

THE USTILAGINALES (SMUT FUNGI) OF OHIO*

C. W. ELLETT

Department of Botany and Plant Pathology, The Ohio State University, Columbus 10

The smut fungi are in the order Ustilaginales with one family, the Ustilaginaceae, recognized. They are all plant parasites. In recent monographs 276 species in 22 genera are reported in North America and more than 1000 species have been reported from the world (Fischer, 1953; Zundel, 1953; Fischer and Holton, 1957). More than one half of the known smut fungi are pathogens of species in the Gramineae.

Most of the smut fungi are recognized by the black or brown spore masses or sori forming in the inflorescences, the leaves, or the stems of their hosts. The sori may involve the entire inflorescence as *Ustilago nuda* on *Hordeum vulgare* (fig. 2) and *U. residua* on *Danthonia spicata* (fig. 7). *Tilletia foetida*, the cause of bunt of wheat in Ohio, sporulates in the ovaries only and *Ustilago violacea* which has been found in Ohio on *Silene* sp. forms spores only in the anthers of its host.

The sori of *Schizonella melanogramma* on *Carex* (fig. 5) and of *Urocystis anemones* on *Hepatica* (fig. 4) are found in leaves. *Ustilago striiformis* (fig. 6) which causes stripe smut of many grasses has sori which are mostly in the leaves. *Ustilago parlatorei*, found in Ohio on *Rumex* (fig. 3), forms sori in stems, and in petioles and midveins of the leaves.

In a few smut fungi the spore masses are not conspicuous but remain buried in the host tissues. Most of the species in the genera *Entyloma* and *Doassansia* are of this type.

A list of Ohio fungi in the Botany section of Volume 7 (1893) of the *Report of the Geological Survey of Ohio* includes 11 species of smut fungi. A catalogue of Ohio fungi has not been prepared since 1893 (Kellerman and Werner, 1893). The following compilation of Ohio smut fungi includes 45 species in 10 genera on 57 angiosperm hosts. The list is based upon collections in herbaria, reports from the available literature, and numerous collections and observations of the author throughout Ohio. Collections were examined in herbaria of The Ohio State University, the Agricultural Experiment Station, and Oberlin College. Host-fungus reports followed by a literature reference are those based on reports in the literature. Some of these literature reports are based on collections, which were not seen, in the herbarium of the University of Cincinnati (Cooke, 1941).

The nomenclature for the smut fungi is from Fischer's *Manual of the North American Smut Fungi* (1953), and the nomenclature for the host plants is from Gray's *Manual of Botany*, 8th edition.

USTILAGINALES

Contractia junci (Schw.) Trel.
Juncus tenuis Willd.

Doassansia sagittariae (Westend.) Fisch.
Sagittaria latifolia Willd.
S. sagittifolia L. (Fischer, 1953)

Entyloma australe Speg.
Physalis lanceolata Michx.

Entyloma compositarum Farl.
Ambrosia trifida L.
Rudbeckia laciniata L.

Entyloma eryngii (Cda.) deBary
Sanicula canadensis L.

Entyloma floerkeae Holw.
Floerkea proserpinacoides Willd.

*Publication 549, Department of Botany and Plant Pathology, The Ohio State University.

