CHARACTERS OF THE LARVÆ OF MYCETOPHILIDÆ.

BY C. R. OSTEN SACKEN.

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PREFACE.

The volume of the Proceedings of the Entomological Society in Philadelphia (1862), which contains my paper on the larvae of Mycetophilidae is very seldom found in european libraries, and hence my paper has become almost inaccessible. As it is the only attempt as yet made of a *comparative description* of the external anatomy and especially of the mouthparts of the larvae of the principal genera of Mycetophilidae I deem it useful to reprint it for the purpose of distributing it among my friends and correspondents.

This reprint, except some small emendations, is without change; a few short passages, which I have added, are enclosed in square brackets [——]. In a Postscript, the literature is brought to date.

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By C. R. Osten Sacken.

(Plate 2.)

A considerable amount of information on the earlier stages of existence of Diptera is scattered through the entomological publications. Only a few years ago, Mr. Haliday prepared a list of nearly all the references on this subject. (*List of the genera and species of the British Diptera, the earlier stages of which are more or less perfecty known, with references to the principal authorities*, in the Natural History Review, 1857, p. 180.) The next step, after a publication of this kind, is to digest the materials thus collected, and to reduce to a more compact form the information contained in them. But this being done, one becomes very soon aware that the increase of knowledge thus obtained is rather insignificant, that a vast number of references add but very little to the facts, and that a real advance can be obtained only by fresh investigation. The knowledge of larval *forms*, due to former observers, does not, in most cases, supply us the knowledge of the *characters* of these forms. The desideratum of dipterology in its present state is to establish the natural character of each family in its larval form, as well as the natural character of at least the principal genera within each family, during the same stage of existence.

An attempt of this kind on the family of *Mycetophilidæ* is offered in this paper. It contains: 1st.—A comparative description of the external anatomy of the principal genera in their larval form. 2d.—A brief account of what is known about the habits of each genus. 3d.—A list of references, with a short notice on the importance of each.

It will be observed that the description of the transformations of *Mycetobia pallipes*, usually considered as belonging to the *Mycetophilidæ*, has been omitted. The earlier stages of this insect, as observed and described in perfect agreement by Lyonnet, Dufour and Guérin, are totally at variance with those of the other genera of the family, the larva being amphipneustic, and the pupa having spines round the abdominal segments, like those of the *Tipulidæ*. Both resemble most strikingly the larva and pupa *Rhyphus*. I have deemed it better, therefore, to *exclude* this genus from the family until further research indicates its true location.

The principal descriptions of the larvæ of *Mycetophilidæ* have been given by Dufour, Bouché and Heeger.

Léon Dufour*), in his paper on the metamorphoses of fungivorous larvæ, made the first and only attempt at a generalization of the characters belonging to the different genera of the family. He divides these larvæ in *antennatæ* (Bolitophila) and *non-antennatæ;* the latter are subdivided in *oculatæ* (Mycetophila, Cordyla) and *non-oculatæ* (Sciara). But it will be shown below that the antennæ may be considered as always extant, although frequently in a rudimentary state. It is difficult to say what Dufour took for *the ocelli;* if it was the pair of small, pellucid, convex spots which may be perceived below the antennæ, he was correct in stating that they are absent in *Sciara;* but how did he not perceive them in *Bolitophila?* („Mes investigations les plus répéteés, says he, ne m'ont fait reconnaître *dans les antennées*, ancune trace d'yeux.") As to the trophi, their description is very imperfect; the author *indistinctly* perceived a pair of serrated mandibles, but did not discover any maxillæ nor palpi. He gives, however, very valuable observations on the internal anatomy of these larvæ.

Bouché described several larvæ of *Mycetophila* and *Sciara*, but, besides giving an idea of their general appearance, these descriptions have little value. The statements about the trophi are very imperfect; the figures appended to them are incorrect. (Thus the mandible of *Myc. signata*, Tab. III., f. 7, or the head and mandibles of *Sciara*, Tab. III., f. 11, are altogether imaginary.)

*) All the quotations have to be looked for in the *References*, at the end of this paper.

Heeger, likewise, has published observations on a *Sciara* and a *Mycetophila*. The paper on *Sciara* contains the only correct description and figures of the trophi of any larva of this family hitherto given. In the article on *Mycetophila*, on the contrary, Heeger has committed a most singular error, in taking the back of the larva for its venter, and vice-versa. The trophi are not mentioned at all *).

In the sequel I have attempted to establish the general characters of the larvæ of this family, and to show at the same time the modifications which these characters incur in the principal genera. My statements are principally based upon my own observations on the larvæ of *Mycetophila signata* (or a closely allied species), of *Bolitophila cinerea* M., *Sciophila limbatella* Zett, and several species of *Sciara*, all of which I have reared. I had, moreover, a larva found under the bark of a tree in Virginia, and which I have some reason to suppose to be that of *Leja*.

It is on the examination of these larvæ, supported by scattered statements found in previous authors, that I have tried to define the characters of this family and of the genera. These characters may, and probably will, be modified by future research; but the only way to arrive at their *improvement*, is to establish a basis to start from.

I. LARVA.

The general characters of the larvæ of *Mycetophilidæ*, known to me, may be set down thus: —

A distinct horny head; a fleshy labrum, encased in a horny frame; horny, flat, lamelliform mandibles, indented on the inside; maxillæ with a large coriaceous inner lobe, and a horny outside piece, with a circular excision at the tip; labium horny, small, almost rudimentary; body fleshy, with eight pairs of stigmata.

I. *The head* consists of a more or less strong horny shell; it is strongest in *Bolitophila* and softest in *Sciophila*; it is open anteriorly and posteriorly, the anterior opening containing the *trophi*, the posterior one forming the connection with the first thoracic segment.

Viewed from above, the heads of the larvæ show the following differences: 1st. — In the form, which is sometimes cordiform (fig. 2,

[*) Heeger committed another error in describing the larva of a *Bolitophila* as that of *Limnobia platyptera* Macq. Heeger, Sitzungsb. d. Wien. Acad. XI, 1853.]

Myc. signata); sometimes almost square (fig. 4, *Sciara)*; or broad and rounded (fig. 9, *Bolitophila)*. The head of *Sciophila*, as well as that of the larva which I suppose to belong to *Leja*, are more elongate than the others (figs. 6 and 7). 2d.—In the outline of the posterior (occipital) margin; in *Mycetophila* and *Sciara*, it is more or less emarginate in the middle (figs. 2 and 4, *t.*); the same is the case with the four larvæ of *Mycetophila*, with *Cordyla crassipalpa*, and *Sciara ingenua*, all described by Dufour; this emargination is sometimes in the middle of a produced lobe (fig. 10, *a.*), or of a lobe formed by two lateral emarginations, although not produced beyond the lateral parts of this margin (fig. 10, *b*); sometimes the lobe is hardly perceptible (fig. 10, *c.*); in some larvæ, as, for instance, that of *Myc. signata*, there is a distinct notch on each side of the lobe (fig. 2, *g*), formed by a fold of the horny substance. In *Bolitophila* (fig. 9) and *Sciophila* (fig. 6) the posterior margin is not, or is almost imperceptibly emarginate and not produced. 3d.—The direction of the *occipital lines*, two slender, pellucid lines, beginning at the interval between the mouth and the antenna and running towards the posterior margin. They converge towards the middle of this margin in *Mycet. signata*, *Sciophila limbatella* and in all *Sciaræ* which came under my examination; sometimes they are nearly straight (fig. 2 and 6, *f*), sometimes undulated and angular (fig. 4, *f*). They are not convergent, and reach the posterior margin at two distant points in *Bolitophila* (fig. 9).

