

ON THE MICROSCOPIC FUNGI OF THE DISTRICT
AROUND LIVERPOOL.

By R. G. McLeod Esq.

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No apology is needed, I presume, for bringing such a subject before the notice of the Historic Society.

The micro-fungi form a department of Cryptogamic botany, which up to the present time has been totally neglected by our local botanists; the reason, without doubt, that has deterred them from turning their attention to this interesting study, is the absence of all literature in the English language containing specific descriptions of these minute plants. The want of a proper guide to the systematic study of this diminutive flora has been much felt. That want, to a certain extent, has now been supplied by Mr. M. C. Cook of London, who has published a handbook to the microscopic fungi parasitic on living plants, to which particular branch this paper is principally confined.

The micro-fungi, many of which attack other vegetables in the early stages of their growth, are known popularly by the names of blights, brands and mildews. They are chiefly found upon the leaves and other annual productions of plants. They are very minute, but remarkably prolific, affording extraordinary instances of the vast number of distinct individual lives which can be accumulated in an exceedingly small space. According to estimates deduced from the most careful investigations, it has been ascertained that a single cubic inch will contain a progeny of more than two hundred and nineteen thousand five hundred and twenty

trillion spores or germs of vegetation—a number not only greater than that of all the human beings, but of all the warm-blooded animals that ever lived upon the earth since the moment of its creation. In consequence of their minuteness, they are dispersed through the atmosphere, not like smoke merely, but like invisible vapour.

The question is naturally asked, why this prodigious fecundity? why this immense profusion? The answer is this. The fungi, as a class, perform a highly useful office in creation. Existing only by the absorption of foetid exhalations, and rapidly depriving them of their insalubrious properties, they execute duties analogous to those of certain tribes of insects, and in this respect have been appropriately associated with these animals as the scavengers of nature. How disgusting to the eye, how offensive to the smell would be the whole face of nature were the vast quantity of putrid and decaying matter, daily falling to the earth from various sources, suffered to remain until gradually dissolved by the rain or decomposed by the elements! That it does not thus offend us, we are indebted to inconceivable hosts of scavengers, both animal and VEGETABLE, which attack it the moment it falls, and speedily consume all the liquid and noisome particles, leaving nothing but the dry dust, which is soon scattered by the winds. With regard to the parasitic fungi, a difference of opinion exists amongst naturalists as to whether they are the cause or effect of disease. Some think that the spores of fungi, coming into contact with the plant, act both as the predisposing and exciting cause of disease; others, without doubt more correctly, think that some change is first produced in the cells of the plant which enables the spores to find a nidus, and then the disease goes on rapidly, assuming a peculiar type on account of the presence of the fungus; in the same way as vegetable organisms, found in diseases of the skin, are not to be looked upon as the origin

of the disease, but as being developed in textures previously morbid, and as giving often a peculiar character to the disease. Berkely attributes the potato disease entirely to fungi. With all due deference to so learned an authority, I beg to differ. The view which seems to be most consonant with the phenomena is, that changes are induced by cultivation in the cells of the potato which render it liable to disease. Atmospheric influences are thus enabled to act upon it so as to cause alterations in its cells; putrefying azotised matter accumulates and is carried to all parts of the plant, causing a struggle between vital and chemical forces, inducing decomposition by a process of fermentation. The azotised matter, in a condition to act as ferment, is produced by the state of the season, deficiency of light, rainy weather and other meteorological causes. The moment decomposition sets in, the spores of the fungi, true to their instinct, awake to their work. So let it be clearly understood that their province is not to cut down the strength or impede the healthy growth or action of any one production of nature; for that would display an imperfection in the system altogether inconsistent with and unworthy of its divine origin. It is only when, in consequence of a local or temporary cause, some organic being, or PART OF AN ORGANIC being, is in excess of what the healthy condition of its species can bear in the proper balance of the system, and is therefore unwholesome, in short, when putrefaction would ensue and produce either a poisoning or a waste, that the spore of the fungus awakens to its duty. Thus we see that the spore of a fungus, only the $\frac{1}{219,520,000,000,000,000}$ of an inch, though a small matter in itself, is of vast importance in the economy of nature in maintaining the balance of life. So do we see that mankind are the fools of their senses as to great and small; and that the sooner that vulgar prejudice which despises minuteness and idolizes magnitude, is made aware that these are only com-

parative terms the better ; for even philosophers themselves often yield unconsciously to the impressions that magnitude is calculated to produce on our external senses.