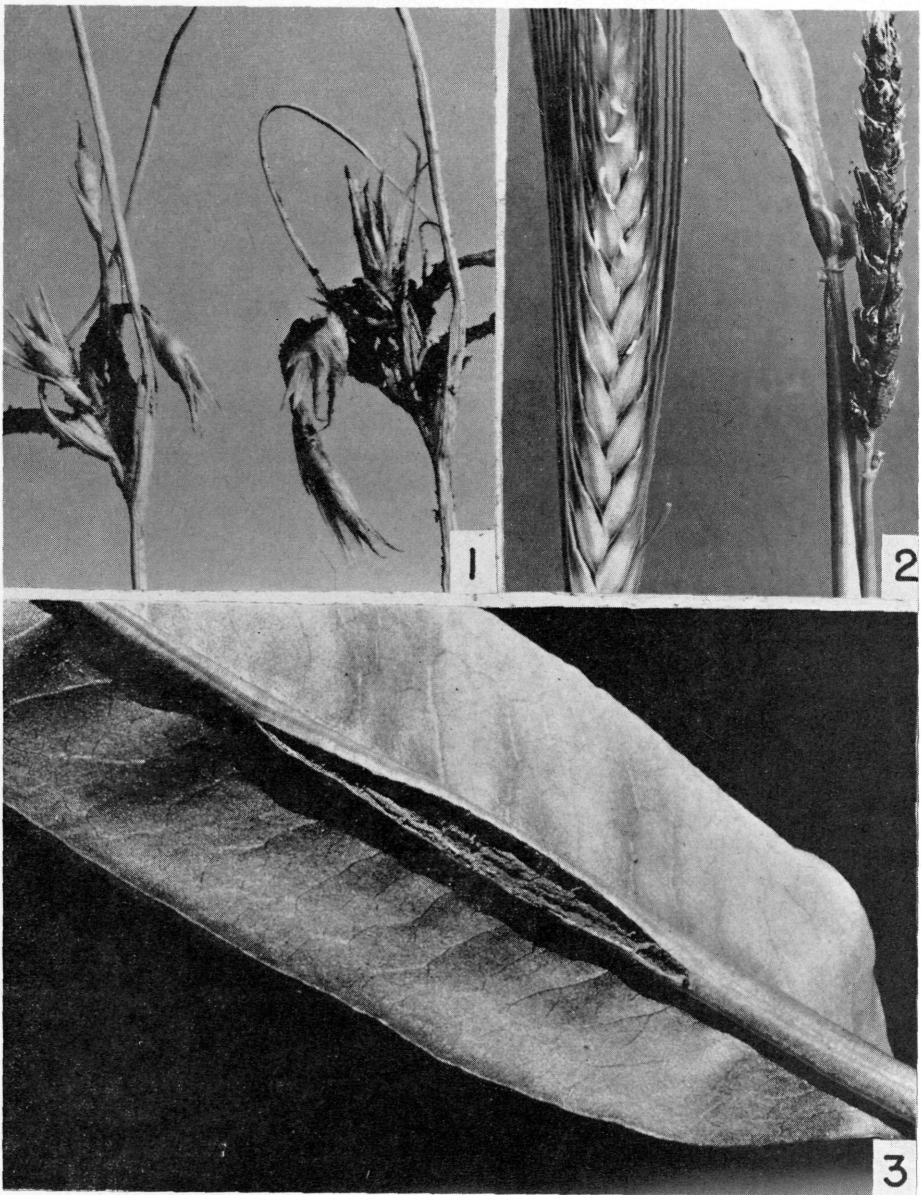


FIGURE 1. *Cintractia junci* on *Juncus tenuis*.

FIGURE 2. *Ustilago nuda* on *Hordeum vulgare*.

FIGURE 3. *Ustilago parlatorei* in midvein of leaf of *Rumex altissimus*.

