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DIPTERA AND FUNGI.

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The object of this paper is to call attention to certain Dipterous families which are more or less closely associated with fungi, particularly the fleshy fungi belonging to the families *Agaricaceae* and *Polyporaceae*. A survey of the general literature dealing with the food habits of dipterous larvae indicates that there are several families whose members in part inhabit fungi. These are shown in the following table in which other larval habits are indicated also. In the *Mycetophilidae* and *Platypezidae*, the fungus habit appears to be most pronounced. In the other families, only a comparatively few species have been found associated with fungi. The families mentioned in the table apparently contain most of the species having the fungus habit although some species of other families may also live in fungi.

Family	General Larval Habits
Tipulidae	In fungi, in earth, decomposing wood, in water.
Mycetophilidae	In fungi, in decaying matter, vegetable mould, under dead bark, etc.
Itonididae	Habits diverse, in fungi, in or on plant tissue usually forming galls, in decaying wood, predaceous.
Phoridae	In fungi, habits diverse, in decaying plant matter, in ants' nests, on decaying insects, in nests of burrowing bees, etc.
Platypezidae	Larvae live between lamellae of Agaric fungi.
Syrphidae	In fungi, in stems of plants, in decaying wood, in animal remains, in ants' nests, feeding on aphids.
Borboridae	In fungi, in algae, diseased potatoes, dung.
Helomyzidae	In fungi, in decaying animal and vegetable substances, in bat and rabbit dung, etc.

Johannsen in his "Fungus Gnats of North America"[1] has considerable to say concerning the *Mycetophilidae* and their relation to fungi. According

[1] Me. Agric. Exp. Sta. Bul. 172, 180, 196, 200.

to him, a large number of wild mushrooms are infested with the larvae of *Mycetophilinae*, particularly of the genera *Exechia* and *Mycetophila*. In several instances they were found with *Phora* larvae in numbers sufficient to ruin a cultivated mushroom bed. Most of the following information concerning *Mycetophilidae* has been compiled and tabulated from Johannsen's monograph. In the case of subfamilies not mentioned, no definite information was given.

Subfamily	Ceroplatinae	Larvae in rotten wood and in fungi.
"	Sciophilinae	Larvae in rotten wood and in fungi.
"	Mycetophilinae	Larvae in rotten wood and in fungi.
"	Sciarinae	Members occasionally reported as injuring mushrooms. After partial decay of fungus growths, *Sciara* larvae found in numbers and this has led mushroom growers to attribute the destruction to these gnats, when damage was probably done by species of *Mycetophila*, *Exechia* or *Phorids*.

In the *Sciophilinae* the genera *Tetragoneura*, *Sciophila* and *Mycoma* are mentioned as living in rotten wood and in fungi during their larval stages and Winnertz is recorded as rearing *Mycoma* from *Daedalea quercina* and *Polyporus* and *Sciophilae* from *Hydnum repandum*, *Boletus scaber* and *Daedalea quercina*. The last mentioned fungus is a Polypore which is rarely attacked by insects probably on account of its corky and consequently unpalatable context and it is quite likely that the above mentioned rearings were made from sporophores which were in an advanced stage of decay. According to Osten Sacken, the larvae of *Sciophila* live on the surface of the fungus which they cover with a web and do not burrow inside.

In the *Mycetophilinae*, the activities of the genera and species appear to be definitely known as follows.

Genus	Leia	Larvae in mushrooms.
"	Cordyla	Larvae in decaying wood and in fungi.
"	Rhymosia	Larvae in fungi (*Armillaria*, etc.) *R. inflata* Joh. bred from *Armillaria mellea*.
"	Exechia	Larvae frequently in wild mushrooms, occasionally in cultivated ones. *E. cincinnata* Joh., reared from *Boletus granulatus*. *E. satiata* Joh., from shelving mushroom. *E. nativa* Joh., from *Collybia* sp. *E. absoluta* Joh., from *Boletus granulatus*. *E. capillata* Joh., from *Collybia dryophila*.
"	Mycothera	Larvae in decaying wood and in fungi.
"	Mycetophila	Larvae frequently in wild mushrooms, sometimes in cultivated ones. *M. scalaris* Loew, reared from *Boletus* and *Polyporus*. *M. foecunda* Joh., from *Polyporus sp.* *M. lenta* Joh., from mushrooms.
"	Sceptonia	Larvae in decaying wood and in fungi.
"	Zygomyia	Larvae in decaying wood and in fungi.

