

ANNOUNCEMENT OF FURTHER RESULTS SECURED IN THE STUDY OF MUSCOID FLIES.

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The work on the female reproductive system, eggs, and first-stage maggots of the Tachinid flies and their allies, begun in 1908 by the writer at the Gipsy Moth Parasite Laboratory in Massachusetts, under the direction of Dr. L. O. Howard, Chief of the Bureau of Entomology, has been prosecuted to date as time permitted. The results are now such that it becomes desirable to make an announcement of them in brief. This announcement is in advance of a series of much more complete papers, which will contain plates of the female reproductive and accessory organs, eggs, first-stage maggots, and cephalopharyngeal skeletons of the latter, some 200 drawings having already been completed for this purpose.

The female reproductive and accessory organs in the Muscoid flies consist of (1) ovaries, (2) oviducts and common oviduct, (3) spermathecae and their ducts—3 in number, (4) tubular (or colleterial or accessory) glands and their ducts—2 in number, (5) uterus when present, including what may be termed the preuterus which is present in some forms, (6) uterovagina, being a vagina proper which functions anteriorly as a true uterus when latter is absent, and (7) ovipositor or larvipositor and appendages.

The functions of most of the above organs are generally understood, but the following points need mention:

The tubular glands function as secretory organs for the production of the viscid fluid for coating the eggs, and are more or less rudimentary in those forms that deposit maggots; the preuterus is a small sac at the head of the uterus, in which the egg of some forms is fertilized before passing into the uterus proper, the spermathecal ducts opening into it; the uterovagina is a short tube homologous with the so-called insect vagina, its anterior portion filling the office of uterus in those forms without distinct uterus, the spermathecal and tubular gland ducts opening therein, its posterior end filling the office of vagina. The openings of the spermathecal ducts always mark the transition from common oviduct to functional uterus.

The results so far secured in the present work indicate at least 37 distinct series in the Muscoid flies (exclusive of Anthomyiidae and Acalyptratae), based mainly on the characters of the reproductive and accessory organs of the female fly, the egg, first-stage maggot, and in some cases the facial plate and other characters of the external anatomy of the adult. Undoubtedly further work will demonstrate the existence of further series demanding recognition. Briefly the series so far recognized may be tabulated as follows:

1. TRICHOPODINE series—*Xanthomelanodes peruanus* n. sp. (Peru) dissected and drawn, TD 3983. No uterus, uterovagina short and broad, tubular glands short and thick, spermathecal ducts very long and spermathecae attached in hood, oviducts of moderate length and thickness, ten egg tubes in each ovary in the above species, eggs flattened and pink-salmon to flesh-brown in color when mature. The chorion of egg is beautifully honey-comb reticulate. *Xanthomelanodes* and allies. *Trichopoda* and allies, many of which have been dissected, have same eggs and ovaries, and almost certainly the same type of reproductive system.

2. RUTILINE series—*Rutelia* sp. and *Amphibolia* sp. (Australia) dissected, TD 1864, 1866. Uterus present, but its character not yet known. Maggots long and slender, hairy or furnished with hairs at anal end. *Rutelia* maggot has anal hairs, *Amphibolia* maggot is thinly hairy on body. *Rutelia*, *Amphibolia* and allies—Australian flies, most of rather large size. These will probably need division into several series.

3. PHASIINE series—Uterus present, form not known. Egg very elongate, slender, TD 480 (South Carolina), near *Alophora*, has what seems a piercing larvipositor or ovipositor, but curved in the opposite direction from that of *Compsilura* and not so sharp apically. *Phasia*, *Alophora*, *Hyalomyia* and allies, but these have yet to be studied.

4. GRAPHOGASTERINE series—*Hyalomyodes* sp. (South Carolina) dissected, TD 481. Uterus present, eggs and maggots slender. *Hyalomyodes* and allies, and probably *Anurogyna*.

5. GLOSSININE series—Functional uterus, whether uterus proper or uterovagina, greatly enlarged to hold the maggot until fully grown and ready to pupate, some special provision being evidently present for the feeding of the maggot during

its three stages. A most remarkable and distinct type, in any event, not only in its reproductive system and habit, but also in its venation and other characters. Glossina and allies—African blood-sucking flies, carriers of Trypanosomae of various forms of sleeping sickness in man and animals.

6. STOMOXYDINE series—*Stomoxys calcitrans* (Peru) dissected and drawn, TD 3985. No uterus, uterovagina short, spermathecal ducts long and doubled, tubular glands fairly well developed but not longer than oviduct plus common oviduct. Eggs elongate and deposited on dung. Adult with piercing mouthparts in both sexes. Ovipositor with a dorsal pair of bristly, slightly curved, subcylindrical chitinous processes. *Stomoxys*, and probably *Lyperosia*, *Haematobia* and allies—blood-sucking flies and probable carriers of microzoa of certain cattle diseases.

7. CALLIPHORINE series—*Compsomyia macellaria* (Peru) dissected and drawn, TD 3984. No uterus, uterovagina very short; spermathecal ducts very short, only as long as the spermathecae themselves; tubular glands only very moderately developed, about as long as common oviduct plus oviduct, the latter hardly half the length of the former. Ovipositor simple. Mouthparts fleshy. Eggs elongate, deposited in sores or on meat, the product of both ovaries being deposited at one time. *Compsomyia* and allies, and probably *Calliphora*, *Lucilia* and allies.

8. MESEMBRININE series—Probably a distinct series comes here, including *Mesembrina* and allies, and especially Dr. Adolf Lutz's strange Brazilian fly which Prof. Hermann determines to be *Pseudogametes*, and which seems to have *Mesembrinine* affinities.

9. MUSCINE series—*Musca domestica* (Peru) dissected and drawn, TD 3982. No uterus, uterovagina elongate; a pair of uterovaginal pouches springing from lateral anterior walls, one on each side below insertion of spermathecal and tubular gland ducts, being accessory copulatory vesicles of Hewitt; tubular glands long and slender; eggs elongate, deposited on dung, etc. *Musca* and allies.

