



FIELD GUIDE TO INTEGRATED PEST MANAGEMENT



TABLE OF CONTENTS – OUTLINE

Ref	Group / Section	Coordinator	Page
A	Integrated Disease Management	K. Seebold, University of Kentucky, USA	1
A.1	Fungal Diseases	K. Seebold, University of Kentucky, USA	
A.2	Bacterial Diseases	C. Fisher, University of Kentucky, USA	
A.3	Viral Diseases	B. Kennedy, University of Kentucky, USA	
A.4	Seedling Diseases	K. Seebold, University of Kentucky, USA	
A.5	Postharvest Diseases	C. Fisher, University of Kentucky, USA	
A.6	Diseases Not Covered	A. Jack, University of Kentucky, USA	
B	Integrated Nematode Management	C. Johnson, Virginia Tech, USA	
B.1	Rootknot Nematodes	C. Johnson, Virginia Tech, USA	
B.2	Other Nematodes	C. Johnson, Virginia Tech, USA	
C	Integrated Insect Management	P. Semtner, Virginia Tech, USA	
C.1	Stem and Root Insect Pests	F. Reay-Jones, Clemson University, USA	
C.2	Chewing Insect Pests	D. Martin, Profigen, USA	
C.3	Sucking Insect Pests	R. McPherson, University of Georgia, USA	
C.4	Seedling Insect Pests	P. Semtner, Virginia Tech, USA	
C.5	Stored Tobacco Pests	V. Schmidt, RJ Reynolds, USA	
D	Integrated Weed Management	A. Bailey, University of Kentucky, USA	
D.1	Field Weeds	A. Bailey, University of Kentucky, USA	
D.2	Parasitic Weeds	J.L. Verrier, Altadis, France	
E	Components of IPM	A. Kohler, UNISC, Brazil	
E.1	Pests, Pesticides, and Epidemics	C. Fisher, University of Kentucky, USA	
E.2	Systemic Acquired Resistance	A. da Rocha, Universal Leaf, Brazil	
E.3	Biological Control Organisms	tba	
E.4	Trap, Barrier, and Rotation Crops	A. Biesdorf, Premium Tabacos, Brazil	
E.5	Cigar Tobaccos	M. Hartley, ASP Enterprises, Ecuador	



INTEGRATED DISEASE MANAGEMENT



TABLE OF CONTENTS – DISEASES

Chapter	Disease	Pathogen	Author	Page
<u>A.1 Fungal Diseases</u>				
Foliar Diseases				
1	Brown Spot / Alternaria Leaf Spot	<i>Alternaria alternata</i>	S. Dimbi	5
2	Frogeye	<i>Cercospora nicotianae</i>	K. Seebold	
3	Anthrachnose	<i>Colletotrichum</i> spp	K. Seebold	
4	Powdery Mildew / White Mould	<i>Erysiphe cichoracearum</i> , <i>Erysiphe orontii</i>	J.L. Verrier, B. Cailleteau	
5	Blue Mould	<i>Peronospora tabacina</i>	E. Lahoz	
6	Target Spot / Rhizoctonia Leaf Spot	<i>Thanatephorus cucumeris</i> (perf) <i>Rhizoctonia solani</i> (imperf)	K. Seebold	
Root and Stem Diseases				
7	Fusarium Wilt	<i>Fusarium oxysporum</i> fs. <i>nicotianae</i>	B. Kennedy	
8	Big Yellows	<i>Phytophthora glovera</i>	D. Shew	
9	Black Shank	<i>Phytophthora nicotianae</i>	D. Shew	
10	Pythium Damping-Off	<i>Pythium</i> spp.	C. Mainjeni	
11	Soreshin / Rhizoctonia Damping-Off	<i>Rhizoctonia solani</i>	E. Lahoz	
12	Collar Rot	<i>Sclerotinia sclerotiorum</i>	K. Seebold	
13	Southern Blight / Southern Stem Rot	<i>Sclerotium rolfsii</i>	D. Shew	
14	Black Root Rot	<i>Thielaviopsis basicola</i>	D. Shew	
<u>A.2 Bacterial Diseases</u>				
Foliar Diseases				
15	Wildfire, Angular Leaf Spot	<i>Pseudomonas syringe</i> pv. <i>tabaci</i> (tox+, tox-)	A. Jack	
16	Stolbur, Aster Yellows, Big Bud	<i>Phytoplasma</i> spp.	F. Mornet	
Root and Stem Diseases				
17	Black Leg, Hollow Stalk	<i>Erwinia carotovora</i> subsp. <i>carotovora</i>	B. Fortnum	
18	Granville Wilt / Bacterial Wilt	<i>Ralstonia solanacearum</i>	B. Fortnum	

TABLE OF CONTENTS – DISEASES cont.