Viewed from beneath, the horny shell of the head also shows some differences of structure: a. In *Sciara* and *Mycetophila signata* its anterior and posterior openings are almost connected, or separated only by narrow, horny stripes; in some *Sciaræ*, for instance, there are two such stripes (fig. 3); in others but one (they seem to break off easily, at least in specimens preserved in spirits); b. In *Sciophila* (fig. 7, *t'*) and the supposed larva of *Leja*, (fig. 8, *t'*) the anterior and posterior openings are separated by a broad portion of the shell; a distinct longitudinal suture in the middle of this interval, indicates the soldering together of the two edges of the shell. As to *Bolitophila*, among my five specimens of its larva, one has the edges of the shell connected, in the others this connection was broken, as was evident from the irregular outline of the margins.

Viewed in front (in the direction of the axis of the body) the

head generally shows the following openings in the horny shell, easily perceptible on account of their paler color: in *Mycetophila* (fig. 12) a subtriangular spot in the middle (*d*), which is the fleshy part of the upper lip; a round spot on each side, (rudimentary antenna, fig. 12*a*); a second, more oblong and irregular spot below (the interval between the root of the mandible and the edge of the horny shell, fig. 12 *k**; fig. 11, the interval between *r* and *s*), and a third smaller spot (*m*) which is the ocellus; the three slits on the lower part of the head (*n**) are the intervals between the maxillæ. *Sciophila* has the same pellucid spots; but those marked *a* and *k** on the plate are oblong, and the spot (ocellus?) *m* is black, opaque. *Sciara* is in this respect like *Mycetophila*, only the spot *m* (ocellus) is either black, opaque or wanting. In *Bolitophila* the spot *d* (labrum) is much smaller, *a a* (antennæ), on the contrary, larger.*)

The organs connected with the head, and which I have to describe now, are the *antennæ*, the *ocelli* and the parts of the mouth *(trophi)*.

A. *Antennæ*. A pair of round openings in the horny shell of the head, one on each side of the mouth, are the places of insertion of the antennæ. In *Mycetophila* they seem to be generally rudimentary, mere soft, fleshy swellings projecting through a round hole (figs. 1 and 2, *a*); still, the larva of *Myc. nigra* has, according to Bouché, distinct, stout, conical two-jointed antennæ, and *Cordyla crassipalpa* (according to Dufour) likewise, although short ones. *Sciara* (fig. 4, *a*) and *Sciophila* (fig. 6, *a*) have, like *Mycetophila*, rudimentary antennæ. In *Bolitophila* they reach the greatest development, being distinctly jointed. They consist of a stout, whitish, fleshy basal joint, divided in two by a horny ring; second joint cylindrical, horny; third joint much shorter (it bears a bristle, according to Dufour; my specimens, preserved for years in spirits, may have lost it). However, even the rudimentary antennæ of the other genera, when viewed from above, show on the fleshy tubercle an indistinct circle or ring, probably the indication of a joint.

B. *Ocelli*. *Bolitophila* and *Mycetophila* (*m* in figs. 1, 11 and 12) show on each side, below the antenna, a small, pellucid, convex spot,

*) I deemed it useful to notice these paler spots on the dark ground of the head, as former authors have mentioned them, without explaining their meaning. Perris, for instance, has figured the head of Sciophila viewed in the direction of the axis of the body.

which may be an ocellus, and has been taken for one by Dufour. The other larvæ have either no such spots at all, or opaque, black spots in their stead.

C. *Trophi.* The trophi of the larvæ of the *Mycetophilidæ* consist of all the parts forming the normal type of the insect mouth: the *labrum*, a pair of horny *mandibles*, a pair of *maxillæ* and a *labium*.

1. *Labrum.* It is a fleshy piece, encased in a kind of horny frame, which is fastened to the epistoma and interrupted anteriorly. Fig. 13 represents the labrum of *Mycetophila signata; d* is the fleshy part, *c* the horny frame, the inner margin of which is fringed on the inside, towards the tip, with a row of very minute, stiff bristles. The labrum of the other genera has precisely the same structure; it is somewhat smaller in *Bolitophila* (fig. 9, *d*); in Sciophila, and in the larva which I take to be *Leja*, the epistoma shows a distinct depression in the middle. In all these larvæ the labrum occupies a considerable portion of the upper part of the mouth, its tip, in repose, resting between the inner sides of the maxillæ (*see d*, in figs. 1—4, 6, 7, 9 and 11). Its function seems to be, principally, to shut the oral orifice, and perhaps to press on the mandibles and maxillæ during the process of mastication.

2. *Mandibles.* They are horny lamels, serrated or indented on the inside, and attached at two points to the horny shell of the head, that is, to a horny projection of this shell, generally existing close by the antenna (fig. 11, *r*) and another point a little below it, so that a vacant space, already mentioned above, remains between the lower edge of the mandible and the horny shell. The mandibles are compressed between the labrum and the maxillæ, and their indented edge is more or less closely applied to the indented edge of the maxilla (*k* in figs. 1, 3, 5, 7 and 11; fig. 5 shows the position of the mandibles of *Sciara* after the removal of the maxillæ). It results from this description that, differing from the usual situation of the mandibles, here they are in a more or less oblique position towards each other. The *form* of the mandibles differs in different genera. Those of *Myc. signata* (fig. 15) have a thin, rounded, serrated inner edge and a second row of indentations, parallel to the first, on the flat surface of the lamel, along the margin of its stronger portion (fig. 15, *q*). The mandibles of *Bolitophila* resemble the former in their outline. Those of *Sciara* are more square, and have only three

or four large indentations at one end (fig. 16); those of *Sciophila* are uniformly thin, slightly concave, with several large indentations, and some minute ones in their intervals and on the surface (fig. 17).

3. *Maxillæ* (figs. 18 and 19). They consist of a triangular *cardinal piece* (*x x* in the figs. 1, 3, 7, 8 and 18) and a *stipes* composed of two distinct pieces: 1st. An inner one, which is generally connected with the cardinal piece below by a horny process (*o* in figs. 18 and 19) and ends above in a coriaceous, more or less cultriform lobe, serrated on the inside (*z*). 2d. An outside one (*d'*), which is horny, and has near its tip a round excision (*i*) for the palpus. The cardinal piece of one side is generally separated by an interval from that on the opposite side (as in *Mycetophila, Sciara, Sciophila*; see the above quoted figures); but in the larva which I suppose to be that of *Leja*, they are remarkably large and contiguous (fig. 8, *x x*). The *serrated lobe* offers much analogy of structure in all the larvæ which came under my examination; in *Mycetophila*, its edge had 10 or 11 sharp indentations, which become smaller and indistinct towards the tip. The *Sciaræ* showed only 6 or 7 such indentations, of which four were larger and less sharp than in *Mycetophila*, the other 2 or 3 were small and rounded; in *Sciophila* the serrated lobe is elongated, narrow and curved; the indentations are distinct only at the base; in *Bolitophila* (fig. 19, *z*), on the contrary, the lobe is short, rather stout, with sharp indentations. The horny process *o* is particulary developed in this genus, being strongest and showing a distinct excision immediately below the first tooth of the cultriform lobe (fig. 19). The horny outside piece of the maxilla (*d'* in figs. 18 and 19) is closely applied to the inner one (see *h*, figs. 1 and 3, showing the maxillæ of *Mycetophila* and *Sciara* in their relative position to the other parts of the head), although not soldered to it (a slight pressure between two glass plates easily separates them, as fig. 18 shows.) A small fleshy tubercle, protruding through the round opening at the tip of this piece, is evidently a rudimentary maxillary *palpus* (*i*), which I have seen developed only in *Sciophila* (fig. 7, *i*) where it is subuliform and apparently two-jointed. The round excision is unusually large in this genus. The rudimentary palpi of the other genera, show under a strong magnifying power a minute horny ring in the middle of the excision (as in fig. 18) which may be the indication of a second joint. In two *Sciaræ* which I dissected, the hoop encircling

the excision is stout, so as to be somewhat tubular (this is the reason why, when isolated and compressed between two glass plates, this opening appears less pellucid than in *Mycetophila).*

The combined action of the mandibles and maxillæ is probably that of abrading the objects against which the under side of the head is applied. This may also explain the large sized upper lip, which presses these organs against the scraped surface, and the internal situation of the lower lip, which, if projecting, would interfere with the function of the other organs.