10. SARCOPHAGINE series—*Sarcophaga* 2 spp. (Peru) dissected and drawn. Uterus, when distended, heart-shaped or cordate, maggots rather irregularly disposed therein. Uterovagina short, but with two dorsally-lying sacs or large pouches

developed from its anterior ventrolateral walls, one on each side, these two sacs and the uterovagina together forming the heart-shaped functional uterus, which contains the eggs until the embryo has developed to the fully formed maggot ready for deposition on host or food-substance. *Sarcophaga* and allies; and possibly *Rhinophora*, *Melanophora*, *Brachycoma* and allies, the last three genera being included by external anatomical analogy. *Brachycoma* is a *Bombus* inquiline or parasite; *Rhinophora* and *Melanophora* are terrestrial-isopod parasites.

11. *METOPHINE* series—*Metopia* sp., TD 3988; *Selenomyia* sp., TD 3998; *Sarcomacronychia* sp., TD 3996 (all Peru) dissected and the first drawn. Uterus thick short V-shape, the arms of the V being productions anteriorly of the ventral walls of the uterovagina on each side, on the same plan as that of *Sarcophaga* but in different form, not rounded but rectangular pouches, the form doubtless due largely to regular disposition of the contained eggs and maggots; spermathecal ducts very long, doubled on themselves; tubular glands thick and moderately long. Maggots and eggs regularly arranged on end in uterus in triple and quadruple file. The uterovagina forms the base of the V, thus functioning as part of the uterus; the empty arms appear as blind tubes. *Metopia*, *Selenomyia*, *Sarcomacronychia* and allies. It is to be noted that the facial plate in the adult of *Metopia* is widely different from that of the rest of the group, probably due to antennal development, thus indicating its inferior rank in this series. Largely muddauber-wasp inquilines or parasites, feeding on contents of nests. Related to the *Sarcophagine* series.

12. *COMPSILURINE* series—*Compsilura concinnata* (Europe), *Dexodes nigripes* (Europe), *Vibrissina* sp. (Florida), and *Eucelatoria* spp. (Florida and Peru) dissected; TD 290, 132, 775, 1229, 3906. Uterus slender, long, in several coils, maggots and eggs normally obliquely on end, the maggots usually in single file, deposited subcutaneously in host through the hollow curved piercer of female fly, the single file arrangement doubtless for the purpose of facilitating the passage of maggots through the piercer. This type is a modification of the *Hemimasiceratine* type, with the addition of a piercing larvipositor for subcutaneous deposition of the maggots. *Compsilura*, *Vibrissina*, *Eucelatoria* and allies, including so far as known all flies whose females are provided with a curved piercing sharp-pointed larvipositor.

13. TACHININE series—*Tricholyga* sp. (Peru) dissected and drawn, TD 3971. *Tachina* spp. (Europe, America and Japan) dissected. No uterus, uterovagina normal and capable of holding but few eggs at a time; eggs oval and flattened, provided with a terminal dorsal hinged lid or cap for exit of maggot, normally deposited in a comparatively undeveloped state of embryo on host. Tubular glands very long and highly functional. Chorion hard, opaque, not reticulate. *Tachina*, *Tricholyga* and allies. Everything here points to egg deposition, and it is thus difficult to understand Dr. I. C. Nielson's record of larviposition for his *Tachina* larvarum, female flies of which appear to be the same as the ordinary form from which we secured deposition of great numbers of eggs but never a maggot, at the Gipsy Moth Parasite Laboratory.

14. MEIGENIINE series—*Eumyothyria* sp. (Peru) dissected and drawn, TD 3981. Uterus in a single coil, tubular and thickened when full of eggs; egg oval and flattened like that of *Tachina*, maggot developing within egg in uterus certainly to some extent, but egg evidently deposited on host after a certain period of uterine incubation. The flat eggs exhibit a shingled arrangement in the uterus. The long well developed tubular glands show that the eggs are intended for deposition as such, before the escape of the maggot. Both tubular glands and eggs are practically same as in the Tachinine series. *Eumyothyria* and quite certainly *Meigenia* and allies. TD 651 (Florida) with small brown flat eggs, which were certainly uterine, and TD 738 (Ocean Beach, So. Florida), with *Plagiola*-like venation and small flat uterine eggs may possibly come here.

15th series—Apparently what Coquillett determines as *Sturmia distincta*, which seems same as *protoparcis* Towns. and is probably referable to *Zygobothria* (Florida), TD 619; and other spp. (Europe and Florida) dissected. Short coiled strap-like uterus full of maggots and eggs on end, after style of *Hystrii* series (which follows) but in only two or three coils and with white maggots which are evidently deposited on hosts, being without anal membraneous pad for leaf-attachment. *Zygobothria* and allies, provided *Z. bimaculata* Htg. of Europe, the type of the genus, agrees herein as it seems to in external characters. Type specimens of many genera will have to be dissected before we will know what name to give this series.

16. *HYSTRICIINE* series—*Archytas* sp. (Peru) dissected and drawn, TD 3989; and *Melanophrys*, *Varichaeta*, *Copecrypta*, *Echinomyia*, *Jurinia*, *Paradejeania*, *Dejeania*, *Saundersia*, and many others dissected and their maggots drawn. Very long coiled strap-like uterus, in many coils, band-like, wide and thick, full of eggs and maggots on end, the thickness of the uterus corresponding to the length of the maggots and eggs contained, but the uterus lying on edge in a spiral like a watch-spring; maggots developing therein and becoming dark colored when mature from the blackish dorsal and lateral minute scale-like plates, deposited on the foliage of plants in proximity to their hosts, being furnished with an anal membranous attachment pad for adhering to plant surfaces. Tubular glands short and small. The above named genera and their allies, forming a very large and predominant series especially in the mountainous regions of both Americas, and representing the most recent phase of Muscoid fly evolution. This series will need to be divided into several groups.

