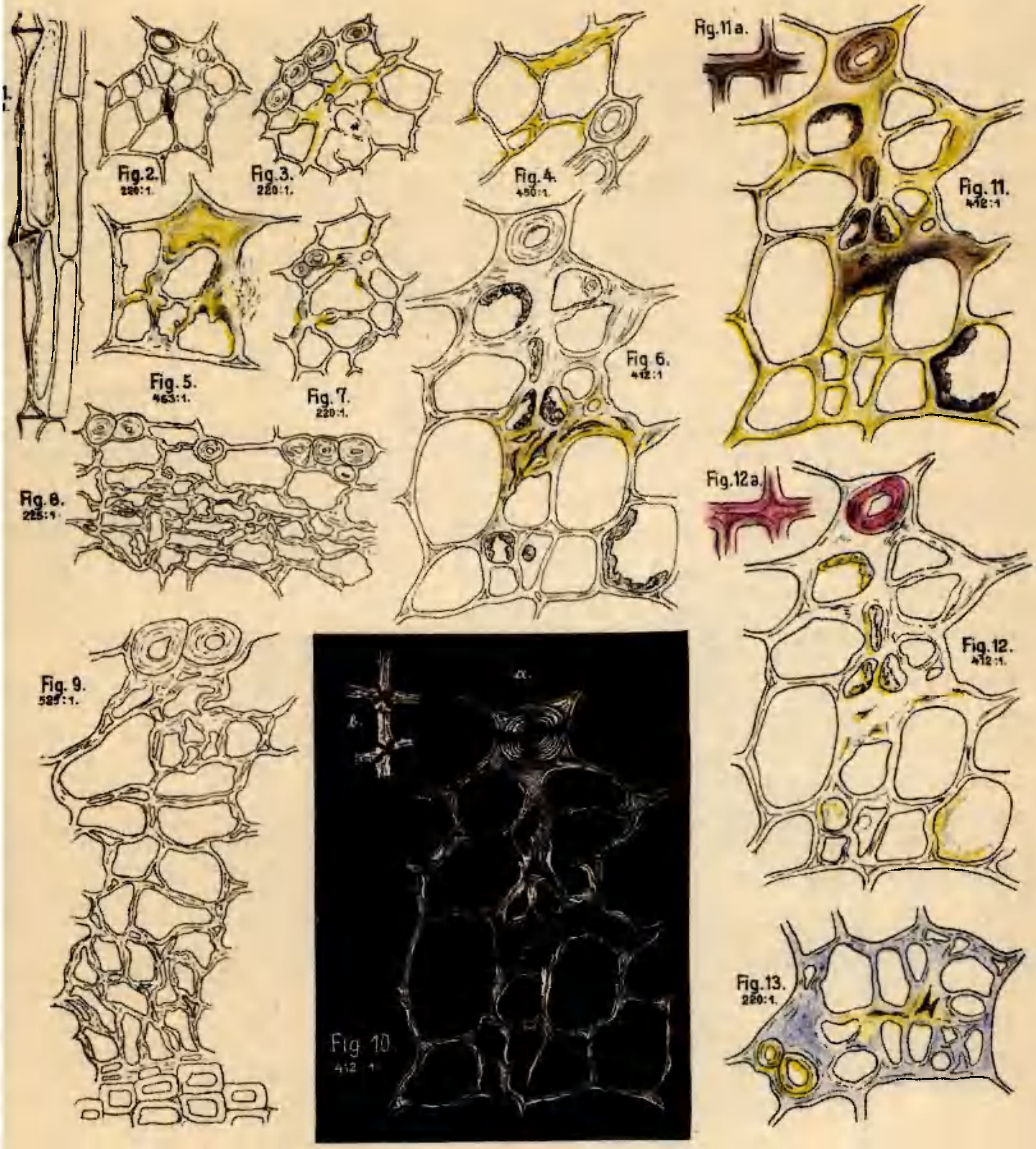

Fig. 1—7. **Nekrose.**

Fig. 1 und 2. Sorte Gloriosa. Fig. 1. Längsschnitt durch nekrotisches markständiges Leptombündel. Fig. 2. Beginnende Nekrose mit schwacher Gewebezerrung, keine Gelbverfärbung. Die nekrobiotischen Verquellungen sind von dem nekrotischen Gewebe unabhängig. Fig. 3, 4, 7. Sorte Paul Krüger. Rindenständiges Leptom. Nekrose im nekrobiotischem Gewebe mit Gelbverfärbungen, Gewebezerrungen und Wandzerstörungen *. Fig. 5 und 6. Sorte Gloriosa. Fig. 5. Markständiges Leptom im oberirdischen Stengel. Nekrose im nekrobiotischem Gewebe. Zerfaserung der gequollenen Wände. Fig. 6. Markständiges Leptom. Nekrotisches Gewebe zwischen gesundem und nekrobiotischem.