Chapter	Disease	Pathogen	Author	Page
A.3	<u>Viral Diseases</u>			
19	Potato Virus Y	PVY	N. Billenkamp	
20	Etch	TEV	B. Kennedy	
21	Vein Mottling	TVMV	B. Kennedy	
22	Leaf Curl Curly Shoot Apical Stunt Yellow Dwarf	TbLCV TbCSV TbASV TYDV	V. Nikolaeva	
23	Tomato Spotted Wilt	TSWV	A. Csinos	
24	Cucumber Mosaic	CMV	K. Koga, H. Harada	
25	Alfalfa Mosaic	AMV	D. Xu	
26	Streak	TSV	T. Lima, F. Viana	
27	Bushy Top	TBTV	C. Fisher	
28	Mosaic	TMV	A. Jack	
29	Ringspot	TRSV	M. Lusso	
A.4	<u>Seedling Diseases</u>			
30	Management of Seedling Diseases		K. Seebold	
A.5	<u>Postharvest Diseases</u>			
31	Fungal Barn Rot	<i>Rhizopus</i> spp., <i>Pythium</i> spp.	S. Dimbi	
32	Bacterial Barn Rot	<i>Erwinia carotovora</i> subsp. <i>carotovora</i>	B. Fortnum	
33	Barn and Storage Moulds	<i>Aspergillus</i> spp., <i>Penicillium</i> spp.	C. Fisher	
A.6	<u>Diseases not covered</u>			
34	List of diseases not covered		A. Jack	

A.1. Fungal Diseases

1. **Brown Spot / Alternaria Leaf Spot** *Alternaria alternata*

Susan Dimbi, Tobacco Research Board, Zimbabwe

General

A.1. Fungal Diseases

2. Frogeye *Cercospora nicotianae*

Kenny Seebold, University of Kentucky, USA

General

A.1. Fungal Diseases

3. **Anthracnose** *Colletotrichum* spp.

Kenny Seebold, University of Kentucky, USA

General

A.1. Fungal Diseases

4. Powdery Mildew / White Mould *Erysiphe cichoracearum*, *Erysiphe orontii*
Jean-Louis Verrier & Bernard Cailleateau, Altadis-Imperial Tobacco Group, France

General

A.1. Fungal Diseases

5. **Blue Mould** *Peronospora tabacina*

Ernesto Lahoz, Agricultural Research Council, Italy

General

A.1. Fungal Diseases

- 6. Target Spot / Rhizoctonia Leaf Spot** *Thanatephorus cucumeris* (perf),
Rhizoctonia solani (imperf)
Kenny Seebold, University of Kentucky, USA

General

A.1. Fungal Diseases

7. **Fusarium Wilt** *Fusarium oxysporum* fs. *nicotianae*

Brenda Kennedy, University of Kentucky, USA

General

A.1. Fungal Diseases

8. Big Yellows *Phytophthora glovera*

David Shew, North Carolina State University, USA

General

A.1. Fungal Diseases

9. **Black Shank** *Phytophthora nicotianae*

David Shew, North Carolina State University, USA

General

A.1. Fungal Diseases

10. Pythium Damping-Off *Pythium* spp.

Chrissie Mainjeni, Agricultural Research & Extension Trust, Malawi

General

A.1. Fungal Diseases

11. Soreshin / Rhizoctonia Damping-Off *Rhizoctonia solani*

Ernesto Lahoz, Agricultural Research Council, Italy

General

A.1. Fungal Diseases

12. Collar Rot *Sclerotinia sclerotiorum*

Kenny Seebold, University of Kentucky, USA

General

A.1. Fungal Diseases

13. Southern Blight / Southern Stem Rot *Sclerotium rolfsii*

David Shew, North Carolina State University, USA

General

A.1. Fungal Diseases

14. Black Root Rot *Thielaviopsis basicola*

David Shew, North Carolina State University, USA

General

A.2. Bacterial Diseases

15. Wildfire, Angular Leaf Spot *Pseudomonas syringae* pv. *tabaci* tox+, tox-
Anne Jack, University of Kentucky, USA

General

A.2. Bacterial Diseases

16. Stolbur, Aster Yellows, Big Bud *Phytoplasma* spp.

Fabienne Mornet, ANITTA, France

General

A.2. Bacterial Diseases

17. **Black Leg, Hollow Stalk** *Erwinia carotovora* subsp. *carotovora*

Bruce Fortnum, Clemson University, USA

General

A.2. Bacterial Diseases

18. Granville Wilt / Bacterial Wilt *Ralstonia solanacearum*

Bruce Fortnum, Clemson University, USA

General

A.3. Viral Diseases

19. Potato Virus Y PVY

Norbert Billenkamp, Agricultural Technology Centre Augustenberg, Germany

General

A.3. Viral Diseases

20. Etch TEV

Brenda Kennedy, University of Kentucky, USA

General

A.3. Viral Diseases

21. Vein Mottling TVMV

Brenda Kennedy, University of Kentucky, USA

General

A.3. Viral Diseases

- 22. Leaf Curl** TbLCV
Curly Shoot TbCSV
Apical stunt TbASV
Yellow Dwarf TYDV

Velitchka Nikolaeva, Consultant, Bulgaria

General

A.3. Viral Diseases

23. Tomato Spotted Wilt TSWV

Alex Csinos, University of Georgia, USA

General

A.3. Viral Diseases

24. Cucumber Mosaic CMV

Kazuharu Koga & Haruyasu Harada, Japan Tobacco, Japan

General

25. Alfalfa Mosaic AMV

Dongmei Xu, Altria Client Services, USA

General

In general, alfalfa mosaic virus (AMV) is not a major problem in tobacco, although local incidences of infection occur each year. It can affect all tobacco types, but typically is more of a problem on burley. It infects a wide range of plant species. Although tobacco is not a major host, an increasing number of cases of AMV infection has been observed in burley tobacco growing regions in recent years (Fig. 25.1). Infections typically occur early in the growing season, and infected plants are stunted and the leaves are not harvestable.