17. *MASICERATINE* series—*Blepharipa politana* n. sp. (Peru) dissected and drawn, TD 3977; others dissected and their maggots and eggs drawn. Very long coiled tubular slender uterus, in many coils, filled with thousands of microscopic eggs which are held till the contained maggots are fully formed when they have become black in color and are deposited on foliage to be swallowed by hosts in feeding, being placed in proximity to leaf-eating insects, probably always lepidopterous larvae. Tubular glands moderately thick and developed. The chorion of the egg in this series exhibits always a honey-comb-like or network system of reticulation, though often also showing minute light-colored points appearing as microscopic punctures. The chorion of egg is oval in outline viewed from above. TD 877 (So. Florida), the adult of which at first sight appears much like *Cnephalia*, has the egg-substance protruded beyond the chorion at both ends, giving the eggs a decidedly slender and pointed appearance especially when seen in situ through the walls of the uterus. The explanation of this peculiarity has yet to be learned. The series includes *Masicera*, *Blepharipa*, etc., forming with other leaf-ovipositing flies a large group more especially predominant in the lowlands of both Americas as well as other parts of the world, and representing an extreme phase of Muscoid fly evolution somewhat less recent than that of the *Hystriicine* series.

18th series—Species agreeing in external characters with *Eumasicera* but certainly not that genus (Peru), TD 3987; dissected; probably *Exorista futilis* O. S., determined in the adult by Mr. W. R. Thompson (Massachusetts), TD 344, 361. Uterus short, thick, tubular, in only two or three coils, filled with microscopic oval eggs of same character as those of *Masiceratine* series except that they show no honeycomb or network reticulation but a concentric-ring or concentric-arc pattern viewed from above, apparently due to a disposition of ridges or wrinkles in the chorion. Eggs deposited on foliage, probably for lepidopterous larvae only. The above mentioned forms must, I think, belong to the same genus as the reticulation of the chorion is of the same character; but until the type species of *Exorista*, *Sturmia*, and various other genera are dissected, it will be impossible to say what generic name must be given them; and still further genera must be dissected before we can know what name to give this series, which may include *Phorocera*, or even older genera. TD 437, which seems referable to *Phorocera* on external adult characters, probably comes in this series; it is European.

19th series—*Ophirosturmia cincta* gen. et sp. nov. (Peru) dissected and drawn, TD 4012. Uterus tubular and elongate in four to six coils, stouter near head, filled with microscopic oval brownish-yellow to yellow-brown eggs, whose choria exhibit a honeycomb reticulation, the eggs deposited on leaves in proximity to certain leaf-eating insects. There is no punctulation to the chorion. Distinguished from the *Masiceratine* series by difference in spermathecal ducts, and by the brown-yellow color of the mature eggs, as well as other points. Apical cell ending well before wing-tip.

There are other series yet to be defined among the leaf-ovipositing forms.

20. *GYMNOCHAETINE* series—*Gymnochaeta* sp. (Peru) dissected, maggot drawn, TD 3973. Maggots and eggs on end in two or three rows in very long subtubular coiled uterus; maggots black by reason of the body segments bearing a large dorsal and two small lateral colored plates, these made up of minute colored scale-like plates of different form from those of the *Hystriicine* series; the maggot with ventral locomotory spine-pads and spine-rows composed of very microscopic spines and evidently specially fitted for locomotion in the open; no anal

membraneous attachment pad being present. This is a totally new type of maggot and indicates a widely diverse habit from others so far known. *Gymnochaeta* and allies.

21st series—*Ophirion mirabile* gen. et sp. nov. (Peru) dissected and drawn, TD 3980. Maggots and eggs rather loosely disposed in long slender tubular uterus, the eggs in two rows obliquely on end; an elbow-like preuterus, uterus arising from inside angle of elbow, common oviduct opening into one end of elbow and the spermathecal and tubular gland ducts into the other end; oviducts long and slender, tubular glands very short; maggots of a peculiar and new type, remarkable in that they appear emarginate laterally and are furnished with a dark-colored pattern.

22. PSEUDODEXIINE series—*Ophirodextia pulchra* gen. et sp. nov. (Peru) dissected and drawn, TD 3999. Uterus thick, tubular, in two coils, with eggs and maggots obliquely on end; a true preuterus homologous with the forward half or more of the uterovagina, the uterus having evidently developed from the walls of the vagina proper; spermathecal and tubular gland ducts opening into the preuterus, which has capacity of just one egg; all these ducts very short; tubular glands only about three times as long as preuterus, or as long as common oviduct plus oviduct; oviducts very short and thick; common oviduct much longer and slender, being about twice length of preuterus. Maggots slender. Abdomen of fly elongate, subcylindrical; facial plate long, wide, not constricted by vibrissal angles, cut off abruptly below; antennae elongate, arista plumose. These characters apply to the above form, TD 3999. *Ophirodextia* and allies, including probably *Pseudodextia*, *Lep-toda*, *Cordyligaster*, and a host of others. *Atrophopoda* may come here, or may be very distinct.

23. OCYPTERINE series—Probably a distinct series comes here for *Ocyptera* and allies. The genus has been dissected, but not with sufficient care. The eggs are elongate, stout, subcylindrical; maggot unknown to me.

24. THRYPTOCERATINE series—Probably a series comes here for *Thryptocera* and allies. Eggs slender, elongate. Maggot not known to me.

25. HEMIMASICERATINE series—Uterus present, doubtless coiled, containing elongate white maggots which must be deposited on host. *Hemimasicera*, *Sisyrropa* and allies. These

genera dissected and maggots drawn, but the form of uterus was not determined.

26. SIPHOSTURMINE series—*Siphosturmia* sp. (Peru) dissected. TD 4002. Single-coil uterus, sub-tubular, with two rows of eggs and maggots; very long ovipositor, sub-chitinous, in its unextended position in abdomen measuring nearly one-half the length of uterus; ovaries slender, elongate, with few egg-tubes; oviducts long, common oviduct same length as oviduct; spermathecae elongate-oval, two joined in hood, the third free; spermathecal ducts elongate, about as long as common oviduct; tubular glands moderately elongate and slender, about as long as common oviduct plus oviduct. *Siphosturmia* and allies. Florida specimens of the genus have also been dissected.