4. *Under lip.* This organ is but little developed, and I have not succeeded in elucidating its structure completely. Between the maxillæ a horny, often V-shaped piece is seen (fig. 14; *y* in figs. 3 and 7; see, also, fig. 18), the branches of which extend behind the maxillæ. Judging from the analogy of other insects, it is not improbable that this organ has some function to perform in connection with the cocoon-spinning of the larvæ. I incline to find this opinion confirmed by Dufour's description of the larva of *Ceroplatus*, where these organs seem to have more development. After having mentioned *two pairs of mandibles* (evidently meaning by the second pair the maxillæ), he describes a pair of blackish, horny tubes, slightly curved, inserted, one each side, *between the basis of both mandibles*, their tips being directed backwards. They are the organs for spinning. The only doubtful point here is the position ascribed to these organs, and which, if I understand it right, would not quite answer to that of the labium.

II. *The body* of the larvæ of *Mycetophilidæ* is subcylindrical, more or less elongated, fleshy, whitish or yellowish (in *Sciophila* and some *Sciaræ*) and consists of 12 segments. It is most elongate, almost serpentiform, in *Sciophila*; stouter and shorter in *Bolitophila* and *Mycetophila*. *Sciara*, in this respect, seems to hold the middle. It is smooth, without hairs or bristles, except those on the ventral side. Generally it is very transparent, showing distinctly the intestinal canal and the tracheæ. It has *eight* pairs of stigmata*), one on the first

*) Bouché attributes *nine* pairs of stigmata to the larvæ of *Myc. nigra* and to those of the three *Sciaræ* which he reared; Heeger, the same number to *Myc. lunata*. I believe these statements to be erroneous, as all the larvæ of *Mycetophila* and *Sciara* which I saw, and likewise those described by Dufour, had *eight* pairs.

thoracic and seven on the first seven abdominal segments, the two last ones having none. These stigmata are small, horny, nipple-shaped projections; those of *Sciophila* are the smallest. (At least they were so in the species I reared; judging, however, from Dufour's description and figures of the larvæ of *Sc. striata*, it seems that the stigmata were much larger and projecting in that species; the thoracic pair was bifid.) The locomotive organs consist of more or less apparent transverse swellings on the under side of the ventral segments, sometimes furnished with minute bristles or spines. The latter are frequently arranged (especially in *Mycetophila*) in two transverse, parallel rows on each of eight or ten segments; in *Bolitophila*, if sufficiently magnified, they appear to consist of a multitude of short bristles, arranged in lines, and forming a transverse band. The arrangement of these bristles seems to vary in different species, and has been used by Dufour as a specific character in the description of the larvæ of several *Mycetophilæ*. *Myc. modesta* Dufour, according to this author, had no such bristles; likewise the locomotive swellings of all the *Sciaræ* which I have examined, had none; however, *Sciara ingenua* Duf. had them, according to the same author. The larva of *Sciophila* which I reared was furnished with them, but they were exceedingly minute; they were placed on the ventral side of eight abdominal segments; all rows being double, except the first, which seemed simple; the 8th or last, was almost obsolete. The last abdominal segment of the larvæ is generally simple, but often, as in some larvæ of *Mycetophila*, more or less bilobed.

The larva of *Ceroplatus*, judging from the descriptions of Reaumur, Bosc and Dufour, has a very different structure of the body. Its four anterior segments only are distinctly separated, the incisures of the others being concealed by numerous transverse wrinkles, which give this larva the appearance of a leech (see fig. 20). No stigmata were perceptible.

II. PUPA.

The pupæ of the *Mycetophilidæ* are *extricated*; that is, not encased in the contracted skin of the larva. The legs are applied to the breast and venter; the antennæ bent round the eyes, and their remaining portion applied to the breast between the wings and the legs. In *Sciara* their basis is frequently expanded into a tooth. The

prothoracic stigma is placed on a small protuberance a little above the root of the wing, immediately behind the antenna. In some *Sciaræ*, this protuberance is extended into the shape of a pointed horn, the direction of which is parallel to that of the longitudinal axis of the body (fig. 22); an air-tube may be distinctly seen entering this horn. The abdominal stigmata are distinct on both sides of the abdomen, in the shape of small, brownish, nipple-shaped projections.

These pupæ are smooth, the margins and angles of the body are rounded, and not sharp or pointed, like those of the pupæ of *Tipulidæ*, for instance. The only exceptions I met with are those mentioned: the prothoracic horns in some species of *Sciara*, and the double point on the top of the head, due to the tooth-like expansion at the bases of the antennæ. In this respect, these pupæ have a close resemblance to those of some *Cecidomyiæ*—a resemblance which has already been noticed before. (See Loew, Stett. Entom. Zeit., 1842.) Not all the species of *Sciara*, however, have pupæ of such a structure.

The pupæ of *Mycetophila* and *Sciophila* are enclosed in a cocoon, of more or less density in different species*). Exceptions may occur, however, as for instance is the case with *Mycet. inermis* Dufour, which, according to this anthor, has apparently no cocoon, but, as he suggests himself, it may have been so delicate as to have been destroyed by the observer in the attempt to extricate the pupæ from among the remains of the fungus in which they were concealed. *Sciara* in some species spins, in others, does not spin a cocoon. An earthy case sometimes replaces it (as in *Sc. fuscipes* Meig., observed by Heeger). The pupæ of *Sciara toxoneura* O. S. (fig. 22), were enclosed in small hollows just below the surface of the cow-dung in which I found them. *Bolitophila*, according to Dufour, has no cocoon (although I have reared the same insect, I find no notice about its pupa in my papers). *Ceroplatus* and *Cordyla* spin cocoons (Dufour).

III. Remarks on the Habits of the MYCETOPHILIDÆ.

All the larvæ are gregarious, and live in decaying vegetable matters. *Mycetophila* and *Sciophila* seem to prefer fungi and other

*) The pupa of *Sciophila striata* Meig., reared by Dufour, had no cocoon.

fungoid growths, as all the known larvæ have been observed in such situations. *Sciara*, on the contrary, is found among decaying leaves, in vegetable mould, in cow-dung, under the bark of dead trees, etc. That these larvæ shed their skins several times before transforming into the pupa state, seems to be beyond doubt, although I have never had occasion to observe it myself. Heeger asserts it with the precision of an eye-witness about the larva of *Sciara fuscipes*.

Mycetophila.

Heeger gives the following account of the habits of *Myc. lunata:* —

"They hibernate mostly as perfect insects or as pupæ; seldom "as larvæ; they appear in the spring and copulate after a few days, "generally in the evening. After 6 days, or 10, if the weather is "moist and rainy, the female lays its eggs on the fungi growing on "old horse-chestnuts, singly, 20 or 30 on the same fungus. Before "depositing them, she generally walks along the root of the fungus, "in order to find the proper location for them. The larvæ appear "after 8 or 10 days, and begin to burrow in the unterside of the "pileus; they shed their skin three times, and transform near the "outer margin; the pupa state lasts from 9 to 12 days, after which "the fly comes out, generally in the morning; it begins to move "about to take its first food only towards the evening.

"The eggs are one fifth of a line long, cylindrical, white."

The larvæ of this genus are generally whitish, rather stout. The horny head is more or less brown.

Myc. signata Meig. (? or a closely allied species), which I have reared, also spun its cocoon without leaving the fungus. In order to ascertain the relative proportion of the sexes in the perfect insect, of which I had obtained a large number, I examined a *hundred* specimens and found 51 males and 49 females. The cocoon was truncated at one end, and this truncature covered with a delicate web, which the fly breaks through in escaping. In this, as in all other respects, Dufour's statements about *M. hilaris* Duf. (syn. *M. arcuata* Meig?), a species closely allied to *M. signata*, agree exactly with mine.