Symptoms and Detection

The best diagnostic symptom of AMV infection is a bright yellow mosaic of the affected leaves (Fig. 25.2) but not all strains of the virus produce this symptom. Chlorotic blotches and vein clearing of expanding leaves are often present (Fig. 25.3). Chlorotic line patterns similar to the symptoms of tobacco ringspot are common (Fig. 25.5). Stunting of AMV-infected burley tobacco plants is usually mild, but foliar damage can be severe (Fig. 25.6). The leaves from heavily infected plants are totally destroyed by late season.

The genome of AMV consists of three molecules of RNA contained in three capsids. The virus is infectious only if all three particles are present and the coat protein is necessary to initiate the infection process.

Detection methods commonly used on other viruses are all applicable on AMV. These include ELISA, PCR, and mechanical sap re-inoculation onto typical AMV hosts or tobacco.

Source and Transmission

AMV over-winters in weed hosts (Ch. 61) and is transmitted to tobacco by aphids, *Myzus persicae* (Ch. 51). It is transmittable in other hosts by at least 13 other species in Aphididae in a non-persistent manner. It can be transmitted by mechanical inoculation and grafting, but not by contact between plants, and through by seed via infected pollen.

Rotation and Site Selection

Legume weeds or crops, such as alfalfa, and volunteer tobacco plants can serve as AMV reservoirs. Therefore, rotation (Ch. 77) and site selection are important aids in preventing AMV infection of tobacco.

Alternate Hosts

AMV is vectored by aphids and infects plants in over 50 plant families. Legumes are the main hosts in the burley tobacco growing area. A list of the range of alternate hosts can be found at the website <http://www.agls.uidaho.edu/ebi/vdie/descr009.htm>.

Resistant Varieties

There are no commercial tobacco cultivars with resistance to AMV. There are transgenic tobacco lines which have a high tolerance to AMV, but these are not commercially available.

A.3. Viral Diseases

Sanitation

Mechanical transmission of AMV can be minimised by good sanitation practices during seedling production and transplanting. All tools, particularly those used for mowing and clipping, should be frequently cleaned and disinfected.

Scouting

Scouting tobacco fields and removing infected plants early in the season could be an effective means of minimizing the secondary spread of the virus.

Chemical Control

No totally effective chemical control strategies are currently available, and aphid control measures (Ch. 51, Ch. 70) are inconsistent in their effect on virus spread. Insecticides to control the aphid vectors cannot prevent infection from incoming aphids because they will not kill the aphids before virus transmission occurs. However, a good aphid control strategy, ideally including soil-applied systemic insecticides, can minimise virus spread in the field.

Biological Control

No biological control agent is available.

Summary

An integrated approach (Ch. 68) to the management and control of AMV includes the following:

- . Avoid planting tobacco near alfalfa fields
- . Use virus-free transplants
- . Use intensive sanitation practices during seedling production and transplanting
- . Practice early season field scouting and removal of infected plants
- . Apply insecticides, ideally soil-applied systemics, to minimise further disease spread

References

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A.3. Viral Diseases

Zaumeyer, W. J. 1963. Two new strains of alfalfa mosaic virus systemically infectious to bean. *Phytopath.* 53:444-449.

Zaumeyer, W. J. and G. Patino. 1960. Vein necrosis, another systemically infectious strain of alfalfa mosaic virus bean. *Phytopath.* 50:226-231.



Brenda Kennedy, UK, USA

Fig. 25.1: An increasing number of cases of AMV infection have been observed in burley tobacco growing regions in recent years



Kenny Seebold, UK, USA



Kenny Seebold, UK, USA

Fig. 25.2: Bright yellow mosaic symptoms of burley plants infected with AMV

A.3. Viral Diseases



Kenny Seebold, UK, USA

Fig. 25.3: Chlorotic blotches in an expanding leaf infected with AMV



Kenny Seebold, UK, USA

Fig. 25.4: AMV-infected plant in row with healthy burley tobacco plants



Anne Jack, UK, USA

Fig. 25.5: Chlorotic line patterns of AMV-infected leaves of burley tobacco.