27th series—*Anisia*, *Erynnia*, *Gymnostylia* spp., or forms allied to these genera so far as can be known by external adult characters, including *Hypostena barbata* of Coqt. in part (Peru and Maryland) dissected, TD 4001, 433. Plump white maggots with well-developed spine rows on ventral surface. Uterus slender, tubular, coiled three times within itself; maggots in single file, oblique to nearly longitudinal in position according to degree of crowding in uterus; spermathecal ducts long, tubular glands not long; ovaries elongate, with few egg-tubes. The maggots of the Peruvian form (TD 4001) show five highly developed ventral spine rows; those of the D. C. form (TD 433, collected by Knab on Plummers Island following a beetle of *Calligrapha bigsbyana*) are very similar, having five transverse rows of strong hooked spines on posterior half of median ventral surfaces. Maggots of TD 352 (Mass.) are short and plump, with strongly marked complete rows of spines encircling the body, and may not belong here; the fly has a different facies. The series embraces flies that are parasites of both the grubs and adults of certain beetles, especially Chrysomelidae. The European tachinid parasite of the imported elm-leaf beetle apparently belongs here. Many genera will likewise have to be dissected before this series can be named.

28. PAREXORISTINE series—*Parexorista cheloniae* (Europe) and *Parexorista* sp. (Mass.) dissected, TD 432. Uterus in a single coil, containing elongate subcylindrical eggs which are furnished with a pedicel, the eggs incubated in uterus sometimes to an advanced stage of the embryo and then deposited on host attached to skin or hairs of latter by pedicel. *Parexorista* and allies.

29. DEXINE series—*Almugmyia arida* gen. et sp. nov. (Peru) dissected and drawn, TD 3979. *Dexia*, *Mochlosoma*, *Sirostoma*, *Sardiocera*, and allied forms dissected and maggots drawn. Uterus thick, tubular, in one coil; eggs and maggots in a very oblique and somewhat spiral arrangement; ovaries very slender, elongate, consisting of few egg tubes; common oviduct rather long, oviducts short, spermathecal ducts long and doubled, tubular glands small. The maggots of *Almugmyia* and *Sirostoma* have anal spiracular tubes carried out in long slender anal processes which are tipped with bristles; the eggs of the first are sharply pointed anally, due to the presence inside the chorion of the anal bristles of the developing maggot. Probably the genera above mentioned all come in this series with many others, but the reproductive-system characters above given have not yet been verified for the genera other than *Almugmyia*. Parasites of white-grubs, woodboring-grubs, and probably others.

30. MYIOPHASIINE series—*Ennyomma globosa* (South Carolina and Florida) dissected, TD 509. The maggot is so slender as to be almost filiform. Uterus present, but form not determined. *Ennyomma*, *Myiophasia* and allies. Parasites of weevil grubs in green fruits.

31. PHASIOPTERYGINE series—*Phasiopteryx* spp. (Colorado, Veracruz and Peru) dissected, TD 1791, 1791a, 4005. Uterus present, very long and slender, in many irregular knot-like coils and turns, the upper part more regularly coiled, receiving the eggs while latter are still microscopic, the eggs growing to full size in upper part of uterus. Ovaries and oviducts very small, the latter not over one-fourth the diameter of a full-grown uterine egg. Preuterus present. Spermathecal ducts very short, tubular glands short. Maggots with five longitudinal rows of strongly chitinized segmental plates, those of median row wide and covering dorsum of segments, those of inner lateral row narrowed, those of outer lateral row presenting a serrate outline below; underside white and soft. The chitinized plates of the maggot vary from brownish-yellow to black, overlap when the maggot is contracted, the segments telescoping and producing a strongly emarginate outline both from above and in profile. These plates are evidently ambulatory in function as well as protective against conditions of life in the open or subopen. Maggots elongate when not contracted, moderate-

ly wide, flat below; wide and short when contracted. The habit is larviposition, but one can not even guess at the larval habit and host relation. This is a most interesting and remarkably distinct type. Although the Colorado and Veracruz specimens of the fly look quite alike externally, the maggots from the Veracruz specimen all show two large black bunches of strong more or less swollen and hooked or cleft spines on cephalic segment which are wholly lacking in the maggots from the Colorado specimen, indicating two very distinct species. The maggots from the Peruvian specimen do not show these cephalic spine-bunches; they besides differ from both the Colorado and Veracruz maggots in the characters of the segmental plates.

The Veracruz specimen came from Orizaba (coll. by Herbert Osborn) and is probably *P. bilimeki* B. B., the type of which came from the same locality. A much fuller description with figures of the maggots and female reproductive system will be given in forthcoming papers.

32. MEGAPROSOPINE series—*Microphthalma* spp. (North and South America) dissected, TD 313, 3915. Uterus present, long, subtubular, in several coils, filled with thousands of slender pointed eggs and maggots. The maggot of *Microphthalma* is very hairy, being the extreme development in this respect so far as known. This series includes *Microphthalma* and allies, and almost certainly *Megaprosopus*. *Trixodes* is almost certainly the type of a separate series. The first and probably the second are white-grub parasites, while *Trixodes* is probably a woodboring-grub parasite.

33. MACRONYCHNIINE series—No dissections of *Macronychia* have as yet been made. The uterus may well be *Mctopiine* in form. At all events it must be quite distinct from the preceding series. The forms are perhaps muddauber-wasp inquilines.

34. CUTEREBRINE series—*Cuterebra* spp. (Florida and South Carolina) dissected, eggs drawn, TD 487, 486. Probably no uterus, as the eggs are certainly deposited; chorion of egg very thick and hard, furnished at what is probably cephalic end and with a hinged lid or cap opening on dorsal aspect of egg and provided for the exit of the maggot which could not otherwise escape from its heavy chorion-prison, thus demonstrating most conclusively that the egg is intended for deposition as such. Eggs probably deposited externally on skin or

hairs of host, and not swallowed, the maggots probably—almost certainly—penetrating skin at point of oviposition; *Dermatobia hominis* is practically known to have these habits. *Cuterebra*, *Dermatobia*, and probably *Rogenhoferia* and *Bogeria*.