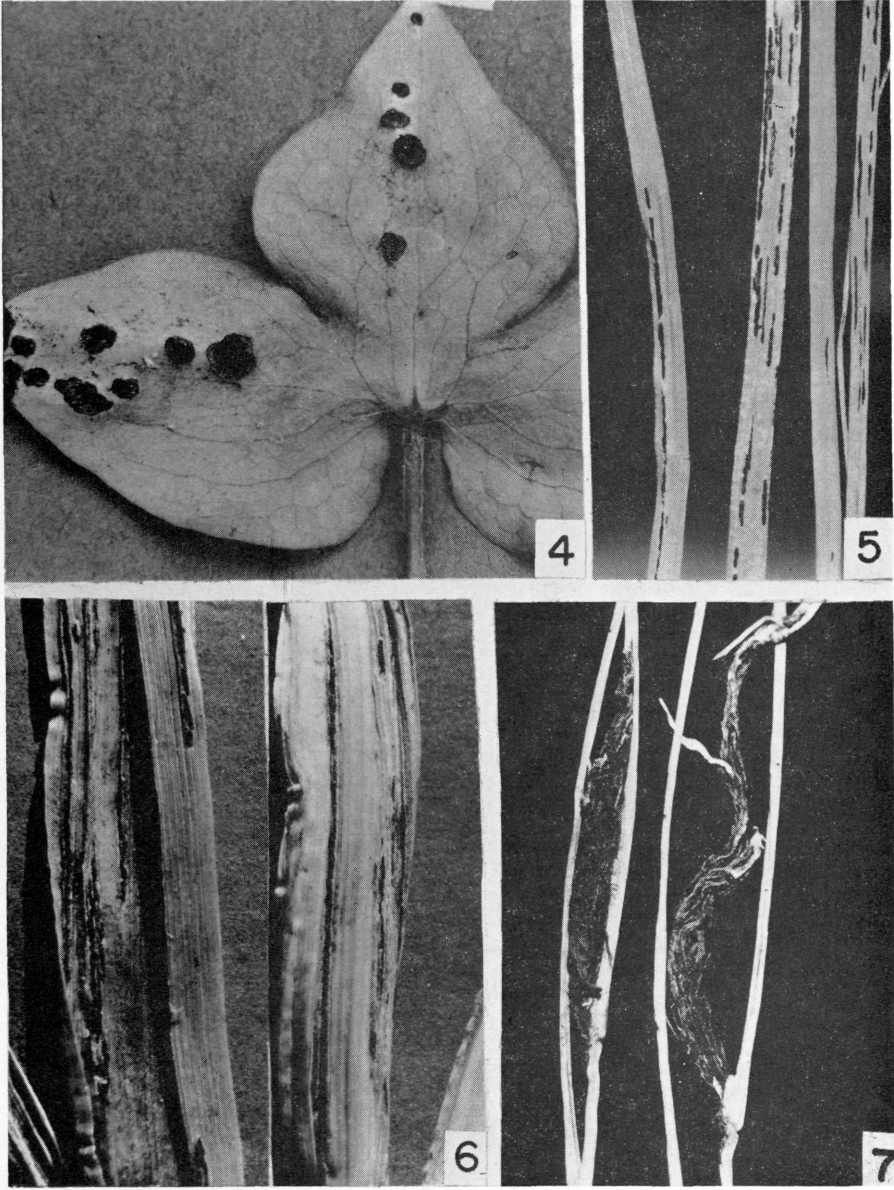


FIGURE 4. *Urocystis anemones* on *Hepatica acutiloba*.
FIGURE 5. *Schizonella melanogramma* on *Carex pennsylvanica*.
FIGURE 6. *Ustilago striiformis* on *Phleum pratense*.
FIGURE 7. *Ustilago residua* on *Danthonia spicata*.

- Entyloma lobeliae* Farl.
Lobelia inflata L.
- Entyloma menispermi* Farl. & Trel.
Menispermum canadense L.
- Entyloma nymphaeae* (Cunn.) Setch.
Nymphaea odorata Ait.
- Melanopsichium pennsylvanicum* Hirschh.
Polygonum hydropiperoides Michx.
P. lapathifolium L. (Weiss, 1950-1953)
- Schizonella melanogramma* (DC.) Schroet.
Carex pennsylvanica Lam. (Fischer, 1953)
- Sorosporium cenchri* Henn.
Panicum dichotomiflorum Michx.
- Sorosporium confusum* Jacks.
Aristida dichotoma Michx.
- Sorosporium ellisii* Wint.
Andropogon scoparius Michx.
A. virginicus L. (Cooke, 1941)
- Sphacelotheca hydropiperis* (Schum.) deBary
Polygonum sagittatum L.
- Sphacelotheca occidentalis* (Seym.) Clint.
Andropogon scoparius Michx.
- Sphacelotheca reikiana* (Kuhn) Clint.
Sorghum vulgare Pers.
Zea mays L.
- Sphacelotheca seymouriana* Clint.
Andropogon gerardi Vitm.
A. virginicus L.
- Sphacelotheca sorghi* (Lk.) Clint.
Sorghum vulgare Pers.
- Tilletia caries* (DC.) Tul.
Triticum aestivum L. (Fischer, 1953)
- Tilletia corona* Scribn.
Leersia virginica Willd.
- Tilletia foetida* (Wallr.) Liro
Triticum aestivum L.
- Tilletia maclagani* (Berk.) Clint.
Panicum virgatum L.
- Tilletia pallida* G. W. Fisch.
Agrostis canina L. (Fischer, 1953)
- Urocystis agropyri* (Preuss) Schroet.
Elymus riparius Wieg.
- Urocystis anemones* (Pers.) Wint.
Anemone quinquefolia L.
Hepatica acutiloba DC.
H. americana (DC.) Ker (Fischer, 1953)
- Urocystis carcinodes* (Berk. & Curt.) Fisch.
v. Waldh.
Cimicifuga racemosa (L.) Nutt.
- Urocystis colchici* (Schlecht.) Rabenh.
Allium cepa L.
Colchicum autumnale L. (Weiss, 1950-1953)
- Urocystis erythronii* Clint.
Erythronium americanum Ker (Fischer, 1953)
- Urocystis occulta* (Wallr.) Rabenh.
Secale cereale L.
- Ustilago avenae* (Pers.) Rostr.
Arrhenatherum elatius (L.) Mert. & Koch
Avena sativa L.
Hordeum vulgare L.
- Ustilago crameri* Korn.
Setaria italica (L.) Beauv.
- Ustilago heufleri* Fckl.
Erythronium albidum Nutt.
E. americanum Ker
- Ustilago hordei* (Pers.) Lagerh.
Avena sativa L.
Hordeum vulgare L.
- Ustilago maydis* (DC.) Cda.
Euchlaena mexicana Schrad.
Zea mays L.
- Ustilago neglecta* Niessl
Setaria glauca (L.) Beauv.
S. viridis (L.) Beauv.
- Ustilago nuda* (Jens.) Rostr.
Hordeum vulgare L.
Triticum aestivum L.
T. spelta L.
- Ustilago oxalidis* Ell. & Tracy
Oxalis sp. (Weiss, 1950-1953)
- Ustilago parlatorei* Fisch. v. Waldh.
Rumex altissimus Wood

Ustilago residua Clint.
Danthonia spicata (L.) Beauv.