Anne Jack, UK, USA



A Brenda Kennedy, UK, USA



B Colin Fisher, UK, USA

Fig. 25.6: Foliar damage can be severe. **A:** severe distortion of the leaf tips **B:** hooking of the leaf tips

A.3. Viral Diseases

26. Streak TSV

Tatiana Lima & Fernanda Viana, Souza Cruz, Brazil

General

A.3. Viral Diseases

27. Bushy Top TBTV

Colin Fisher, University of Kentucky, USA

General

A.3. Viral Diseases

28. Mosaic TMV

Anne Jack, University of Kentucky, USA

General

A.3. Viral Diseases

29. Ringspot TRSV

Maros Lusso, Altria Client Services, USA

General

A.4. Seedling Diseases

30. Management of Seedling Diseases

Kenny Seebold, University of Kentucky, USA

General

A.5. Post-Harvest Diseases

31. Fungal Barn Rot *Rhizopus* spp., *Pythium* spp.

Susan Dimbi, Tobacco Research Board, Zimbabwe

General

A.5. Post-Harvest Diseases

32. Bacterial Barn Rot *Erwinia carotovora* subsp. *carotovora*

Bruce Fortnum, Clemson University, USA

General

A.5. Post-Harvest Diseases

33. Barn and Storage Mould *Aspergillus* spp., *Penicillium* spp.

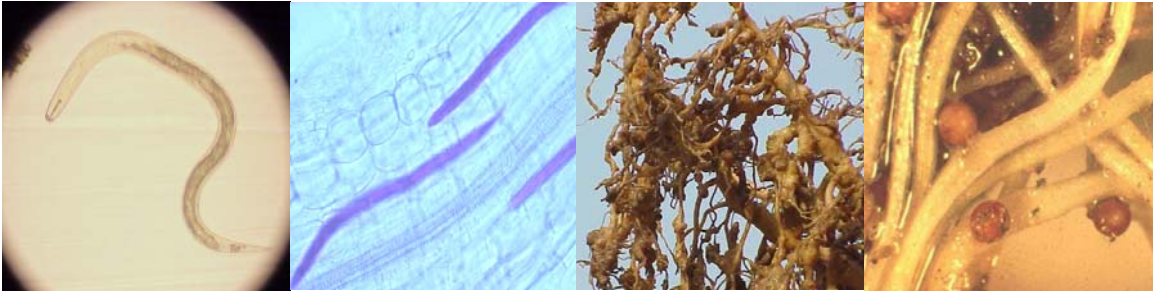
Colin Fisher, University of Kentucky, USA

General

A.6. Diseases Not Covered

34. List of Diseases Not Covered

Anne Jack, University of Kentucky, USA



INTEGRATED NEMATODE MANAGEMENT



B. Nematodes

TABLE OF CONTENTS – NEMATODES

Ref	Common Name	Scientific Name	Author	Page
B.1	<u>Rootknot Nematodes</u>			
35	Javanese Rootknot Nematode	<i>Meloidogyne javanica</i>	J. Way	
36	Southern Rootknot Nematode	<i>Meloidogyne incognita</i>	B. Fortnum	
37	Peanut Rootknot Nematode	<i>Meloidogyne arenaria</i>	B. Fortnum	
38	Northern Rootknot Nematode	<i>Meloidogyne hapla</i>	B. Fortnum	
B.2	<u>Other Nematodes</u>			
39	Tobacco Cyst Nematode	<i>Globodera</i> spp.	J.L. Verrier	
40	Lesion Nematode	<i>Pratylenchus</i> spp.	B. Fortnum	

B.1. Rootknot Nematodes

35. Javanese Rootknot Nematode *Meloidogyne javanica*

Jennifer Way, Zimbabwe

General

B.1. Rootknot Nematodes

36. Southern Rootknot Nematode *Meloidogyne incognita*

Bruce Fortnum, Clemson University, USA

General

B.1. Rootknot Nematodes

37. Peanut Rootknot Nematode *Meloidogyne arenaria*

Bruce Fortnum, Clemson University, USA

General

B.1. Rootknot Nematodes

38. Northern Rootknot Nematode *Meloidogyne hapla*

Bruce Fortnum, Clemson University, USA

General

B.2. Other Nematodes

39. Tobacco Cyst Nematode *Globodera* spp.

Jean-Louis Verrier, Altadis-Imperial Tobacco Group, France

General

B.2. Other Nematodes

40. Lesion Nematode *Pratylenchus* spp.

Bruce Fortnum, Clemson University, USA

General



INTEGRATED INSECT MANAGEMENT



TABLE OF CONTENTS – INSECTS

Ref	Common Name	Scientific Name	Author	Page
C.1	<u>Stem and Root Insect Pests</u>			
41	Wireworms and False Wireworms	<i>Conoderus</i> spp., <i>Gonocephalum</i> spp., <i>Trachynotus</i> spp., <i>Psammodes</i> spp.	C. Sazaki	
42	Cutworms	<i>Agrotis</i> , <i>Feltia</i> , <i>Peridroma</i> spp.	L. Sannino	
43	Whitefringed Beetles	<i>Graphonathus</i> (<i>Naupactus</i>) spp.	P. Semtner	
44	Minor Stem and Root Insect Pests			
	a. Crickets and Mole Crickets	<i>Scapteriscus</i> , <i>Gryllotalpa</i> spp.	R. McPherson	
	b. Vegetable Weevil	<i>Listroderes costirostris obliquus</i> (Klug)	P. Semtner	
	c. Termites	<i>Isoptera</i> , many species	tba	
	d. Ants	<i>Solenopsis</i> , <i>Tetramorium</i> spp.	tba	
	e. Dusty Surface Beetle	<i>Gonocephalum simplex</i> (F.)	tba	
	f. Tobacco Stem Borer	<i>Scrobipalpa heliopa</i>	tba	
	g. Sod Webworms	<i>Crambus</i> spp.	P. Semtner	
	h. Root Maggots	<i>Hylemya</i> spp. [<i>Delia platura</i> (Meigen)]	P. Semtner	
	i. White Grubs	<i>Cotinis nitida</i> (L.), <i>Popillia japonica</i> , <i>Phyllophaga</i> spp.	P. Semtner	
C.2	<u>Chewing Insect Pests</u>			
45	Budworms	<i>Heliothis</i> , <i>Helicoverpa</i> spp.	F. Reay-Jones	
46	Hornworms	<i>Manduca</i> spp.	M. Jackson	
47	Grasshoppers and Locusts	<i>Melanoplus</i> , <i>Schistocerca</i> , <i>Zonocerus</i> spp.	tba	
48	Potato Tuber Moth	<i>Phthorimaea operculella</i>	A. Scholtz	
49	Tobacco Flea Beetle	<i>Epitrix hirtipennis</i> (Melsheimer)	L. Sannino	