35. GASTROPHILINE series—Probably a uterus in which the eggs are incubated to a certain extent; eggs pediceled and perhaps ready to hatch soon after deposition, deposited on hairs of *Equus* and on *Elephas*, in the latter case probably on the hairs; maggots issuing from chorion in mouth or oesophagus of host and living in alimentary canal of same, passing out with the faeces when fully grown. *Gastrophilus* and probably *Cobboldia*, the latter parasitic in elephants in Africa and India.

36. OESTRINE series—Uterus certainly present; maggots deposited in nostrils of ruminants, elephant and horse, living in nasal and pharyngeal cavities and issuing through nostrils when ready to enter ground for pupation. *Oestrus*, *Rhinoestrus*, *Cephenomyia*, *Cephalomyia*, *Pharyngobolus*—last known only as maggot in pharynx of elephant in Africa.

37. HYPODERMATINE series—*Peristomalina* or *facilia* of adult fly remote, enclosing between them what seems to be the excessively broadened clypeus or epistoma, perhaps both differing in this character of the facial plate most widely from all the other Muscoidea. The sclerites of these parts need careful study before they can be rightly interpreted. Perhaps a uterus in which the eggs are partially incubated; eggs deposited on hairs of ruminants, rodents and horse, taken into mouth of host, where they hatch or in oesophagus, the resulting maggots making their way slowly through the tissues to a position beneath the skin where they provide an air-hole and develop rapidly. *Hypoderma*, *Oedemagena* and *Oestromyia*. One of the most remarkable, widely divergent and at the same time well known groups of the superfamily Muscoidea.

It is to be noted that the statements "dissected and drawn" and "dissected" refer always to the female reproductive and accessory organs; also that the term maggot as used refers always to the first-stage maggot only, unless otherwise specified. The term series above is not used in a strictly taxonomic sense. The maggots of most of the genera mentioned above for maggot characters have been drawn and described.

Although much has been already accomplished in the investigations above outlined, the results as tabulated most graphic-

ally illustrate the astonishing amount of such work that yet remains to be done. The above 37 series, as defined or at least mentioned, and including others indicated therewith, will no doubt be more than doubled before the work is brought to a satisfactory conclusion. I have at present in tentative outline some 91 groups—taxonomic categories which are to be considered of subfamily or tribal rank, perhaps better the latter, and which may be termed GROUP UNITS. But before these can be satisfactorily defined, hundreds of type species of genera must be carefully dissected and figured, as well for their eggs and maggots as for the reproductive system. It is now most confidently believed—in fact, it is axiomatically apparent—that this method of work will finally clear up the taxonomy of these flies and put it on a sound basis.

ADDENDA.

In order to bring the outline of results up to date of reading proof of the foregoing (April 15, 1911), I wish to add the following very brief particulars:

CALLIPHORINE series—*Synthesiomyia* belongs here, as shown by dissection of Peruvian material. It was formerly thought to be more closely allied with *Musca*.

MESEMBRININE series—Dr. Lutz has sent me three specimens in fluid of *Pseudogametes* for dissection, but unfortunately all are males. The fly has a wonderfully strong Oestrid habitus, greatly resembling *Cuterebra* in general form and appearance. It will almost certainly need a separate group, the *Pseudogametinae*.

SARCOPHAGINE series—*Sarcophaga auribarbata* n. sp., *aurigena* n. sp., *argenta* n. sp. (all Peru) have been dissected and drawn. *Sarcophagula peruana* n. sp. (Peru) and many other species of several genera (Florida and Peru) have been dissected and the maggots drawn.

TD 354, from Massachusetts, which is apparently closely related to this group, if not a member of it, is remarkable as showing most clearly in the first-stage maggot the seven main pairs of sclerites of the cephalopharyngeal skeleton enumerated at the end of these addenda, with the single exception of the dorsopharyngeal sclerite which is rudimentary or nearly absent.

METOPHNE series—Prof. Osborn's important observations on the habits of *Senotainia* (Ohio Nat., VII, 1906, p. 38) indicate that these flies are guided to the nests of the host by observing the latter in the act of transporting spiders or caterpillars with which to provision same. I believe the maggots are deposited in choria, and stuck to the spiders or caterpillars. After the nest is closed the increased temperature probably arouses the maggots to activity, whereupon they first devour the egg or grub of host and then attack the stored provision. The entire contents of the uterus, which are not great, are deposited almost certainly at one time, extending over several hours, and probably may all be deposited in one nest if the conditions are favorable. Perhaps the fly attaches a maggot to the egg of host.

COMPSILURINE series—*Eucelatoria australis* n. sp. (Peru) has been dissected and drawn. The piercing larvipositor in this group is composed of two pieces, of which the upper is much shorter than the lower, the lower being concave dorsally and the upper concave ventrally. Both are sharply pointed but the lower piece curves broadly downward to the point and forms the main piercing organ. The two pieces are hinged at the posterior edge of their broad basal portion and the vagina opens between them. The maggot is expelled between these pieces within the skin of the host. Bouche, Heim and Kirschner were right as to the piercing function of this organ, while Giard was wrong. Nielson adopted the latter's view in his criticism of my original announcement of subcutaneous larviposition in these forms, to which I replied in *Science* (issue of Feby. 4, 1910, p. 195).

There are other forms with what appears to be a piercing larvipositor. Mention has already been made of TD 480, which seems to be near *Alophora* (see Phasiine series). Another case is furnished in a fly from Massachusetts with pseudodexiine aspect, TD 371, which has a broad blade-like larvipositor. These, if true piercers, are probably cases of independent specialization not indicating relationship with this group. *Emphanopteryx* (not *Cryptomeigenia*) has a piercer-like organ in the female, but it is doubtful if it is functional as piercing the skin of the host.