A very curious larva of the same genus has been observed by Perris (*Myc. scatophora* Perris). It carries on its back a sheath formed of its own excrements, and moulded by means of a peculiar undulatory motion of the skin. The larva is more stout and convex

than the other larvæ of the genus, otherwise it agrees with them. The pupæ remain within the sheath, but before assuming this state the larva extends the sheath anteriorly into a short neck, and tapestries it on the inside with a pellicule, which renders it more tough and resisting. Larvæ and pupæ were found on a meadow, under an old plank, the under side of which was overgrown with byssus.

Bremi observed a similar larva, but referred it to *Sciophila*. The probable origin of this error will be explained below.

Cordyla.

The larva of *C. crassipalpa* Dufour, observed by this author in a fungus, seems to agree in every respect with the larva of *Mycetophila*.

Bolitophila.

The habits of this genus seem to be like those of *Mycetophila*. The larva spins a cocoon, which remains on the surface of the ground or among the fragments of the decayed fungus. Dufour's observations agree with mine. Guérin, as will be shown below, mistook for *Bolitophila* quite a different larva.

Sciophila.

The larvæ of this genus are easily distinguished from those of *Mycetophila* by their more elongated form and their mode of life, as they do not burrow inside of the fungi, but live on the surface, generally on the under side of the pileus, which they cover with a web.

Some of them are found on decaying wood, especially when it is covered with *byssus*.

Degeer was the first observer of these larvæ; Dufour and Perris came next. At present the transformations of *Sciophilæ* of all the three divisions of Meigen (A, B, C) are known, and all seem to share the same habits. Perris reared *Sc. unimaculata* Macq. (Div. B, Meig.); the same author, as well as L. Dufour, reared *Sc. striata* Meig. (Div. A), and I obtained in the same way *Sc. limbatella* Zett. (or a closely allied species of the same division *C* Meig.). The concurrence of these observations makes me believe that the statement of Van Roser, who found the larva of *S. marginata* Me erl. in an agaricus, and described it as being "exactly like that of *Mycetophila*," must be

founded on a mistake; it will be shown below that larvæ of both genera frequently dwell together in the same fungus. The following is an account of my own observations on *Sciophila*: —

I had brought home (in St. Petersburg, Russia, in Sept, 1855) larvæ of *Mycetophila*, which I succeeded in raising. Not less than 120 specimens came out. What remained of the agarici, after this, was a putrid, shapeless, semi-fluid mass, spread over the earth at the bottom of the box in which the experiment was made. On these remains I soon noticed minute larvæ, diligently engaged in spinning; they grew rapidly, and in five days were almost full-grown. During this time they had spun over with a delicate web the whole surface of the putrid mass, especially the hollows and inequalities in it. Each larva had its own district, where it continued working under cover of the already completed tent. The latter consisted of a dense upper stratum, under which hung, like so many suspension-bridges, the tracks of the single larvæ. On these tracks, marked by a slimy substance, the larvæ glided rapidly, like on a rail, forwards und backwards. When disturbed, they immediately backed and disappeared in their hollows. Sometimes they turned round without leaving the track, by doubling the body and sliding the head towards the anus. A short time before transforming, the larvæ left their webs and crawled away in different directions. Their slimy tracks remained visible on the ground even when dry The pupæ were located in the corners of the box, and protected by a dense web, consisting of several layers; the first enclosed the pupa, the others connected both sides of the corners. The pupa-state lasted only a few days, and the imago was excluded fourteen days after I had first noticed the larvæ. The males appeared first, soon afterwards the females. (Dufour's larva did not spin a cocoon.)

It is curious that the larvæ of *Sciophila* appeared only after the transformation of the *Mycetophilæ* was entirely completed; for two or three weeks the eggs of the former remained apparently dormant among the bustle of so numerous larvæ of the other species. This association of the two insects seems to be of frequent occurrence. L. Dufour obtained *Sciophila melanocephala* n. sp., together with *Mycetophila hilaris* n. sp., from *Fistulina hepatica*. Perris found larvæ of *Sciophila* together with the remarkable larva of *Myc. scatophora*, and if Bremi mistook the latter larva for that of *Sciophila*,

his error had very probably the same foundation as that of Mr. Van Roser,—the promiscuity of the two larvæ.

The larva of S. *limbatella* is about half an inch long, very narrow, snake-like, pellucid, yellowish, with some slightly darker spots; the head is yellowish, the margin of its excision brownish. The details of its structure have already been given. It is strange that neither Dufour nor Perris mention the palpi of these larvæ. The latter says explicitly: "no antennæ, no palpi, no mandibles." Likewise, Perris did not discern any organs of locomotion; "not the slightest bristle, nor hair."

Leja.

The habits of these larvæ, as far as known, are similar to those of *Sciophila*. Van Roser (Verz. Würt. Dipt.) says of *Leja fasciola* Meig., "the transparent, smooth and slimy larva lives in delicate webs on the surface of tree-fungi."

In September, 1860, I found (in Virginia) under the bark of a felled and decaying tree, a full-grown, white larva, living on a similar web, and which may be a Leja, as several specimens of the perfect insect of this genus were concealed under the same bark, in the vicinity of the larvæ. Some peculiarities in the structure of the trophi of these larvæ have been noticed above.

Ceroplatus.

Reaumur's, Bosc's, Dufour's and Wahlberg's observations on these larvæ, prove that their habits have much analogy with those of the two preceeding genera. They live on the underside of the pileus of treefungi, where they spin a transparent tent. The larva leaves this tent before transforming, and spins a cocoon for the pupa somewhere in the vicinity. The cocoon, like that of many *Mycetophilidæ*, is truncate at one end, and, according to Wahlberg, closed with a lid.

Dufour, in speaking of the larva, mentions a pair of large *eyes*. What he took for them was probably nothing but the rudimentary antennæ, like those of *Mycetophila* and *Sciara*, already described. In all respects, the structure of the mouth seems to be like that of the other larvæ of the family, except two tubes, used for spinning, and inserted one on each side, between the root of the mandibles

and the maxillæ (see above, *Under lip*). An interesting observation is that of Wahlberg, on the phosphorescence of the larvæ, and, in a still higher degree, of the pupa; the latter shine through the cocoon as through a lantern.

As Bosc's observation was made on an American species, *Ceroplatus carbonarius* Bosc, from Carolina, we may reproduce here what he says about it (extracted from the article *Ceroplatus* in *Dict. classique d'histoire naturelle*, Vol. III., p. 403. 1823). "This larva is "vermiform white, slimy, with a black head, distinct segments,*) and "tuberculiform organs of progression. It lives on a species of *Boletus* "very like *B. unicolor* Bulliard, and is gregarious. It appears in "June, and completes its growth in August; then it is about $2^1/_2$ inches "long, and about $^1/_4$ of an inch in diameter. During the whole period "of this growth, but especially towards its close, these larvæ spin in "common a loose web of a shining white, in the tissue of which they "abscond when disturbed. They are so delicate that a mere touch "crushes them. When left dry, they soon perish. About the time of "their transformation they spin a cocoon, which is more dense than "their web, although loose enough to allow the pupa to be seen "through it."

Sciara.

The localities where the larvæ are found are indicated above, and some more statements will be found below, under the head of the references. They are whitish, sometimes yellowish and more slender, and their skin is more delicate than that of the larvæ of *Mycetophila*, whom they otherwise resemble. They may be further distinguished by the structure of the trophi, and most of them seem to have no bristles or spines on the locomotive processes on the under side of the body, whereas the majority of the *Mycetophilæ* have them. They are even more gregarious than the other larvæ of this family, and have the singular propensity of sticking together in dense patches, in which situation they are frequently found, for instance, under the bark of trees. It is probably to the same propensity that the phenomenon, known in Germany under the name of *army worm* (Heerwurm), is due. This is a procession of larvæ, sometimes from 12

*) The statement of *distinct segments* does not seem to agree with Dufour's description and figure of the leech-like appearance of the larva.

to 14 feet long, and two or three inches broad, consisting of numberless specimens, sticking closely together and forming a layer of about half an inch thickness. Such processions have been often observed in the woods in Germany, Sweden and Russia, but never sufficiently investigated to explain their object. That the larvæ do not migrate in search of food, we can infer from the fact that they appear to be full-grown when they form these processions. (I have not seen the last pamphlet on this subject, by Mr. Hohmann, published in 1857. I believe, however, that it contains nothing new, as Dr. Gerstäcker, in his Annual Report on the Progress of Entomology, for 1858, merely mentions its publication, without giving any extract.)