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Fig. 10—13. **Nekrose.**

Fig. 10. Schnitt wie Fig. 6 aber im polarisierten Lichte gesehen. Fig. 11 und 12. Schnitt wie Fig. 6 nach der Reaktion von Mäule behandelt. Fig. 13. Sorte Gloriosa. Markständiges Leptom. Nekrose mit Nekrobiosegewebe nach Behandlung mit Chlorzinkjodlösung.

v. Brehmer.

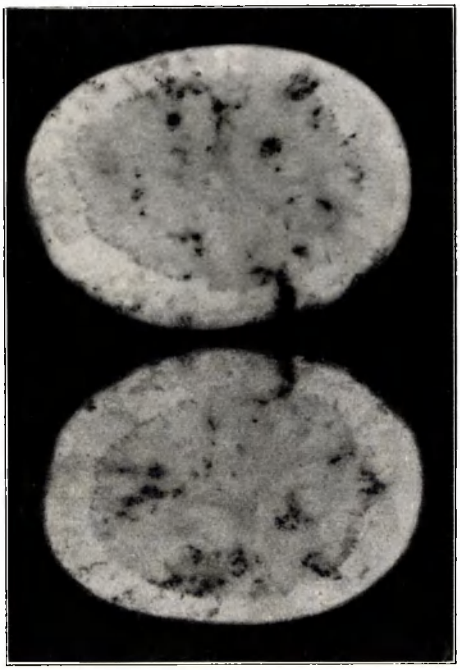


Fig. 1

Fig. 2

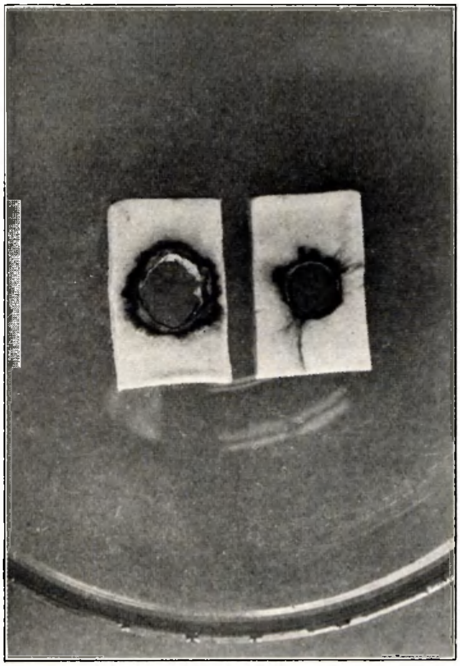


Fig. 3

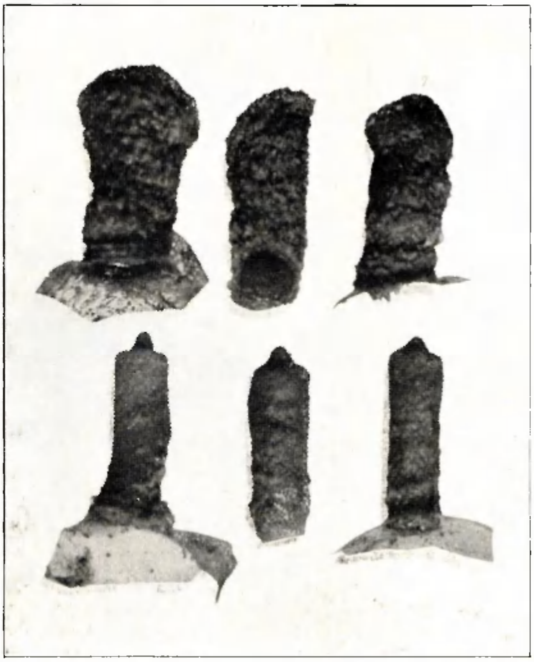