The genus *Celatoria* probably also possesses a piercing larvipositor similar to that of *Compsilura*. Judging wholly from the descriptions and figures, Coquillett evidently misinter-

puted the sexes. The sex which he calls the male and which has the strong ventral keel is apparently the female, the keel being functional as a protection to the point of the larvipositor. The ventral groove described indicates this, and the fifth segment mentioned is probably the broad basal part of the larvipositor. If my surmise is correct, it appears that this form is unique in having the male front wider than that of female. At all events the genus must go in a group by itself, the CELATORIINE, on the remarkable spinose character of the last-stage maggot and puparium combined with the other striking characters.

GYMNOSOMATINE series—*Gymnosoma* sp. (California and Veracruz) dissected, TD 1815, 1815a. The uterus was not noted and is probably absent. The egg is large, white, very elongate-oval, flattened, chorion without reticulation. *Gymnosoma* and allies, perhaps including *Oedemasoma*, Parasites of adult pentatomids. Habit, host-oviposition.

TACHININE series—Nielsen is evidently wrong in his statement that his *Tachina* larvarum deposited maggots. The eggs which he referred to *Carcelia* were almost certainly those of his *T. larvarum*. This can be seen by reading his text. In his second paper (1910) he shows the egg of *Carcelia* to be pediceled.

MEIGENIINE series—This will need further division. The present forms are parasites of Chrysomelid larvae, sawfly larvae, and lepidopterous larvae. *Tachinomyia* appears to belong here. The following further groups can be indicated at present.

VIVIANIINE series—For *Viviania*, *Cryptomeigenia* and allies. All are parasites of adult beetles so far as yet known.

THRIXIONINE series—*Thrixion* and allies. Parasites of adult phasmids, etc.

PLAGIOPINE series.—*Plagiops littoralis* gen. et sp. nov. (Ocean Beach, So. Florida), TD 738, mentioned above under Meigeniine series, dissected. The uterus was not noted but is perhaps present. The egg is small, flattened, and ovate. Habit, host-oviposition.

PLAGIINE ser—*Siphoplusia* sp. (Florida) dissected, TD 489; *Cyrtophloebe* sp. (Mass.), TD 2731, and *Plagia* sp. (Mass.) TD 2711, dissected. The uterus is in several coils and strap-like in upper extent, the elongate subcylindrical eggs packed in

rows and developing maggots therein. Habit, larviposition probably on host, as the uterine capacity is limited to a few hundreds.

ZYGOSTURMIINE series.—This is the 15th series above. *Zygosturmia inca* gen. et sp. nov. (Peru) dissected and drawn, TD 4031. Coquillett's *Sturmia distincta* and my *protoparcis* belong to this genus apparently. The oviducts are quite long and slender, common oviduct about two-thirds as long as oviduct, tubular glands about one and one-half times as long as common oviduct plus oviduct, spermathecal ducts about as long as common oviduct, tubular gland ducts only a little shorter than spermathecal ducts; ovaries with comparatively few ovarioles; no true preuterus; uterus strap-like, in but one or two coils, eggs and maggots packed in on the *Echinomyiine* plan.

AZYGOBOTHRIINE series—*Azygobothria aurea* gen. et sp. nov. (Peru) dissected and drawn. The ovaries are large, of many ovarioles. Common oviduct is about as long as one ovary. There is a nipple-like preuterus. The spermathecal ducts are very long, fully twice as long as common oviduct, sinuate, bent at or below middle. Tubular glands are short, only half as long as common oviduct, their ducts nearly twice as long as the glands. The uterus is wide and strap-like, in about two coils more or less.

Argyrophylax and *Zygobothria* seem to belong in the neighborhood of these two series, but may not come within either.

HYSTRICINE series—The leaf-larvipositing forms will need division into at least seven groups, the present including *Hystricia*, *Bombyliomyia*, *Jurinia* and allies. The others follow:

MELANOPHRYONINE series—*Melanophrys* and *Artopharista* which may or may not be the same.

PANZERIINE series—*Panzeria*, *Varichaeta* and their allies. Nielson has described the first-stage maggot of *Panzeria* as having no minute colored plates, which I think is a mistake. The fragment which he thought to be first stage of this species seems either not to have been this species or else to have been a piece of a second-stage skin. His text and figures indicate this conclusion.

MICROPALPINE series—*Micropalpus* and allies. *Cope-drypta* may or may not come here.

ECHINOMYIINE series—*Echinomyia*, *Fabricia* and allies. *Peletria* and their allies may come here.

SAUNDERSIINE series—*Saundersia*, *Epalpus* and their allies.

DEJEANIINE series—*Dejeania*, *Paradejeania* and *Lasio-palpus*.

MASICERATINE series—This and the 18th and 19th series above represent only a part of the leaf-ovipositing minute-egg forms of Tachinidae, which exhibit a surprising variety of type, in female reproductive organs and eggs. They may be divided as follows, so far as now known, leaving the present group for *Masicera*, *Blepharipa* and allies, which have a long uterus containing black eggs with a honey-comb reticulation of the chorion.

BRACHYMASICERATINE series—This is the 18th series above. *Brachymasicera polita* gen. et sp. nov. (Peru) dissected, TD 3987 Short uterus, black eggs, chorion with a wrinkle pattern and not honey-comb reticulate.

BELVOSIINE series—*Belvosia*, *Latreillimyia* and allies. *Belvosia piurana* sp. nov. (Peru) dissected, TD 4032. Uterus long, eggs black, chorion without reticulation but coarsely punctulate, the punctures largely double and triple.

Triachora has the chorion more finely and evenly punctulate, the punctures all single.

BLEPHARIPEZINE series—*Blepharipeza*, *Parachaeta* and allies. Long uterus with black eggs, the chorion conspicuously honey-comb reticulate, the divisions with minute raised points.