Another remarkable fact with relation to the habits of *Sciara*, has been discovered by Mr. Winnertz, and published afterwards by Mr. Loew. The larva of *Sc. tilicola* Lw., produces a *gall* on the leaves of young linden trees, in shady, sheltered situations. The lemon-yellow larva, capable of leaping, like the cheese-maggot, lives in numbers in the stem, generally near the origin of the last or of the two last leaves. Each of them has a hollow of its own, and produces a swelling of the size of a pea, which it abandons before the transformation. [Compare however p. 27, below.]

The following additional account is given on the habits of *Sciara fuscipes* Meig., by Heeger: — "The females lay their eggs in decaying fungi or vegetable mould; the eggs form short strings, from 6 to 10 in succession. If the weather is favorable and the temperature moderate, the larvæ are excluded in 8 or 10 days; they shed their skin three times, at irregular intervals, depending on conditions of heat and moisture. Before undergoing the pupa-state they form near the surface of the soil a little barrel-shaped case, out of which the pupa extricates itself in part, before the exclusion of the perfect insect."

"The shedding of skin and the transformations generally take place in the morning; the copulation more frequently in the evening."

We have mentioned already, that the pupa of *Sciara* is sometimes enclosed in a cocoon, sometimes not, and that, in some species, the bases of the antennæ are expanded into a pair of pointed teeth, and the prothoracic stigmata assume the shape of horns*).

*) I may be allowed to describe here a remarkable *Sciara*, distinguished from the other species of the family by the form of the fork on the wings,

About the habits of *Platyura*, *Asindulum*, *Plesiastina* and some other genera, see *References* at the end. Nothing is as yet known about the structure of their larvæ; and it is not at all impossible that some of them belong, like those of *Mycetobia* (see page 1), to a totally different type of organization.

and which I reared from larvæ and pupæ found in dry cow-dung, near Washington, in April, 1861.

Sciara toxoneura n. sp.—Nigra, antennis, ore, palpisque nigris, thorace nigro, polito, coxis anticis flavescentibus; alis ♂ subhyalinis, ♀ nigrescentibus; ramo superiore furcæ alarum valde arcuato, ventricoso; long. 0.12—0.15. inch.

Head, mouth and palpi black; antennæ black, covered with a short, dense pubescence; no verticils, nor any longer hairs; joints cylindrical, connected by very short pedicels; front, vertex and thorax black, shining; pleuræ velvety-black; halteres blackish; feet pale, with a blackish tinge; a darker spot on the knees; tarsi also darker; coxæ pale or yellowish, basis black; tibiæ with a pair of short, yellow spurs at tip; abdomen black; the connecting skin between the segments, when distended, especially on the last segment of the female, yellow; wings (♂) almost hyaline, (♀) tinged with inky black, hyaline at base; the anterior branch of the fork, being very arcuated at the basis, forms a knee; its latter half is straight; posterior branch only slightly curved; the cross-vein, connecting the first and second longitudinal veins is a little anterior to the middle of the distance between the tip of the first longitudinal vein and the origin of the petiole of the fork.

This species somewhat resembles *Zygoneura* in the form of the fork, but is distinct on account of the structure of its antennæ. [In my Catalogue of N. A. Diptera 1878 I placed this species in the genus *Zygoneura* nevertheless.]

Larva. Head black, hind margin somewhat produced and emarginate in the middle; occipital lines convergent (very faint); on the under side it has two horny stripes, connecting the edges of the horny shell; body white, anal segment somewhat coarctate in the middle.

Pupa yellowish; head, thorax and wings become blackish before the exclusion of the perfect insect; basis of the antennæ and thoracic spiracles as mentioned above (see figure 22).

REFERENCES*).

MYCETOPHILA.

Dufour (Léon). Mémoire sur les métamorphoses de plusieurs larves fungivores, appartenant à des diptères. (Annales des Sciences Naturelles, 2e série, Vol. XII, 1839, pp. 5—60; tab. I—III.) Second Mémoire (l. c. Vol. XIII, 1840, page 148—163; tab. III.) This is an elaborate and most important paper on the natural history and anatomy not only of the larvæ of *Mycetophilidæ*, but also of other families of fungivorous diptera, illustrated by numerous figures. Besides a general introduction, the part of which referring to *Mycetophilidæ* has been reviewed above, the following species of this family are mentioned:—

Mycetophila amabilis Duf. (Syn. *M. praecusta* Meig?), *M. hilaris* Duf. (syn. *M. arcuata* Meig?), *M. modesta* Duf. (related to *M. brunnea* Macq.) *M. inermis* Duf., *Cordyla crassipalpa* Macq., *Sciara ingenua* Duf., *Bolitophila fusca* Meig. (under the name of *Macrocera hybrida* Meig.). Larvæ and pupæ of all these species are described, and a part of them figured.

Bouché, Naturgeschichte der Insecten, Berlin, 1834, p. 37, sqq. *M. signata* (Tab. III, figs. 5—9, l. p. and details); *M. nigra*. Descriptions short; that of the structure of the mouth of the larvæ is not correct.

*) All these references have been compared, except a few marked with an asterisk; *n. e.* (nothing else) at the bottom of a reference, means that it contains nothing but what is stated about it: *l.*, *p.*, *i.* are *larva*, *pupa*, *imago*. The titles of works and papers are given in full, when mentioned for the first time: afterwards, in abbreviation.

Heeger (Ernst), *Beiträge zur Naturgeschichte der Insecten*, in the Sitzungsber. d. Wien. Acad., Vol. VII, 1851, p. 394. Tab. XI, (l. p. i.) *M. lunata* M.

This paper is a puzzle to me; it is very detailed; the figures are prepared with great care; and still statements and figures are totally at variance with what is known about other larvæ of *Mycetophila* and even about larvæ of species closely related to *M. lunata*. The stigmata are said to be nine, on nine consecutive segments of the body, except the two first; the locomotive swellings, with their bristles, are described and figured as being *on the back* of the larva, etc.! It seems evident that the back has been taken for the venter, and *vice versa*.

Van Roser, Verzeichniss Württembergischer Diptern. In the *Correspondenzblatt d. Württ. Landwirthsch. Vereins*, 1834. *M. hydni* n. sp. (undescribed). "The yellow larva," says the author, "lives in *Hydnum repandum*, in galleries which it spins over; its shape is different from the larvæ of the same genus." (n. e.) [The l. is probably that of *Sciophila*.]

Perris, Notice sur quelques diptères nouveaux, Ann. Soc. Entom. de France, 1ère Série, Vol. VIII., 1839, p. 47. Tab. V., figs. 1—3. *M. lycogalæ* n. sp. Pupa found in *Lycogala miniata*; larva unknown; imago described.

— Notes pour servir a l'histoire des métam. de diverses esp. de diptères, Ann. Soc. Entom. de France, 1849, p. 51. Tab. III. No. 1. (l. p. i. and details.) *M. scatophora* n. sp. (extract given above, p. 12).

Bremi, Beitrag z. Kunde d. Diptern insbes. über das Vorkommen mehrerer Gatt. nach besond. Localitäten und Fang derselben; auch über die Lebensweise mehrerer Larven. Isis 1846, p. 164. *M. lutea* and *M. lunata* obtained from *Agaricus citrinus* (n. e.).