Fig. 4

Fig. 1

Fig. 2

Fig. 1

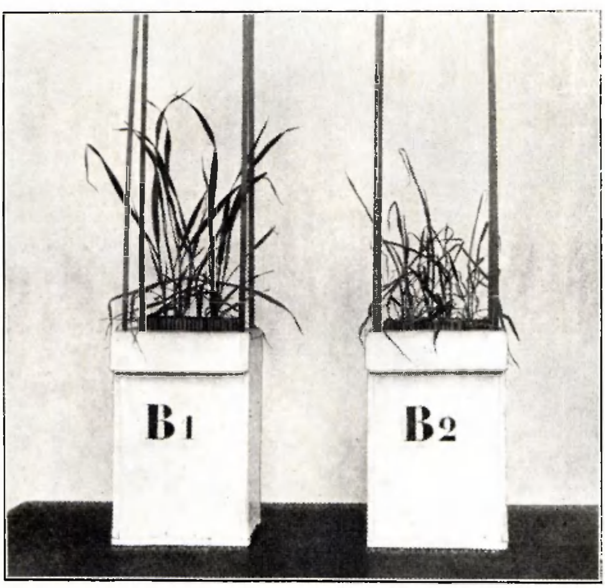


Fig. 2

HUDIG

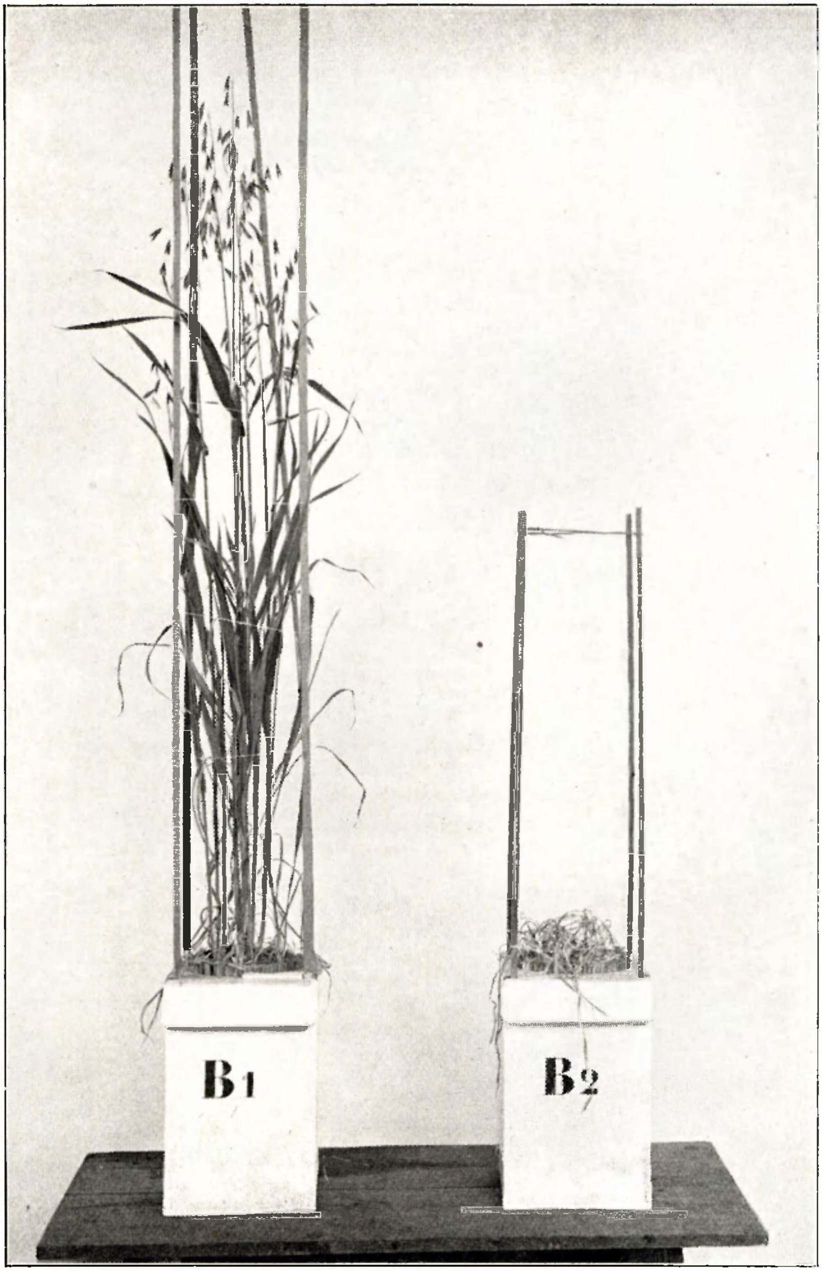


Fig. 3

HUDIG

Fig. 1

Fig. 2

v. Slogteren

Fig. 1

Fig. 2

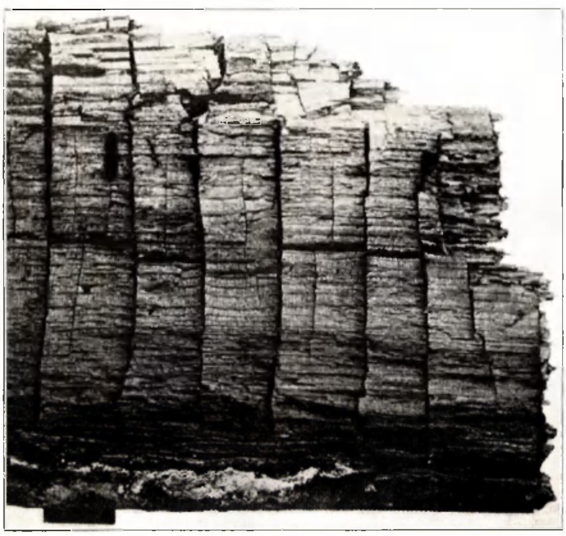


Fig. 3