In the subfamily *Sciarinae*, *Sciara multiseta* Felt has been reared from mushrooms and *Sciara agraria* Felt is recorded as being numerous at times in mushroom cellars. Definite information concerning the exact identity of the hosts of most of the *Mycetophilidae* is lacking although it is quite possible that almost any agaric or bolete will suit the tastes of many of these flies.

In the *Itonididae*, Dr. E. P. Felt has called my attention to the fungus and related habits of several species as recorded in several of his reports.[1] The more or less strictly fungous species were listed by Dr. Felt in his paper on "Hosts and Galls of American Gall Midges[2]" and these are presented as follows:

Host	Species
Fungus on rotting plum	Hyperdiplosis fungicola Felt.
Unknown fungus	Arthrocnodax macrofila Felt.
Aecidiospores of Uromyces pisi	Toxomyia rubida Felt.
Teleutospores of Puccinia	Toxomyia fungicola Felt.
Young mushrooms	Mycophila fungicola Felt.
Reared from Oecidium impatientis	Mycodiplosis impatientis Felt.
Larvae on Oecidium importatum affecting Peltandra sp.	Mycodiplosis sp.
Under hard, black carbonaceous fungus on decayed oak stump	Lasiopteryx flavotibialis Felt.
Fungus affected heartwood of pine	Monardia lignivora Felt.
Large yellowish fungus on rotten bark	Mycodiplosis fungiperda Felt.[3]

Of particular interest are the species of *Toxomyia* and *Mycodiplosis* which were reared from the spores of the rusts and smut. Many other species of *Itonididae* are mentioned by Dr. Felt as having been bred from decaying bark and wood and it is extremely probable that these may be more or less closely associated with the fungous hyphae which usually penetrate such objects.

In connection with Diptera and fungi, it is of interest to note the peculiar fungoid growth or development of the tissues which accompanies the activities of *Asteromyia* larvae in the leaves of *Solidago*. Writing about *Asteromyia carbonifera* Felt, the oval, blister-like gall of which is common upon the leaves of the narrow leaved *Solidago graminifolia*, Felt[4] states that "the characteristic blister galls produced by this and allied forms are usually filled, or nearly so, with a black carbonaceous matter, suggesting that the tissues may have become badly infected by fungus. This material is almost invariably present in many galls. Professor Peck states that after repeated examinations, he has failed to observe any evidence of the characteristic fruiting bodies of fungus, and consequently we must assume this malformation to be independent of fungus infection and produced by the activities of the larva. Doctor Trelease, writing in 1884,

[1]N. Y. St. Mus. Bul. 165, 175, 180, 198, 202.
[2]Jour. Econ. Ent. vol. 4, No. 5, p. 461.
[3]N. Y. St. Mus. Bul. 202, p. 196.
[4]N. Y. St. Mus. Bul. 198, p. 209.

states that some of these blister galls occur in the herbaria of mycologists, under the name of *Rhytisma solidaginis* and *R. asteris.*"

From the foregoing it appears that most but not all of the Diptera associated with fungi confine their feeding activities to members of the fungus families *Agaricaceae* and *Boletaceae*, the sporophores of which are fleshy and also to such members of the *Polyporaceae* which are fleshy. Several exceptions are those such as a *Winnertzia* sp., which was bred from a tough and leathery specimen of *Lenzites saepiaria* and *Monardia lignivora* Felt,[1] the larvae of whch were bred from the fungus-affected heartwood of *Pinus rigida*, where they were apparently attacking spongy as well as hard wood. It further appears that as far as known, most of the more or less strictly fungus inhabiting Diptera are confined to the families *Mycetophilidae* and *Platypezidae*, the members of the former being by far the most numerous. By reason of their food habits, members of these families are generally found in damp surroundings and are usually classed as scavengers although many are not true scavengers as they do not feed upon decaying vegetable matter. Most of them must of necessity have brief larval periods, because many of the agarics do not last more than ten days or two weeks. For many of the species definite information is lacking and little is known concerning their true relations with and dependence upon the lower forms of plant life.

[1]Univ. State of N. Y. Bul. 547, p. 191.