Scholz, Ueber den Aufenth. d. Dipteren während ihrer ersten Stände. Schles. Entom. Zeit. 1819. *M. pallida* Stann. and *M. luctuosa* Meig., reared from *Boletus bulbosus*. (n. e.)

Stannius, Bemerkungen über einige Arten Zweiflügl. Gattungen: Macrocera, Platyura, Sciophila, Leja und Mycetophila, Isis 1830. *M. signata* reared from *Boletus edulis*, and found especially in pine woods. (n. e. The paper contains synonymical remarks, descriptions, etc.)

Boie, Zur Verwandlungsgeschichte inländischer Zweiflügler. Kröjers Tidskr. II., p. 234, 1838. *M. signata*; a few words, only.

Degeer, Mémoires, Vol. VI., p. 361 [Germ. edit. p. 142], 14. Tab. XXII., figs. 1—13 (l. p. i.) The figures are good, and represent a larva with distinct antennæ; this makes me doubt whether Meigen (Europ. Zweifl. I. p. 266) was right in referring them to *M. fusca*. Although the figure of the perfect insect is undoubtedly a *Mycetophila*, Degeer's letterpress shows that he could not be very certain whether it was really reared from the larva which he figured.

CORDYLA.

Dufour, l. c. (See *Mycetophila*.)

Réaumur, Mémoires pour servir a l'histoire des insectes, Vol. IV., p. 181, Tab. XIII., figs. 9—11 (l. above and below magnif., and nat. size). In the letterpress a few words, only. Dufour refers it here.

BOLITOPHILA.

Guérin, Mémoire sur un insecte du genre *Bolitophila*. Annales des Sciences Naturelles, 1ère série, 1827, Vol. X., p. 399—411, Tab. XVIII., figs. 1—13 (l. p. i. and details); see, also, extract in Isis 1834, p. 926. The figure of the perfect insect, given as that of *B. cinerea*, undoubtedly belongs to this genus. As to the larva, however, some mistake must have been committed, as it cannot be the larva of *Bolitophila*. Guèrin's larva had two anal stigmata, placed between four moveable lobes, and no lateral stigmata; it belonged, therefore, probably to the *Tipulidæ*. It was found in a fungus.

Dufour, l. c. (see *Mycetophila*) Tab. I, figs. 9—15 (l. p. and details). *Bol. fusca* is described here under the name of *Macrocera hybrida* Meig. (its old name in Meigen's earlier work).

[Heeger, Sitzungsber. d. Wien. Acad. d. Wiss. 1853; XI, p. 24. Larva of a *Bolitophila* mistaken for that of *Limnobia platyptera* Macq.]

LEJA.

Van Roser, Verg. Württ. Dipt. *Leja fasciola* Meig. (Nothing but what is given above, p. 15, under the head of *Leja*.)

SCIOPHILA.

Degeer, l. c. Vol. VI., p. 367 (p. 143 Germ. edit.); Tab. 21, figs. 6—13. Although the figures are not very good, it is evidently either *Sciophila*, as Perris thinks or a *Leja*.

Dufour, Hist. des Métamorph. de *Sciophila striata*, Mém. de la Soc. de Lille, 1841, p. 201—206 (figures of l. p. and i). Agrees with my own observations, except some differences already noticed.

Id. l. c. Ann. Sc. Nat., 2e série, Vol. XII. (1839); he obtained *Sc. melanocephala* n. sp., together with a *Mycetophila*, from *Fistulina hepatica*; no other details given, as he did not see the larva.

Van Roser, Verz. Württemb. Dipt. (1834) *Sciophila marginata*; nothing besides the error, corrected above (see p. 13).

Bremi, l. c. Isis, 1846. He gives a short description of sheath-bearing larvæ, which leaves no doubt of their identity with the l. of *Mycetophila scatophora* Perris; he erroneously takes them for the larvæ of a *Sciophila* which he calls *S. cellaria* n. sp.

Perris, l. c. Ann. Soc. Entom. 2e série, Vol. VII., 1849, p. 331, Tab. IX, No. 6 (l. and details). *Sc. unimaculata* Macq. and a few words on *Sc. striata* Meig. Some differences from my own observations have been noticed above (see p. 15).

CEROPLATUS.

Réaumur, Mémoires, Vol. V., p. 23, Tab. IV., fig. 11—18 (l. p. i. and details). Detailed and correct account of the transformations and habits. Dufour calls the species *Ceroplatus Reaumurii* n. sp.

Dufour, Révision et monographie de genre *Ceroplatus;* Ann. des Sc. Natur. 2e série, Vol. XI., 1839, p. 193. Tab. V., fig. 8—25. Five species of the genus are described, and a detailed account on the transformations of one of them, *C. tipuloïdes* Bosc, given, with anatomical details (l. c. fig. 21—25, l. p. and details).

Bosc, quoted in Dict. d'Hist. Natur. Vol. III., 1823, p. 403, in an article of Audouin on *Ceroplatus*; a translation of the passage on *Cer. carbonarius* from Carolina has been given by me above. (See *Ceroplatus*, p. 16.) A figure of this larva is to be found in a previous (second) edition of the Dict. d'Hist. Natur., Tab. B, 21, fig. 4, but I have not seen it. Bosc's article on *Cer. tipuloïdes* in the Actes de la Soc. d'Hist. Nat. de Paris, T. I., p. 42, 1792, merely refers to the perfect insect.

Wahlberg, Acta Holm. 1838 and 1848. The latter article is translated in the Stett. Entom. Zeit., 1849, p. 120—123, under the title: *Merkwürdiger Instinct und Lichtentwickelung bei einer Schwedischen Mücken-Art.* The species is *Ceropl. sesioides* Wahlb., found on *Polyporus fomentarius.* The transformation and habits are described, and an account of the phosphorescence of larvæ and pupæ given.

SCIARA.

Bouché, Naturg. p. 38, Tab. III., fig. 10—13 (l. p.). *Sc. vitripennis* Meig. In decayed oak-twigs. Descr. of l. p.

— ibid. p. 39, Tab. III., fig. 14 (last segment of the pupa). *Sc. nitidicollis* Meig., under the bark of decaying stumps, under ground. Descr. of l. p.

— ibid. p. 40, Tab. III, fig. 15 (last segm. of the pupa). *Sc. pruinosa* Bouché. In decaying vegetable matter. Descr. of l. p. i.

— ibid., p. 40. *Sc. elongata* Bouché. Under the bark of decaying pines. Descr. of l. p. i.

Dufour, l. c., Ann. Sc. natur., 2e série, XIIe. Vol. Tab. I., fig. 23—29 (l. p.). *Sc. ingenua* Dufour; in fungi. Descr. of l. p. i.

Heeger, Beiträge, etc., Sitzb. d. Wien. Acad. XI., p. 27. Tab. II., (l. p. and details.) *S. fuscipes* M. Under-ground, among decaying vegetable matter. Detailed description of the l. p. and i., with an account of the habits. (Extract given above p. 17.)

Curtis, Journ. Roy. Agric. Soc., X., p. 101. Tab. V. *S. quinquelineata* Macq., bred from rotten potatoes which were covered with slimy threads spun by the larva. No other details given. The plate gives an indistinct figure of l. and p.

— Gardener's Chronicle for 1845, p. 784 (with figure of l. and p). *Sciara fucata* M., (? or *S. pruinosa* Bouché). Short description; figures not remarkable.

— Farm-Insects: being the nat. history and economy of the insects injurious to field-crops in Gr. Britain and Ireland, 1860. One vol. with plates. Reproduces on p. 460, the remarks of the two former articles on *Sc. fucata* M. (l. p. i. figured), *Sc. quinquelineata* Macq. and *Sc. pulicaria* M?, all reared from rotten potatoes. Nothing of importance for the knowledge of the transformations.