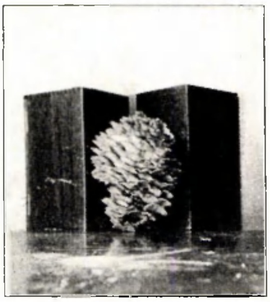


Fig. 1

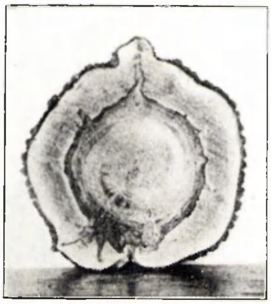


Fig. 2

Vanine

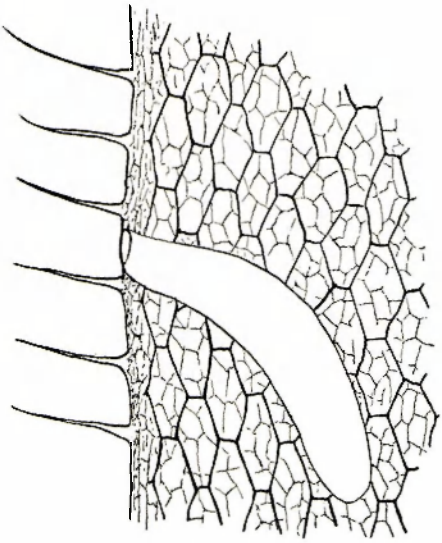


Fig. 3

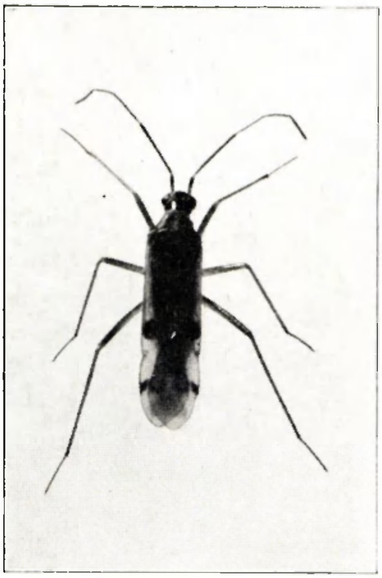
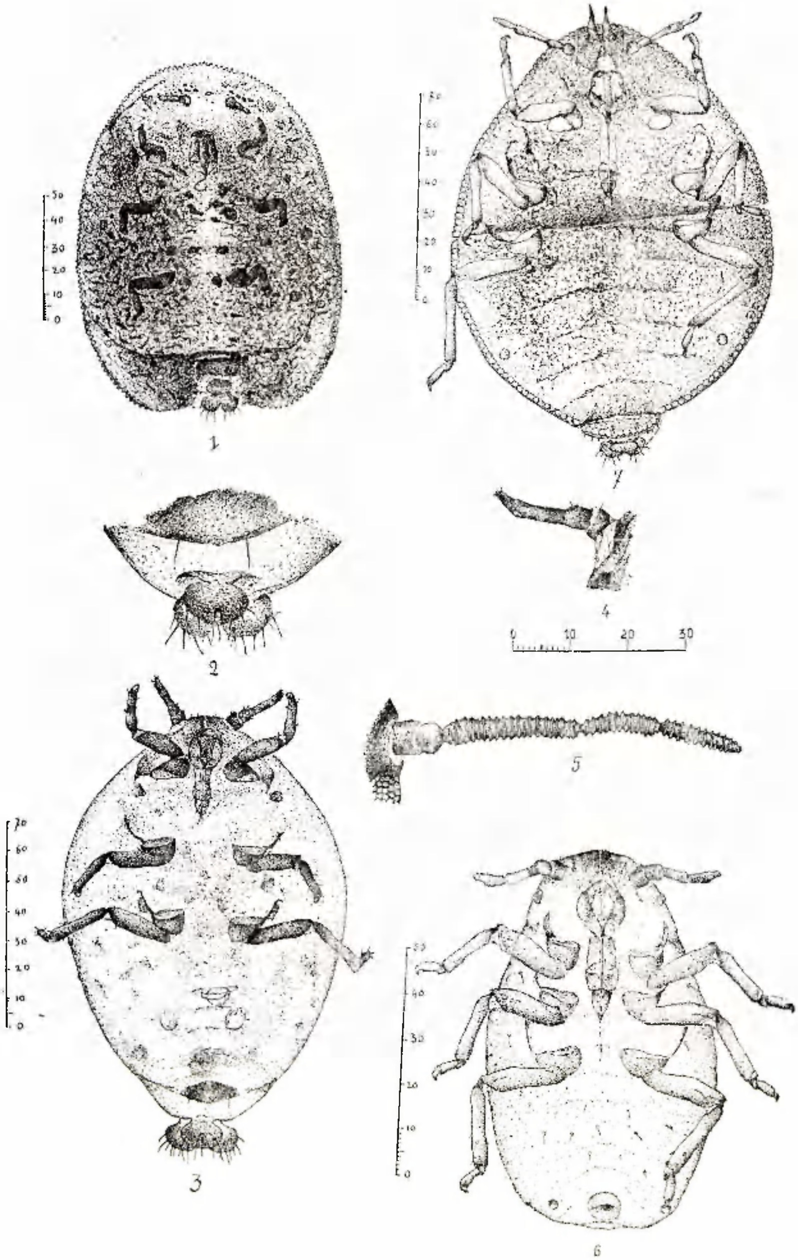