C. Insects

TABLE OF CONTENTS – INSECTS cont

Ref	Common Name	Scientific Name	Author	Page
C.2	<u>Chewing Insect Pests</u> cont			
50	Minor Chewing Insect Pests			
	a. Armyworms	<i>Spodoptera</i> spp.	tba	
	b. Laceworm	<i>Spodoptera littoralis</i> (Boisduval, 1833)	tba	
	c. Japanese Beetle	<i>Popillia japonica</i> Newman	tba	
	d. Tobacco Slug	<i>Lema (Oulema) bilineata</i>	tba	
	e. Climbing Cutworm	<i>Peridroma saucia</i> (Hubner)	P. Semtner	
	f. Spotted Cucumber Beetle	<i>Diabrotica undecimpunctata howardi</i> Barber.	P. Semtner	
	g. Salt March Caterpillar	<i>Estigmene acrea</i> (Drury)	P. Semtner	
	h. Tree Crickets	<i>Oecanthus</i> spp.	P. Semtner	
	i. Loopers and Semi-Loopers	<i>Trichoplusa ni</i> (Hubner)	tba	
	j. Tobacco Leaf Beetle	<i>Gastrophysa atrocyanea</i>	tba	
	k. Slugs	<i>Deroceras</i> spp., <i>Arion</i> spp., and others	tba	
C.3	<u>Sucking Insect Pests</u>			
51	Aphids	<i>Myzus</i> spp.	C. Sorenson	
52	Stinkbugs	<i>Nezara, Eushistus</i> spp.	R. McPherson	
53	Whiteflies	<i>Bemisia, Trialeurodes</i> spp.	C. Sazaki	
54	Thrips	<i>Franklinella, Thrips</i> spp.	R. McPherson, C. Anton	
55	Minor Sucking Insect Pests			
	a. Red Spider Mite	<i>Tetranychus evansi</i> Baker & Pritchard	tba	
	b. Suckfly	<i>Cyrtopelis notatus</i> (Distant)	tba	
	c. Tarnished Plant Bug	<i>Lygus lineolaris</i> (Palisot de Beauvois)	tba	

C. Insects

TABLE OF CONTENTS – INSECTS cont

Ref	Common Name	Scientific Name	Author	Page
<u>C.4 Seedling Insect Pests</u>				
56	Specific Seedling Insect Pests			
	a. Fungus Gnats	<i>Bradysia</i> spp.	P. Semtner	
	b. Shoreflies	<i>Scutella stagnalis</i> and others	P. Semtner	
	c. Earwigs	<i>Forficula, Euborellia, Labidura</i> spp.	P. Semtner	
57	Insect Pests of Field and Seedlings			
	a. White Grubs	<i>Cotinis nitida</i> (L.), <i>Popillia japonica</i> , <i>Phyllophaga</i> spp.	See Chapter 44i	
	b. Cutworms	<i>Agrotis, Feltia, Peridroma</i> spp.	See Chapter 42	
	c. Crickets and Mole Crickets	<i>Scapteriscus, Gryllotalpa</i> spp.	See Chapter 44a	
	d. Ants	<i>Solenopsis, Tetramorium</i> spp.	See Chapter 44d	
	e. Tobacco Flea Beetle	<i>Epitrix hirtipennis</i> (Melsheimer)	See Chapter 49	
	f. Armyworms	<i>Spodoptera</i> spp.	See Chapter 50a	
	g. Slugs	<i>Deroceras</i> spp., <i>Arion</i> spp., and others	See Chapter 50k	
	h. Aphids	<i>Myzus</i> spp.	See Chapter 51	
	i. Whiteflies	<i>Bemisia, Trialeurodes</i> spp.	See Chapter 53	
<u>C.5 Stored Tobacco Pests</u>				
58	Tobacco Moth	<i>Ephestia elutella</i> (Hubner)	M. Winegardner, V. Schmidt	
59	Cigarette Beetle	<i>Lasioderma serricorne</i> (F.)	H. Harada	

C.1. Stem and Root Insect Pests

- 41. Wireworms and False Wireworms** *Conoderus* spp., *Gonocephalum* spp.,
Trachynotus spp., *Psammodes* spp.
Catia Sazaki, Souza Cruz, Brazil

General

C.1. Stem and Root Insect Pests

42. Cutworms *Agrotis*, *Feltia*, *Peridroma* spp.

Luigi Sannino, Agricultural Research Council, Italy

General

C.1. Stem and Root Insect Pests

43. Whitefringed Beetles *Graphonathus (Naupactus)* spp.
Paul Semtner, Virginia Tech, USA

General

44. Minor Stem and Root Insect Pests

44a. Crickets and Mole Crickets *Scapteriscus, Gryllotalpa* spp.