Gimmerthal, Beobachtungen über einige, in krankhaft faulenden

Kartoffeln gefundene Acarier und Diptern-Larven. Arb. d. Rigaer Naturf. Ver. I., p. 325. Tab. III., fig. 3 (l. p.). *S. vittata* Meig., bred from rotten potatoes. Descript. and figures of l. and p. Nothing new. *Sc. longipes* found in the same situations.

Loew, Dipt. Beiträge, fasc. 4th, p. 18. 1850. *S. tilicola* Lw., producing a gall (see above p. 17). *S. morio* M., in the stalks of *Arctium*; no other details given.

— Zur Verwandlungsgesch. einiger Dipteren aus d. Abth. d. *Nemoceren* und über ihre Stellung im Systeme. Stettiner Entom. Zeit., 1843, p. 27. Considerations on the natural affinities of *Sciara;* its pupa, compared to that of *Lasioptera.* (The figures of both pupæ belonging to this paper are to be found in the same journal for 1841, Tab. I., fig. 11—14.)

Meigen, Europ. Zweifl. I., p. 223, obtained *Sc. hyalipennis* from flowerpots. (n. e.)

Kollar (in Rossi's Dipt. Austriaca), p. 6, reared the same species from rotten potatoes. (n. e.)

(Compare, also, Kollar's work on noxious insects.)

— (quoted by Bremi, l. c. Isis, 1846), reared *Sc. Schmidbergii* Kollar, from young pears. (n. e.)

Schilling, Uebers. d. Arb. d. Schl. Naturf. Gesellsch. 1831, p. 74. *Sc. albifrons*, reared from yellow l. and p. found in the stalks of *Angelica sylvestris* (n. e.)

Drewsen, Stett. Entom. Z., 1847, p. 210, found larvæ of *Sciara*, (which he did not succeed in rearing) in the nest of a humble bee, on which *Mutilla* was a parasite. (n. e.)

* Olivier, Premier mémoire sur qlq. insectes qui attaquent les céréales 1813, fig. 7—9. Three *Sciaræ* obtained from wheat.

Frisch, Beschreibung von allerlei Insecten in Deutschland, IV., p. 37. Tab. 20, (l. p.) 1722, is probably the oldest observer of the transformations of *Sciara.* The figures are rough, but certainly belong here.

The references about the *Sciara* of the *army worm* (Heerwurm), are to be found in the pamphlet: Der Heerwurm, sein Erscheinen, seine Geschichte und seine Poesie, von L. Bechstein, Nürnberg, 1851. See, also, Boheman Zoolog., Arsberättelse, 1845—46, p. 21—23; Berthold, Abh. d. Kön. Ges. d. Wiss. zu Göttingen, 1854; Hohman,

Der Heerwurm, Progr. Realsch. Tilsit, 1857; *Lorez, Vierteljahrsschr. Naturf. Gesellsch. Zurich, 1857, II., p. 88 seq.

Other genera of MYCETOPHILIDÆ.

DITOMYIA FASCIATA Meig. In *Boletus versicolor* Meig. I., p. 230. (n. e.) In *Polyporus* Winnertz, Stett. Ent. Zeit., 1846, p. 15. (n. e.)

— MACROPTERA Wz. In *Polyporus igniarius* Winnertz, Stett. Entom. Zeit., 1852, p. 55. (n. e.)

PLESIASTINA BOLETI Kalt. In *Boletus versicolor* Annals of Nat. Hist., 2d series, II., p. 74, 1848.

— APICALIS Wz. Reared from a rotten trunk of Carpinus betulus, Winnertz. Stett. Ent. Z., 1852, p. 56. (n. e.)

PLATYURA MARGINATA Meig. In fungi, Meig., Vol. I., p. 232. (n. e.)

— LATICORNIS Meig. On a tree-fungus. Verh. Schles. Gesellsch. 1837, p. 106.

ASINDULUM FLAVUM Wz. Reared from rotten wood, Winnertz, Stett. Entom. Zeit., 1846, p. 18. (n. e.)

TETRAGONEURA HIRTA Wz. Rotten wood, fungi. Winnerts, Stett. Entom. Z., 1846. (n. e.)

[For completeness' sake I add some references from the Jahresberichte d. Schles. Ges. etc., omitted in the above list. The two first I have not verified; the others have no importance.

1826, p. 23. HARTLIEB, on the metam. of *Mycetophila*.

1828, p. 75. SCHILLING, *Bolit. fusca* and *Sciara*.

1836, p. 86. id., *Mycetophilæ* in fungi.

1850, p. 84. SIEBOLD, Occurrence of *Sciara*-army-worm.

1856, p. 119. PANNEWITZ, Same subject and production of larvæ.]

POSTSCRIPT.

Concerning the literature on the early stages of Mycetophilidæ since 1862.

An indispensable supplement to my publication of 1862 must find its place here. At that time I did not have access to the papers of Berthold (1854) and Hohmann (1857) on the *Sciara*-army-worm. I find now that both contain a very good account accompanied with figures of the mouth-parts of the larva of *Sciara;* Berthold also gives an account of the internal anatomy of the larva. Neither of them, however, recognised as a palpus the protuberance within the circular excision of the maxilla.

In the matter of generalities, about structure and anatomy hardly anything has been added to our knowledge since 1862. Winnertz in his painstaking and elaborate monograph of the Mycetophilidæ (Verh. Zool. Bot. Ges. 1863) has very little about the larvæ. In his introductory chapter "On the early stages of Mycetophilidæ" (l. c. p. 640), all he has to say about their parts of the mouth is this: "they consist of short palpi, which seem often to be wanting; in some species small mandibles are present."

Dr. F. Brauer published an important paper on the larvæ of Diptera (Denkschr. der Mat. Nat. Klasse der Kais. Acad. der Wiss. Wien 1883). The characters of the larvæ of the Mycetophilidæ however are given in very general terms only. A complete review of the literature on the subject is given in the form of a catalogue of species. I refer to it for some references of minor importance, omitted by me.

The special papers on the subject will be found below, arranged under the headings of the different genera.

SCIARA.

Laboulbène, Dr. Alex. Description du *Sciara Bigoti*, de sa larve et de sa nymphe. (Ann. Soc. Ent. Fr. 1863, p. 105—110; av. fig.)

Perris, Ed., Histoire des insectes du pin maritime (Ann. Soc. Ent. Fr. 1870, p. 154—162) contains descriptions of several larvæ of Sciara, with figures.

Compare also, by the same author, l. c. 1876, p. 179, on *Sciara* obtained from moss and earth.

Weyenbergh, Dr. H., Varia entomologica (Tijdschr. voor Entomol. XVII, 1874, p. 5 (of the separate copy) contains a short notice on some larvæ of Sciara.

Cameron, P., Proc. Nat. Hist. Soc. Glasgow, II, p. 298; 1876. Sciara sp. parasitic on *Nematus*-larvæ. (I find it thus quoted in the Zool. Record 1876, Ins. p. 193.)

Gercke, G., Verh. d. Ver. für Naturw. Unterhaltung, Vol. VI, 1880; a short notice on the larvæ of *Sciara intermedia* Heyd., and *Sc. Giraudii* Egger; the latter bred from stems of plants (Malva, Althæa) where they lived with larvæ of *Apion*.

Comstock (Report on noxious Insects for 1881) bred a Sciara from a gall on *Acer rubrum* which I had described as the produce of a Cecidomyia. Professor Mik (Verh. Zool. Bot. Ges. 1883, p. 190—192) has shown since that the larva, figured by Mr. Comstock is that of a Cecidomyia, and that the *Sciara* obtained must have originated from some other larva, contained in the earth which had been used for keeping the galls. He is even inclined to throw some doubt on Winnertz's and Loew's observation of the gall-producing *Sciara tilicola* (see above, p. 17). Larvæ of Sciara may have been introduced accidentally, during such experiments, or they may be mere inquilines in other galls; of which some instances are quoted. I entirely agree with Mr. Mik.