Fig. 4

Moreira


POTATOES

Pl. XV



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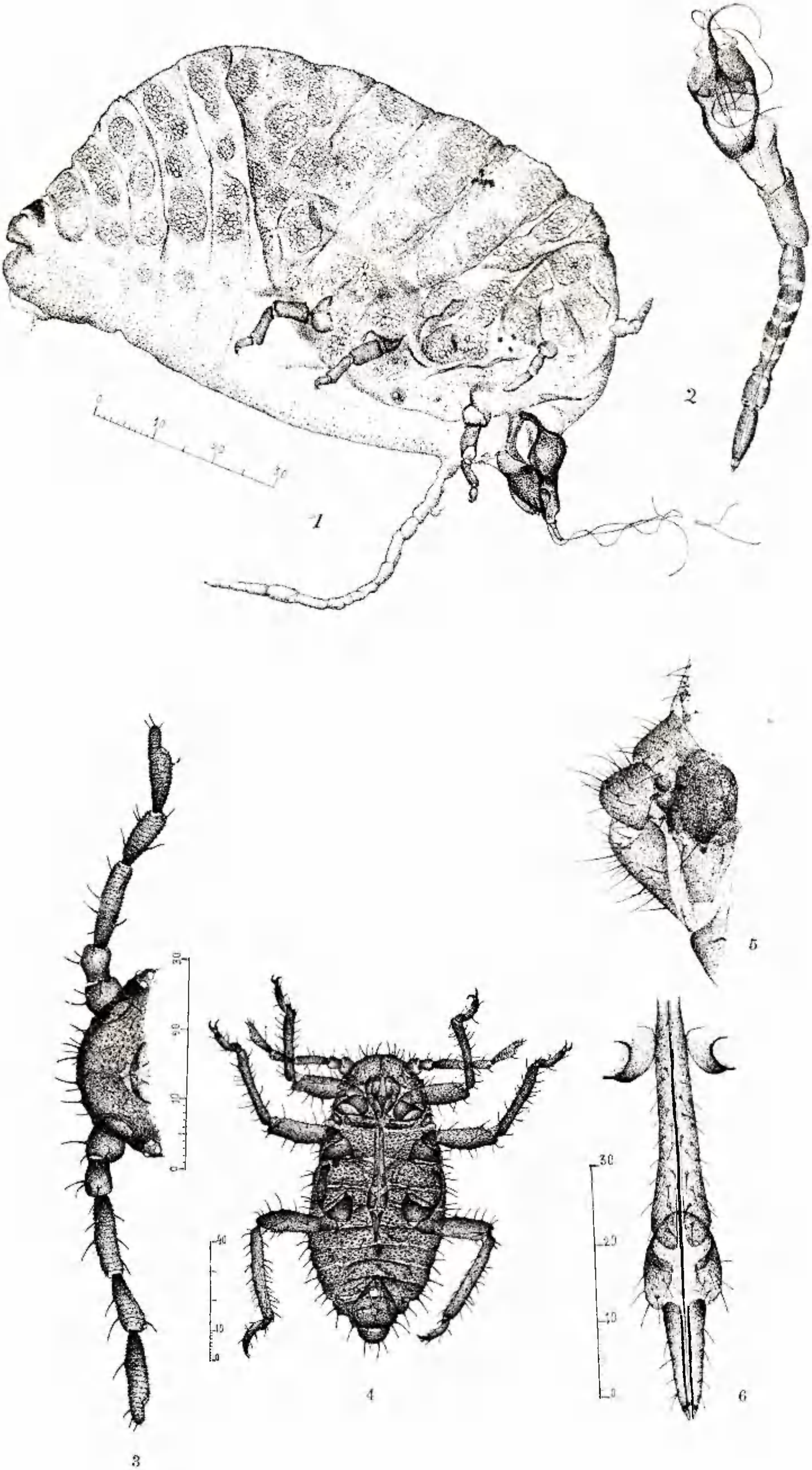

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(to be obtained free of charge for the price mentioned; apply to: Inspecteur, Hoofd van den Plantenziektenkundigen Dienst te Wageningen, Holland).

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13a. The Phytopathological Service in the Netherlands.

13b. Statens Plantepatologisk kontor i Nederlandene.

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15. Proefnemingen met rook, ter bescherming van gewassen tegen nachtvorsten. (23 blz., 11 fig.) f 0.70.
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16a. Black scab (wart disease) in the Netherlands.

16b. La maladie verruqueuse (gale-noire) des pommes de terre aux Pays-Bas.

16c. Der Kartoffelkrebs in den Niederlanden.

17. Vogelkultuur en vogelstudie (28 blz., 1 plaat, 1 staat). f 0.50.
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19. Bestrijding van plantenziekten in kleine tuinen I (20 blz., 3 platen, 22 fig.) f 0.30.
20. Wormstekigheid bij appel en peer (18 blz., 2 platen). f 0.25.
21. Bestrijding van plantenziekten in kleine tuinen II (18 blz., 5 platen, 25 fig.) f 0.35.
22. Plantenziektenkundige waarnemingen II. (27 blz., 8 fig.) f 0.35.
23. De Strepenziekte van de gerst (18 blz., 4 platen.) f 0.30.
24. Plantenziektenkundige waarnemingen III, Iepenziekte, Chloroclystis R. (40 blz., 4 platen.) f 0.45.
25. Bestrijding van tomatenziekten in Engeland (reisverslag). f 0.15.
26. Ziekten en beschadigingen van tomaten. (30 blz., 2 stat., 21 fig.) f0.45.
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28. Plantenziektenkundige waarnemingen IV, Over Emelten (40 blz., 4 platen) f 0.45.
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