In conclusion, allow me to hope that we shall soon have numerous workers in this new and interesting branch of microscopic research. If any one thirst for discovery, he will be certain to meet with success in this comparatively unknown field ; for within the last twelve months five new species have been discovered by myself in the neighbourhood of Liverpool. Certainly some of the micro-fungi are the most unpromising objects to the naked eye which could well be imagined ; but let us bring the highest powers of our microscopes to bear upon them, and we shall not fail to exclaim with the poet—

“ These are thy glorious works, Parent of Good ;
Thyself how wondrous then !
To us invisible, or dimly seen
In these thy lowest works ; yet these declare
Thy goodness beyond thought and power divine ! ”

ÆCIDIACEÆ.

GENUS ÆCIDIUM,

- Æ. Albesceus*, Grev.—Moschatel cluster cups ; on leaves and petioles of *Adoxa moschatellina* ; not uncommon. April.
- Æ. Epilobii*, D. C.—Willow herb cluster cups ; on the under side of leaves of *Epilobium montanum*, rarely on the upper ; common. June to August.
- Æ. Tragopogonis*, Pers.—On stems, leaves and involucre of *Tragopogon pratensis* ; common on the shores of the Mersey. May to June.
- Æ. Berberidis*, Pers.—Berberry cluster cups ; on leaves of *Berberis vulgaris* ; not common. May to July.
- Æ. Periclymeni*, D. C.—Honeysuckle cluster cups ; on leaves of *Lonicera Periclymenum* ; not common. June to August.
- Æcidium Ranunculacearum*, D. C.—Crow foot cluster cups ; on leaves of *R. ficaria*, &c. ; not common. Spring.

- Æ. Valerianacearum*, Dub.—Valerian cluster cups; on the under surface of leaves of *V. dioica*; rare. June to July.
- Æ. Asperifolii*, Pers.—Borage cluster cups; on leaves and stems of *Lycopsis arvensis*; common. Birkdale, September. The parts of the leaves on which it occurs are rendered concave on one side and convex on the other, so that by pressure in drying, this plant loses its character.
- Æ. Urticæ*, D. C.—Nettle cluster cups; on stems and leaves of nettles; common. June.
- Æ. Compositarum*, Var. c. *Tussilaginis*, Pers.—On the under surface of leaves of coltsfoot; very common. Autumn.
- Æ. Compositarum*, Var. d. *Jacobææ*, Grev.—On leaves of *Souchus arvensis*; Southport. June to August.
- Æ. Violæ Schum.*—Violet cluster cups; on leaves, petioles and sepals of *Viola canina*; common. May to June.

PUCCINLÆI.

GENUS AREGMA.

- A. Mucronatum*, Fr.—Rose brand, on rose leaves; common. August.
- A. Bulbosum*, Fr.—Bramble brand, on bramble leaves; very common. August.

GENUS PUCCINIA.

- P. Graminis*, var. *B. Arundinis*, Grev.—Plentiful on the shore at the back of Speke Hall; on *Phalaris arundinaceæ*. August.
- P. Polygonorum*, Lk.—Polygonum brand; on various species of Polygonum; common. June to August.
- P. Menthæ*, Pers.—Mint brand, on leaves of *Mentha hirsuta*, &c.; very common. August.
- P. Compositarum*, Sch.—Composite brand, on leaves of *Centaurea nigra*, *Hieraceum sylvaticum*, *Lapsana communis*, &c.; very common. August.
- P. Glomerata*, Grev.—Ragwort brand, on leaves of *Senecio Jacobææ*. Birkdale and Gilbrook; rare. August.
- P. Anemones*, Pers.—Anemone brand, on *A. nemerosa*. Woodside. April and May.
- P. Calthæ*, Lk.—Marsh marigold brand, on *Caltha palustris*. Birkdale; rare. September.

- P. Violarum*, Lk.—Violet brand, on violets; very common. August.
- P. Saxifragarum*, Schl.—Moschatel brand, on the stem and both surfaces of the leaves of *Adoxa moschatellina*. Bromborough Woods; not common. April.
- P. Pulverulenta*, Grev.—Great willow herb brand, on leaves of *Epilobium hirsutum*. Gilbrook; common. August.
- P. Prunorum*, Lk.—Plum tree brand, on *Prunus spinosa*; not uncommon. September and October.

CÆOMACEI.

GENUS TILLETIA.

- T. Caries*, Tul. Bunt.—On wheat; very common. August.

GENUS USTILAGO.