GONIINE series—Many specimens of various spp. of *Gonia* from both North and South America have been dissected, and drawings made of two of the dissections which appear widely different. One is a short thick uterus in only one to two coils, with very short oviducts and large ovaries, TD 4011; the other is a very long uterus in five or more coils, with elongate oviducts and somewhat smaller ovaries, TD 4037. Both are from Peru. Other specimens from Piura, Nana (near Lima), and Arequipa, Peru, show both long and short uteri, and I have found developed maggots in the short uterus as well as in the long one. The eggs are minute, flattened ventrally, ovate to subcircular; the chorion is without reticulation, but evenly, closely and very finely punctulate throughout. Preuterus present, common oviduct short, spermathecal ducts and tubular glands elongate. The maggot is elongate-pyriform, sometimes appearing nearly sub-

cylindrical, and appears to lie curled in the sub-circular or oval egg. Pressure on the egg often causes it to assume an elongate narrow form pointed at ends, inside which the maggot probably lies straight. Slight pressure or teasing with a needle causes the cylindrical anterior portion of the maggot to protrude from the ventral edge of egg, at right angle to long axis. I can see no difference in the maggots from the short and long uteri, and am constrained to believe that here the uterus gradually increases in length as the eggs descend from the ovaries and fill it, although oviposition may begin while the uterus is still short. If this is so, it is an exceptional case in the great increase of length after maggots have become fully formed within the choria. There seem to be two forms of the flies in the Peruvian material, distinguishable externally, but the separation does not accord with the uterine difference. One or both of these forms are probably what has been called *Gonia chilensis*.

My dissections have shown *Gonia frontosa* (Mass.) to have a long coiled uterus; and what I identify as *G. pallens* and *G. angusta* (S. Florida) to have a very long uterus. The chorion of the egg is the same in these forms as above described.

The above observations indicate that much care and judgment must be used in describing the female reproductive organs in these flies. I have noted variations in lengths of uterus in other forms within certain limits; and variation in the number of rows of eggs in the strap-like forms of uterus as well as in certain others, without a corresponding variation in length. It is evident that we need careful investigations in various groups which shall determine how many days elapse between issuance of the fly or fertilization and complete development of the female reproductive organs. I have noted that in *Variachaeta*, under artificial conditions, this takes about fourteen days.

PHASIATACTINE series—*Phasiatacta elongata* gen. et sp. nov. (Peru) dissected and drawn, TD 4019. Uterus extremely long and slender, in very many coils and irregular turns, preuterus present. Ovaries large; oviducts long and slender, spermathecal ducts long and curved, tubular glands elongate. Eggs black, elongate, pointed at each end, chorion with areoles gathered around a dorsal opaque area, without reticulation.

CNEPHALOMYIINE series—*Cnephomyia floridana* gen. et sp. nov. (So. Fla.) dissected, TD 877. Uterus very long and

slender, eggs blackish, elongate, obtusely pointed at each end, chorion, with an almost perfect hexagonal reticulation, interspersed with fine punctulations.

Cnephelodes pollinosus gen. et sp. nov. (Peru), TD 4038, which has been dissected and drawn, probably belongs here. The uterus is extremely long and slender, in numerous irregular coils and turns, the eggs elongate in single to quadruple file, chorion black with honeycomb reticulation and punctures. The characters of the maggot, including those of the cephalopharyngeal skeleton, show a close relationship with *Gonia*.

OPHIROSTURMIINE series—This is the 19th series above. Uterus long and in many coils, eggs brownish-yellow, chorion honey-comb reticulate interspersed with closely-set microscopic raised points. Oviducts long, spermathecal ducts very long and slender, tubular glands moderately long, preuterus present. *Phasmophaga* evidently does not belong here.

OMMASICERATINE series. *Ommasicerca chaetosa* gen, et sp. nov. (Peru) dissected and drawn, TD 4018. Uterus short and thick, in only one and a half or two coils; eggs brownish-yellow, chorion with an elongate-hexagon reticulation like a honeycomb pattern drawn out of shape longitudinally.

This concludes the leaf-ovipositing groups so far as I am able at present to indicate them. But there remains a multitude of these forms yet to be assigned, among which I can give notes on the following:

Paragermaria has a very long slender uterus, about 40 mm. in length, eggs black, chorion without reticulation, finely punctulate much like that of *Triachora*. It probably goes in the GERMARIINE series, which will include *Germaria* and allies.

Cnephalia has a very long and slender uterus containing black eggs.

Attacta, as represented by a specimen from Guatemala which I doubtfully refer to this genus, has black eggs whose chorion is not honey-comb reticulate but shows minute punctures in a roughened surface. The uterus is probably elongate. The puncture pattern of the chorion appears in the peripheral area like a chitinous network, with an elongate or oval less-closely punctured central area. The surface of the chorion is closely and minutely roughened with projecting points.

Ceromasia has brownish-yellow eggs, the chorion is intensely honey-comb reticulate, each division closely set with microscopic raised points.

Phasmophaga has a brownish-yellow egg, the chorion appears not to possess any reticulation and is not punctulate; the surface appears to be quite smooth.

TD 390 (Mass.) is a small fly with a disproportionately long uterus; it has much the habitus of *Eusisyropa*, and has been determined by Mr. W. R. Thompson as *Masicera* sp. near *pauciseta*. The egg is deeply yellow with a slight brownish tinge, the chorion is reticulate with nearly perfect hexagons, and the surface is sparsely set with long chitinous spine-like points which look like short hairs growing therefrom. No punctulation.

TD 355 (Mass.) was at first determined by me as *Eusisyropa blanda* and so published in Tech. ser. Bull. 12 Bur. Ent., p. 116. I doubt if it is that genus. It contained some 700 whitish eggs in the uterus, which was thus probably of the short thick type. These eggs show the nearly mature maggots within. The chorion is thin, without reticulation or punctulation, and has much the appearance of the *Phasmophaga* chorion externally.

Finally, TD 747, a small yellow-legged fly with a pseudodexiine habitus and a very long slender uterus, from Ocean Beach, South Florida, shows black eggs whose chorion appears very similar to that of *Phasmophaga* in structure. There is no punctulation or reticulation, and practically no appearance of rugosity, the surface being quite smooth. Filaments of translucent substance appear to depend from the ventral surface of this egg, showing in every one of many mounted specimens as pendulous loops and coils. I have seen nothing of the kind in any other egg. They are perhaps intended for more secure attachment to leaf surfaces.