Bob McPherson, University of Georgia, USA

XX
XX

44b. Vegetable Weevil *Listroderes costirostris obliquus* (Klug)

Paul Semtner, Virginia Tech, USA

XX
XX

44c. Termites *Isoptera*, many species

Name, Affiliation, Country

XX
XX

44d. Ants *Solenopsis, Tetramorium* spp.

Name, Affiliation, Country

XX
XX

44e. Dusty Surface Beetle *Gonocephalum simplex* (F.)

Name, Affiliation, Country

XX
XX

44f. Tobacco Stem Borer *Scrobipalpa heliopa*

Name, Affiliation, Country

XX
XX

44g. Sod Webworms *Crambus* spp.

Paul Semtner, Virginia Tech, USA

XX
XX

44h. Root Maggots *Hylemya* spp. [*Delia platura* (Meigen)]

Paul Semtner, Virginia Tech, USA

XX
XX

44i. White Grubs *Cotinis nitida* (L.), *Popillia japonica*, *Phyllophaga* spp.

Paul Semtner, Virginia Tech, USA

XX
XX

C.2. Chewing Insect Pests

45. Budworms *Heliothis, Helicoverpa* spp.

Francis Reay-Jones, Clemson University, USA

General

C.2. Chewing Insect Pests

46. Hornworms *Manduca* spp.

Micheal D. Jackson, USDA Vegetable Lab, USA

General

C.2. Chewing Insect Pests

47. Grasshoppers and Locusts *Melanoplus, Schistocerca, Zonocerus* spp.
Name, Affiliation, Country

General

C.2. Chewing Insect Pests

48. **Potato Tuber Moth** *Phthorimaea operculella*

Anton Scholtz, Lowveld Agricultural Research and Support Services, South Africa

General

C.2. Chewing Insect Pests

49. Tobacco Flea Beetle *Epitrix hirtipennis* (Melsheimer)

Luigi Sannino, Agricultural Research Council, Italy

General

50. Minor Chewing Insect Pests

50a. Armyworms *Spodoptera* spp.

Name, Affiliation, Country

XX
XX

50b. Laceworm (African Cotton Leafworm) *Spodoptera littoralis* (Boisduval, 1833)

Name, Affiliation, Country

XX
XX

50c. Japanese Beetle *Popillia japonica* Newman

Name, Affiliation, Country

XX
XX

50d. Tobacco Slug *Lema (Oulema) bilineata*

Name, Affiliation, Country

XX
XX

50e. Climbing Cutworm *Peridroma saucia* (Hubner)

Paul Semtner, Virginia Tech, USA

XX
XX

50f. Spotted Cucumber Beetle *Diabrotica undecimpunctata howardi* Barber.

Paul Semtner, Virginia Tech, USA

XX
XX

50g. Salt Marsh Caterpillar *Estigmene acrea* (Drury)

Paul Semtner, Virginia Tech, USA

XX
XX

50h. Tree Crickets *Oecanthus* spp.

Paul Semtner, Virginia Tech, USA

XX
XX

50i. Loopers and Semi-Loopers *Trichoplusa ni* (Hubner)

Name, Affiliation, Country

XX
XX

C.2. Chewing Insect Pests

50j. Tobacco Leaf Beetle *Gastrophysa atrocyanea*

Name, Affiliation, Country

XX
XX

50k. Slugs *Deroceras* spp., *Arion* spp., and others

Name, Affiliation, Country

XX
XX

C.3. Sucking Insect Pests

51. Aphids *Myzus* spp.

Clyde Sorenson, North Carolina State University, USA

General

C.3. Sucking Insect Pests

52. Stinkbugs *Nezara*, *Eushistus* spp.

Bob McPherson, University of Georgia, USA

General

C.3. Sucking Insect Pests

53. Whiteflies *Bemisia*, *Trialeurodes* spp.

Catia Sazaki, Souza Cruz, Brazil

General

C.3. Sucking Insect Pests

54. Thrips *Franklinella*, *Thrips* spp.

Bob McPherson, University of Georgia, USA
Catia Anton, Alliance One International, Turkey

General

55. Minor Sucking Insect Pests

55a. Red Spider Mite *Tetranychus evansi* Baker & Pritchard

Name, Affiliation, Country

XX
XX

55b. Suckfly *Cyrtopelis notatus* (Distant)

Name, Affiliation, Country

XX
XX

55c. Tarnished Plant Bug *Lygus lineolaris* (Palisot de Beauvois)

Name, Affiliation, Country

XX
XX

C.4. Seedling Insect Pests

56. Specific Seedling Insect Pests

56a. Fungus Gnats *Bradysia* spp.