- U. Segetum*, Ditm.—Corn smut, on the ears of corn and grasses; very common. August.
- U. Urceolorum*, Tul.—Sedge smut, on *Carices*; common. August and September.

GENUS UREDO.

- U. Potentillarum*, D. C.—Potentilla uredo, on leaves of *Agri-mona rupatoria* and other *Rosacea*; common. July.
- U. Orchidis*. (Martin's.) (New British species.) On *Listera ovata* and *Orchis latifolia*. Crosby sandhills. June, 1865.

GENUS LECYTHEA.

- L. Ruborum*, Lev.—Bramble rust, on the under surface of bramble leaves; very common. July and August.
- L. Rosæ*, Lev.—Rose rust, on the under surface of rose leaves; very common. August, September.
- L. Populina*, Lev.—Poplar rust, on the birch nut; uncommon. June and July.
- L. Epitea*, Lev.—Tawny willow rust, on the under surface of willow leaves. Birkdale; not common. August.
- L. Mixta*, Lev.—Orange willow rust, on both surfaces of the leaves of willows. Birkdale; not common. August.
- L. Saliceti*, Lev.—Common willow rust, on the under surface of willow leaves; common everywhere. August.

GENUS TRICHOBASIS.

- T. Rubigo-vera*, Lev.—Round corn rust, on grasses and corn ; extremely common. July to September.
- T. Linearis*, Lev.—Long corn rust, on leaves and sheaths of corn and grasses ; not so common as the last. July to September.
- T. Senecionis*, B.—Groundsel rust, on *Senecio vulgaris* at Garston, on the road to Speke Hall ; and more common on *Senecio sylvaticus*, Bidston hill and Storeton quarry. August.
- T. Cichoracearum*, Lev.—Hawkweed rust, on *Carlina vulgaris*, *Apargia hispida*, *centaurea nigra*, &c. ; very common. August.
- T. Labiatarum*, Lev.—Mint rust, on *Mentha hirsuta*. Speke woods, Bebington and Gilbrook ; common. August.
- T. Fabæ*, Lev.—Bean rust, on beans. Bromborough. August.
- T. Suaveoleus*, Lev.—Sweet smelling rust, covering the whole under surface of the leaves of *cnicus arvensis*. Birkdale ; not common. August.
- T. Polygonorum*, B.—Knot grass rust, on *polygonum aviculare* and *P. persicaria* ; common. July to September.
- T. Violarum*, B.—Violet rust, on leaves and petioles of violets ; common. July and August.

GENUS UROMYCES.

- U. Apiculosa*, Lev.—Short stemmed rust, on *Lathyrus pratensis*. Red Noses, New Brighton, and on clover in fields about Walton Gaol ; not uncommon. September.
- U. Ficaria*, Lev.—Pilewort rust, on *Ranunculus Ficaria*. In damp woods ; not uncommon. June.
- U. Intrusa*.—On *Alchemilla vulgaris* ; common. July.

GENUS COLEOSPORIUM.

- C. Tussilaginis*, Lev.—Coltsfoot rust, on the under surface of the leaves of *Tussilago forfara* ; extremely common. Autumn.
- C. Pingue*, Lev.—Tawny rose rust, on the nerves and petioles of the leaves of roses ; very common on the sandhills on both sides of the Mersey. July, August.

- C. Petasites*, Lev.—Butterbur rust, on the under surface of the leaves of Tussilago petasites; not uncommon. Autumn.
- C. Souchi arvensis*, Lev.—Sowthistle rust, on Souchus arvensis; common. July.
- C. Rhinanthacearum*, Lev.—Cow wheat rust, on Euphrasia officinalis; very common. August, September.

ERYSIPHEI.

GENUS ERYSIPHE.

- E. Linkii*, Lev.—Mugwort blight, on the under surface of leaves of Artemisia vulgaris. Bootle and Birkdale; common. September.
- E. Lamprocarpa*, Lev.—Composite blight, on Plantago major. Plentiful in fields about Wallasey Church. September.
- E. Graminis*, D. C.—Grass blight, on leaves of grasses; common. August, September.
- E. Martii*, Lk.—Pea blight, on leaves of cultivated pea; common. September.
- E. Communis*, Schl.—Buttercup blight, on polygonum aviculare, Lathyrus pratensis; extremely common. August and September.
- E. Horridula*.—New British species, on Cynoglossum officinalis. New Brighton. September, 1865.

HELMINTHOSPORIACEÆ, Corda.

GENUS CLADOSPORIUM, Lk.