Beling, Th., Beitrag zur Metamorphose der Zweiflügler-Gattung *Sciara* Meig. (Wiener Entomol. Zeitung 1886, p. 11—14, 71—74, 93—96, 129—134.) — Descriptions of *twenty four* species of larvæ and pupæ of Sciara.

— Zur Metam. d. Dipteren-Art *Zygoneura sciarina* (Wien. Ent. Z. 1885, p. 308).

The life-history of the *Sciara-army-worm (Heerwurm* of the germans) has been fully cleared up in two important papers by competent entomologists:

Nowicki, Dr. Max, Der Kopaliner Heerwurm und die aus ihm hervorgehende *Sciara militaris* n. sp. Brünn 1868 (Reprinted from Verh. Naturf. Ver. in Brünn, Vol. VI, 1868).

Beling, Th., Der Heerwurm, die Heerwurmsmücke und die Thomas-Trauermücke. (Zeitschr. f. die ges. Naturw. Vol. 46, 1883, p. 253—271.) — Previous to this article, Mr. Beling published several popular articles on the same subject in the "Der Zoologische Garten, Frankfort a. M., 1868, 69, 71 and 79 and in the Stett. Ent. Z. 1872, p. 322—328).

The general result reached is that it is not the larva of *Sciara Thomæ*, as was formerly believed, which produces the phenomenon, but that of *Sciara militaris* Now. In one case only, among the numerous cases observed, the larva belonged to a different species, *Sciara gregaria* Bel. Verh. Zool.-Bot. Ges. 1872, p. 53. The object of the migrations is search for better feeding-grounds.

Cope, E. D. Proc. Ac. Nat. Sc. Philad. 1867, p. 222 published his observations on the appearance of the *Sciara*-army-worm in Pennsylvania.

About the article by R. Kohaus on *Sciara militaris* see Prof. Mik's account in the Wien. Ent. Z. 1883, p. 205.

MYCETOPHILA.

Brauer, Dr. Fr., in the above-quoted paper on the early stages of Diptera (Denkschr. etc., Wien 1883) mentions a larva of a *Mycetophila* discovered by Dr. Fritz Müller in Blumenau in Brazil, on the leaves of *Casearia*. The larva carries on its back a kind of protecting shield, formed of its own excrements in the shape of an *Ancylus*-shell. This habit is analogous to that of *Mycet. scatophora* Perris, already referred to (p. 12).

SCIOPHILA.

Perris, Hist. des Ins. du Pin maritime (Ann. Soc. Ent. Fr. 1870, p. 146).

Description of the larva and habits of *Sciophila striata* Meig. with figures. The author, long after having prepared his descriptions, had occasion to see my paper on the larvæ of Mycetophilidæ. Concerning my observations on *Sciophila limbatella*, he says: "J'ai éprouvé un véritable bonheur à me trouver d'accord avec lui sur tous les points etc."

The same author, in the Ann. Soc. Ent. 1875, p. 190 mentions another *Sciophila* which he found among the characteristic silk-webs on the under-surface of a fungus.

Girschner, Ernst, Die ersten Stände einiger Dipteren (Katter's Entom. Nachr. 1883, p. 204).

Short notice on the larvæ of Scioph. *punctata* M.; *fasciata* Zett, and *Lasiosoma pilosa*. The facts agree with those previously known.

Dale, C. W., Economy and parasite of a Mycetophilid (The Entomologist, Vol. XIV, p. 92, 1881).

Lasiosoma lutea bred from a Boletus; its parasite is Orthocentrus corrugator; the pupæ were buried in silkwebs, like the other Sciophilæ.

BOLETINA.

Beling, Th., Larva and pupa of *Boletina nigricoxa*, Stäg., described in Wiegm. Archiv etc. 1875, p. 56. They were found among decaying leaves in a forest of deciduous trees.

MYCETOBIA.

For completeness' sake I give the references about the larvæ of this genus, which I had purposely omitted in my paper (see p. 3).

Perris, Ins. du Pin maritime (Ann. Soc. Ent. Fr. 1870). On p. 186 description of the larva and pupa of *Mycetobia pallipes* Meig., with figures (Tab. 2, f. 47—53). — The author corrects and explains some of the statements of Lyonnet, Mém. posth. p. 186, Tab. 17, f. 20. 22. 23. 26—28. 31—33 and Dufour, Ann. S. E. Fr. 1849, p. 195, Tab. XII, Nr. III with whom he otherwise agrees.

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EXPLANATION OF THE PLATE.

FIG. 1. Head of *Mycetophila signata* (larva), from below; *a*, antennæ, *d*, labrum; *m*, ocelli; *k* mandibles; *x*, cardinal pieces of maxillæ; *h* inner, coriaceous piece of the maxilla; *i*, round excision in the external, horny piece of the same, through which protrudes the rudimentary palpus.

FIG. 2. The same head, from above; *a* and *d* the same as in the preceding figure; *c*, horny frame of the labrum; *b*, epistoma; *t*, emargination of the occiput; *g*, notches on both sides of the occiput; *f*, occipital lines.

FIG. 3. Head of *Sciara* (larva) from below; *h*, maxillæ; *d*, *k*, *x*, as in figure 1; *t'*, horny stripes, connecting both edges of the shell of the head; *y*, labium.

FIG. 4. The same head from above; *a*, *d*, *c*. *t*, *g*, *f* as in figures 1 and 2.

FIG. 5. The same head from below, the maxillæ being removed, to show the position of the mandibles *k; t'* as in figure 3.

FIG. 6. Head of *Sciophila limbatella* Zett. (larva); *a*, *d*, *f* as in the previous figures.

FIG. 7. The same head from below; *i* palpi, developed in this genus; *y* labium; *t'* suture of the horny shell of the head; *d*, *k*, *x* as in figure 1.

FIG. 8. Head of a larva analogous to the preceding, perhaps that of *Leja*, from below. *x* and *t'* as in figure 7.

FIG. 9. Head of *Bolitophila cinerea* (larva) from above; *a*, *d*, *f* as in figures 1 and 2; *b* small pellucid spots, peculiar to these larvæ (not the ocelli, which are more on the side of the head).

FIG. 10. Three lines, showing the different emarginations of the occipital margin of the head.

FIG. 11. Mouth of *Mycetophila* (larva), from the side, to show the relative position of the parts; *d*, *k*, *h*, *a*, *m* as in figure 1; *r* and *s* are the two points of attachment of the mandibles.

FIG. 12. Sketch, indicating the openings in the horny shell of the head, as well as the intervals between the trophi, which are visible when the head is viewed in the direction of the axis of the body. *d*, *a*, *m* as in figure 1; *k**, interval between the root of the mandible and the shell of the head; *n**, intervals between the maxillæ.

FIG. 13. Labrum of the larva of *Mycetophila signata; c*, its horny frame, ciliated on the inside at the tip; *d* fleshy portion.

FIG. 14. Labium of one of the larvæ.

FIG. 15. Mandible of *Mycetophila signata; r* and *s*, points of attachment; *q*, denticulations on the edge of the stouter part of the lamel.

FIG. 16. Mandible of *Sciara* (larva).

FIG. 17. " " of *Sciophila* (larva).

FIG. 18. Maxillæ of *Sciara* (larva); *z*, cultriform, coriaceous, serrated inner lobe; *d'* horny external piece, with the excision *i*, through which protrudes the rudimentary palpus; the small horny ring upon it may be indicative of a second joint; *x*, cardinal piece; *o*, horny pieces, connecting the upper and lower parts of the maxillæ, and serving as point of attachment to the muscular fibres.

FIG. 19. Maxilla of *Bolitophila* (larva); *o*, *d'*, *i* and *z* as in the preceding figures.

FIG. 20. *Ceroplatus* (larva), copy from Dufour, reduced.

FIG. 21. *Bolitophila* (larva), magnified and natural size (indicated by a line).

FIG. 22. Pupa of *Sciara toxoneura* O. S.