Paul Semtner, Virginia Tech, USA

XX
XX

56b. Shoreflies *Scutella stagnalis* and others

Paul Semtner, Virginia Tech, USA

XX
XX

56c. Earwigs *Forficula*, *Euborellia*, *Labidura* spp.

Paul Semtner, Virginia Tech, USA

XX
XX

57. Insect Pests of Field and Seedlings

57a. White Grubs *Cotinis nitida* (L.), *Popillia japonica*, *Phyllophaga* spp.

See Chapter 44i

57b. Cutworms *Agrotis*, *Feltia*, *Peridroma* spp.

See Chapter 42

57c. Crickets and Mole Crickets *Scapteriscus*, *Gryllotalpa* spp.

See Chapter 44a

57d. Ants *Solenopsis*, *Tetramorium* spp.

See Chapter 44d

57e. Tobacco Flea Beetle *Epitrix hirtipennis* (Melsheimer)

See Chapter 49

57f. Armyworms *Spodoptera* spp.

See Chapter 50a

57g. Slugs *Deroceras* spp., *Arion* spp., and others

See Chapter 50k

57h. Aphids *Myzus* spp.

See Chapter 51

57i. Whiteflies *Bemisia*, *Trialeurodes* spp.

See Chapter 53

C.5. Stored Tobacco Insect Pests

58. Tobacco Moth *Ephestia elutella* (Hubner)

Mauri Winegardner, Universal Leaf Tobacco, USA

Vernon Schmidt,

General

C.5. Stored Tobacco Insect Pests

59. Cigarette Beetle *Lasioderma serricorne* (F.)

Haruyasu Harada, JT, Japan

General



INTEGRATED WEED MANAGEMENT



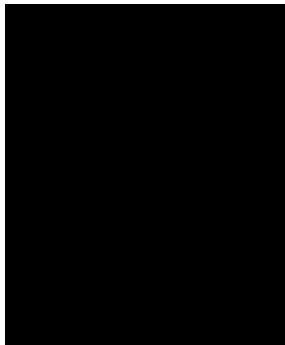
FOREWORD

Integrated Weed Management

The current accepted definition of a “weed” is simply a plant growing where it is not desired or, more simply put, a plant out of place. Needless to say, past and current agricultural production systems have created a rather long list of plants out of place. Modern methods of weed control, primarily through the use of herbicides, have been a major contributing factor toward improving the efficiency of crop production. Herbicides are, however, not the only method of weed control; cultural practices such as good seedbed preparation, tillage, crop rotation, cultivation, and hand weeding are important. Their relative importance varies with the crop situation. While the small-scale tobacco grower may still rely heavily on cultural practices, the large commercial producer of tobacco depends on herbicides to ensure the production of the large weed-free acreages so common in more developed countries. More recently, larger producers may incorporate several of the above agricultural practices as a means of a more integrated weed control program or approach.

Weed pests may be almost any of 250,000 species of plants known to man. Their potential for invading our agricultural areas is significant. Several million weed seeds can be found per acre in many of our agricultural soils. If, after seedbed preparation, only 10% of these weed seeds germinated, this would produce a weed population of several hundred per square meter—extreme competition for any crop.

Weedy species of both dicots (broadleaf) and monocots (grasses) are competitive with tobacco and can dramatically impact tobacco growth and development. An effective as well as environmentally sound weed management program is a critical component of profitable and sustainable tobacco production.



Integrated weed management involves employing as many methods as possible for control of the target weed species. For weed pests of tobacco, these methods primarily include chemical and cultural control, and to a much lesser extent biological control. Effective use of these methods in combination allows for the most effective weed control at the least cost and least environmental impact.

Andy Bailey, University of Kentucky, USA
Weed Group Coordinator

TABLE OF CONTENTS – WEEDS

Ref		Author	Page
<u>D.1</u>	<u>Field Weeds</u>		
60	Competitive Effect of Weeds	A. Bailey	
61	Weeds as Alternate Hosts to Other Pests	A. Bailey	
62	Cultural Practices for Weed Control	A. Bailey, R. Pearce	
63	Chemical Weed Control	D. Martin, A. Bailey	
64	Biological Weed Control	A. Bailey	
65	Descriptions of Common and Troublesome Weeds in Tobacco	A. Bailey	
<u>D.2</u>	<u>Parasitic Weeds</u>		
66	Broomrape	<i>Orbanche</i> spp.	J.L. Verrier
67	Other Parasitic Weeds		J.L. Verrier