- C. Herbarum*, Lk.—On Iris-Pseudoacorus and various grasses; very common. August.

GENUS POLYTHRINCIUM, Kze.

- P. Trifolii*, Kze.—Forming black dots on clover; very common. August.

TUBERCULARIACEÆ, Corda.

GENUS TUBERCULARIA, Tode.

- T. Vulgaris*.—On dead sticks, forming little tubercles of a reddish colour; very common. August.
- T. Vulgaris* Var *B. rubi*.—On bramble; common. August.

SPHÆRIACEI, Fries.

GENUS SPHÆRIA, Haller.

S. Prunastri.—On decaying branches of *Prunus spinosa*; common. April.

S. Hederae.—On leaves of ivy, in hedges, and about old buildings; common. October and November.

GENUS XYLONIA, Pers.

X. Rubrum.—On both surfaces of the leaves of *Prunus spinosa*; common. Autumn.

BYSSINI, Corda.

TRIBE 2. PHYLLERIACEI, Corda.

GENUS ERINEUM, Pers.

E. Padi.—In round patches, on *Prunus padus*; common. May.

CÆOMACEI.

GENUS CYSTOPUS.

C. Candidus, Lev.—Crucifer white rust, on *Capsella bursa pastoris*; very common. July.

PUCCINLÆI.

GENUS TRICHOBASIS.

T. Fallens. (New British Species.) Spots obliterated. Sori amphigenous, numerous, scattered, subrotund brown, surrounded by the remains of the ruptured epidermis. Spores subovate, pedicels short, hyaline evanescent; epis-pore verrucose. (*Uredo fallens*), Demz. Amr. des Sc. Nat. ser. 3, iii, p. 357; pl. Crypt. Exs. ed. i. n. 1325; ed. ii, n. 725. On *Vicia sepium*, intermixed with the puccinia hereafter described. (Gilbrook.) Though this is undoubtedly nothing more than the *Uredo* form of puccinia fallens, I have preferred assigning to it a name, until a revision of the whole of this order takes place, and the forms under which the same species occurs cease to be designated by different names, and become associated together under their proper designation. D. B. F. M. M. C. C. 9, 1865.

GENUS PUCCINIA.

P. Fallens. (New Species.) Maculis obliteratis; Soris amphigenis, paucis, sparsis, rotundatis; sporidiis obovatis longi pedicellatis, fulvis vix constrictis spisorio lævi. On vicia sepium. (Gilbrook.) Sori, few and small, scattered, intermixed with pustules of Trichobasis. Sporidia obovate, on rather long pedicels, of a tawny colour, and slightly constricted at the septum. Epispore, smooth, apparently not common, and, as far as I can ascertain, undescribed. D. B. F. M. C. C. p. 9, 1865.

CÆOMACEI.

GENUS UROMYCES.

U. Polygoni. (New British Species.) Cauline. Sori, elongated and confluent, convex, surrounded by the remains of the ruptured epidermis. Sporidia subglobose or globose, smooth, yellowish brown; pedicels very long, thick hyaline, persistent. Fuckel-fungi Rhen, Exs. n. 399 ("*Capitularia polygoni*"); Rabh. Bot. Zeit. 1851, p. 449; Herb. Myc. ed. I n. 1995; Fung. Eur. n. 185. "*Uredo longipes*," Lasch; *U. clavigara*, Lasch, fide, Rabh. "*Puccinia vagi-nalium*," Link. sp. pl. (in part), on the stems of *Polygonum aviculare*; Bootle. I do not see that this species offers any features whereby its separation from *Uromyces* can be maintained. Hence I have not adopted Dr. Rabenhorst's genus *Capitularia*. The same may be said of Fuckel's genus *puccinella*, which I believe that the author himself has abandoned. D. B. F. M. C. C. p. 10, 1865.

GENUS UREDO.

U. Orchidis. (New British Species.) Mart. Amphigenous, spots reddish brown. Sori subrotund, arranged in circles, often confluent. Sporidia subglobose, golden yellow. Mart. H. Mosq. 229; Cooke, Fungi Brit, Exs. n. 61. *Uredo confluens* v. *orchidis*, Alb. and Sch. p. 122. *Uredo circinalis a orchidis*, Strauss, wett. Amr. ii, 88. *Cæoma orchidium* Lk. sp. pl. ii, p. 9. On leaves of *Listera ovata* and *orchis latifolia*; Crosby. June, 1865. D. B. F. M. C. C. p. 12.