Phleum pratense L.
Poa pratensis L.

Ustilago sphaerogena Burr.
Echinochloa crusgalli (L.) Beauv. (Fischer, 1953)

Ustilago syntherismae (Schw.) Pk.
Digitaria sanguinalis (L.) Scop.

Ustilago striiformis (Westend.) Niessl
Agrostis tenuis Sibth.
Andropogon virginicus L. (Cooke, 1941)
Calamagrostis canadensis (Michx.) Beauv. (Fischer, 1953)
Dactylis glomerata L.

Ustilago utriculosa (Nees) Ung.
Polygonum pennsylvanicum L.
P. punctatum Ell. (Cooke, 1941)
Ustilago violacea (Pers.) Roussel
Silene sp.

Key to Ohio Genera of Ustilaginales
Adapted from Fischer and Holton, 1957)

1. Teliospores separate (single)..... 2
1. Teliospores in groups or balls; rarely single and if so surrounded by an adhering layer of smaller sterile cells..... 6
1. Teliospores mostly adhering in pairs; sori forming black rustlike striae in leaves of *Carex*..... *Schizonella*
 2. Sori dusty at maturity..... 3
 2. Sori more or less firmly agglutinated at maturity..... 5
 2. Sori permanently embedded in the host tissues, usually in the leaves, resulting in conspicuous discolored spots; conidia commonly form on the surface of these spots..... *Entyloma*
3. Teliospores large, 16 μ and larger in diameter; usually in the ovularies..... *Tilletia*
3. Teliospores mostly 4-18 μ in diameter; in various host parts..... 4
 4. Sori naked or at first covered with a membrane of host cells, usually the epidermis..... *Ustilago*
 4. Sori at first covered with a membrane of fungus cells; in ovularies or other parts of inflorescence..... *Sphacelotheca*
 (*Ustilago* and *Sphacelotheca* are not always considered as distinct.)
5. Teliospores more or less agglutinated and formed around a central columella of host tissue; on Cyperaceae and Juncaceae..... *Cintractia*
5. Teliospores agglutinated into irregular, hard, gall-like masses consisting of a mixture of host plant tissue and fungus cells; on Polygonaceae..... *Melanopsichium*
 6. Sori embedded in the leaf tissues of the host, resulting in yellowish to brown spots; spore balls with sterile peripheral cells; Ohio species on Alismataceae..... *Doassansia*
 6. Sori dusty or powdery and not permanently embedded in host tissues..... 7
7. Two to five or six (rarely one) spores in a ball, partially to completely surrounded by smaller, lighter-colored, sterile cells; sori mostly in leaves and stems..... *Urocystis*
7. Spore balls very fragile at maturity and often disintegrating; without sterile peripheral cells..... *Sorosporium*
 (This genus is difficult to separate from *Ustilago* and *Sphacelotheca* unless young stages are examined when the spore balls are more likely to be intact.)

REFERENCES

Cooke, W. B. 1941. Some parasitic and saprobic fungi of southern Ohio. U.S. Dept. Agr. Plant Disease Repr. 25: 190-200.
 Ellett, C. W. 1957. Diseases not previously reported in Ohio. U.S. Dept. Agr. Plant Disease Repr. 41: 369-371.
 Fischer, G. W. 1953. Manual of the North American Smut Fungi. Ronald Press Company, New York. 343 pp.

- Fischer, G. W.** and **C. S. Holton.** 1957. *Biology and Control of the Smut Fungi.* Ronald Press Company, New York. 622 pp.
- Kellerman, W. A.** and **W. C. Werner.** 1893. *Catalogue of Ohio plants.* Rept. Ohio Geol. Survey 7: 56-406.
- Weiss, F.** and **Muriel J. O'Brien.** 1950-1953. *Index of Plant Diseases in the United States.* Plant Disease Survey Special Publication. U.S. Dept. Agr. Plant Industry Station, Beltsville, Maryland. 1263 pp.
- Zundel, G. L.** 1953. *The Ustilaginales of the World.* Contrib. 176 Dept Botany, Penn. State Univ., Univ. Park, Penn. 410 pp.
-