D.1. Field Weeds

60. Competitive Effects of Weeds

Andy Bailey, University of Kentucky, USA

General

D.1. Field Weeds

61. Weeds as Alternate Hosts to Other Pests

Andy Bailey, University of Kentucky, USA

General

D.1. Field Weeds

62. Cultural Practices for Weed Control

Andy Bailey and Bob Pearce, University of Kentucky, USA

General

D.1. Field Weeds

63. Chemical Weed Control

Davis Martin, Profigen, USA
Andy Bailey, University of Kentucky, USA

General

D.1. Field Weeds

64. Biological Weed Control

Andy Bailey, University of Kentucky, USA

General

D.1. Field Weeds

65. Descriptions of Common and Troublesome Weeds in Tobacco

Andy Bailey, University of Kentucky, USA

General

D.2. Parasitic Weeds

66. Broomrape *Orobanche* spp.

Jean-Louis Verrier, Altadis-Imperial Tobacco Group, France

General

D.2. Parasitic Weeds

67. Other Parasitic Weeds

Jean-Louis Verrier, Altadis-Imperial Tobacco Group, France

General



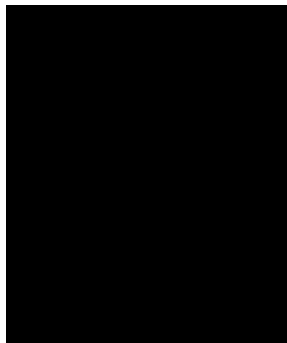
COMPONENTS OF IPM



FOREWORD

Components of IPM

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Andreas Kohler, INUSC, Brazil
Components of IPM Group Coordinator

E. Components of IPM

TABLE OF CONTENTS – COMPONENTS OF IPM

Ref		Author	Page
<u>E.1</u>	<u>Pests, Pesticides and Epidemics</u>		
68	IPM and Pest Epidemic	C. Fisher	
69	Pesticides	C. Fisher	
70	Application of Pesticide	C. Fisher	
<u>E.2</u>	<u>Systematic Acquired Resistance</u>		
71	History, Principles and Applications of SAR	A. da Rocha	
<u>E.3</u>	<u>Biological Control Organisms</u>		
72	Predatory Biocontrol Agents		
	a. General	F. Mornet	
	b. Parasitoid Wasps	F. Mornet	
	c. Ladybugs / Ladybeetles	R. McPherson F. Mornet	
	d. Syrphid Larvae	F. Mornet	
	e. Stilt Bugs	F. Mornet	
	f. Tachinid Flies	F. Mornet	
	g. Summary and References	F. Mornet	
73	Fungal Biocontrol Agents		
	a. General	tba	
	b. <i>Trichoderma</i>	tba	
	c. <i>Beauveria</i>	tba	
	d. <i>Metarhizium</i>	tba	
	e. Summary and References	tba	

E. Components of IPM

TABLE OF CONTENTS – COMPONENTS OF IPM cont

Ref		Author	Page
<u>E.3</u>	<u>Biological Control Organisms</u> cont		
74	Bacterial Biocontrol Agents		
	a. General	tba	
	b. <i>Bacillus thuringiensis</i>	tba	
	c. <i>Bacillus subtilis</i>	tba	
	d. <i>Bacillus spinosa</i>	tba	
	e. Summary and References	tba	
<u>E.4</u>	<u>Trap, Barrier and Rotation Crops</u>		
75	Trap Crops	A. Biersdorf	
76	Barrier Crops	A. Scholtz	
77	Rotation Crops	H. Papenfus	
<u>E.5</u>	<u>Cigar Tobaccos</u>		
78	Wrapper	M. Hartley	
79	Filler	M. Hartley	
80	Economic Thresholds for Cigar Tobacco	M. Hartley	

E.1. Pests, Pesticides and Epidemics

68. IPM and Pest Epidemics

Colin Fisher, University of Kentucky, USA

General

E.1. Pests, Pesticides and Epidemics

69. Pesticides

Colin Fisher, University of Kentucky, USA

General

E.1. Pests, Pesticides and Epidemics

70. Application of Pesticides

Colin Fisher, University of Kentucky, USA

General

E.2. Systemic Acquired Resistance

71. History, Principles and Applications of SAR

Andrea B. da Rocha, Universal Leaf, Brazil

General

72. Predatory Biocontrol Agents

72a. General

Fabienne Mornet, ANITTA, France

XX
XX

72b. Parasitoid Wasps

Fabienne Mornet, ANITTA, France

XX
XX

72c. Ladybugs / Ladybeetles

Bob McPherson, University of Georgia, USA
Fabienne Mornet, ANITTA, France

XX
XX

72d. Syrphid Larvae

Fabienne Mornet, ANITTA, France

XX
XX

72e. Stilt Bugs

Fabienne Mornet, ANITTA, France

XX
XX

72f. Tachinid Flies

Fabienne Mornet, ANITTA, France

XX
XX

72g. Summary and References

Fabienne Mornet, ANITTA, France

XX
XX

E.4. Trap, Barrier and Rotation Crops

75. Trap Crops

Anderson Biersdorf, Premium Tobacco, Brazil

General

E.4. Trap, Barrier and Rotation Crops

76. Barrier Crops

Anton Scholtz, LARSS, South Africa

General

E.4. Trap, Barrier and Rotation Crops

77. Rotation Crops

Henri Papenfus, AOI, United Kingdom

General

E.5. Cigar Tobaccos

78. Cigar Wrapper

Michael Hartley, ASP Enterprises, Ecuador

General

E.5. Cigar Tobaccos

79. Cigar Filler

Michael Hartley, ASP, Ecuador

General

E.5. Cigar Tobaccos

80. Economic Thresholds for Cigar Tobacco

Michael Hartley, ASP, Ecuador

General