These examples might be multiplied, but I have given sufficient to show the wonderful diversity of type exhibited by these minute-egg forms, all of which are believed to oviposit upon the foliage of the plants.

OPHIRIONINE series—This name should be applied to the 21st series above.

EUMYOBIINE series—*Eumyobia flava* gen. et sp. nov. (Peru) dissected and drawn, TD 4021. Ovaries large, oviducts short, common oviduct long, spermathecal ducts and tubular glands short, preuterus present; uterus very heavy and thick, in two stout coils or so, the elongate maggots developing therein. The eggs and maggots are packed in irregularly, in various posi-

tions. *Pyrrhosia* may belong here, and the present form may be that genus or one of its near allies, being apparently what Coquillett determines as *Leskia*. I have no alternative, however, but to name it to prevent doubt hereafter.

PSEUDODEXIINE series—There are almost certainly many distinct groups here. The **ORPHIRODEXIINE** series must be erected for *Ophirodextia* and its allies.

ATROPHOPODINE series—This is quite distinct from *Ophirodextia*, as shown by *Diaphoropeza peruana* sp. nov. (Peru) dissected and drawn, TD 4026. This species is not typical of the genus but comes nearer to it than to any other, and certainly belongs to the *Atrophopoda* group. Ovaries not large, oviducts very short, common oviduct very long, spermathecal ducts and tubular glands short, preuterus present; uterus thick and swollen, in one coil or so, eggs and maggots very oblique to longitudinal. It is as yet doubtful if *Vanderwulpia* can be here included. The group is proposed for *Atrophopoda* and its allies.

BESKIIINE series.—*Beskia* and allies. No proper material for dissection has yet been available but the group must be pointed out as probably furnishing a most marked deviation in larval habit from any hitherto known in the muscoid flies. In 1908, Mr. E. O. G. Kelley found, at Pawnee, Oklahoma, a maggot which he observed at the time to be, to quote from Mr. Webster's letter on the subject, "in the act of actually feeding on a grain aphid of wheat, probably *Macrosiphum granaria*." This maggot changed to a puparium which was attached to the base of a wheat leaf. From this puparium issued a fly of *Ocypterosiphon aelops*, which is very close to *Beskia* if not the same. No confirmation of this larval habit has come to light since, but although the record is a most surprising one it is probable that the maggots of these flies are external feeders on aphids and perhaps some other soft-bodied insects. The anal stigmata of the puparium are borne at the ends of long processes which suggests an analogy with aphidophagous syrphids.

STEINIELLINE series—From what Nielsen has shown of the characters of the first-stage maggot of *Steiniella*, the genus represents a separate group. This maggot possesses minute colored subchitinized plates interspersed with short spines, some of the plates bearing spines on their posterior edge. The maggots are almost certainly not deposited on leaves. The form is not

allied with the Hystriciine group of series, the adult being very distinct in external characters. The minute colored plates of the first stage maggot are evidently an independent specialization, and are interesting as indicating the probable method of development of the more perfect colored scale-like plates of the leaf-larvipositing forms.

PSEUDOMYOTHYRIINE series—This is the 27th series above. *Pseudomothryia perplexa* sp. nov. (Peru) dissected and drawn, TD 4001, 4035. Ovaries small, of only about six ovarioles. Oviducts about one-third as long as ovary, common oviduct about twice as long as oviduct, spermathecal ducts very elongate, tubular glands about the length of latter, preuterus absent. Uterus slender, laterally compressed, in three to four coils, inside each other disposed in a more or less regular spiral, eggs and maggots in single file. The oral spine which terminates the mandibular sclerite of the cephalopharyngeal skeleton in the first stage maggot is very sharp and needle like. *Methypostena* and *Tachinophyto* perhaps come here. It is quite likely that *Erynnia nitida*, the European tachinid parasite of the imported elm-leaf beetle, occurs in North America and had been determined by Coquillett as *Hypostena barbata*.

EUZENILLIINE series—*Euzenillia aurea* gen. et sp. nov. (Mass.) dissected, TD 350. In this dissection the reproductive organs were not extracted intact, and I can judge only from the maggot which is a wholly new type. The latter is elongate, moderately slender, and thickly clothed all over with short fine minute spines except on posterior half of dorsum. The cephalopharyngeal skeleton is rather slender. The spermathecae are suboval or elongate-rounded, and the larvipositor is normal. A uterus is present, which is probably not long.

PAREXORISTINE series—*Carcelia* belongs here. Nielson, in his second paper (1910), has shown the egg to be elongate and pedicel, as in *Parexorista*.

DEXIINE series—This series needs splitting into several groups. Aside from the typical group, to include *Dexia* and allies, the following may be given as at present recognizable:

ALMUGMYIINE series—For *Almugmyia* and allies, whose reproductive characters are mentioned under the Dexiine series above. *Microchaetina* probably comes here, and may prove to be the same as the present form.

SIROSTOMINE series—This will include *Sirostoma* and its allies, which are white-grub parasites. The females deposit their maggots at the surface of the soil, into which the latter penetrate in search of hosts. *Phorostoma* probably comes here.

SARDIOCERATINE series—*Sardiocera* and allies. *Theresia* and *Eutheresia* gen. nov. for Coquillett's *Theresia analis*, probably come here. All are parasites of wood-boring grubs of Coleoptera. The host relations of *Eutheresia* are most interesting, and will be detailed elsewhere. The maggots of *Sardiocera* (which I determine as Coquillett's *Theresia tandrec*) and *Eutheresia* both have a pair of short anal processes carrying the tracheas with the anal stigmata at their ends.

PROSENINE series—For *Prosenia*, *Myiocera* and allies.

ECHINODEXIINE series—For *Echinodexia* and allies. Probably *Hystrichodexia*, *Eudexia*, *Hystrisiphona*, and *Bathydexia* come here. These forms are distinguished in the fly by having spine-like macrochaetae on scutellum and abdomen, and would thus seem to form a natural group by themselves. This character probably does not carry with it the leaf-larviposition habit, although the flies bear a strong superficial resemblance to the *Hystriciine* and allied forms. It will be noted that spine-like macrochaetae occur in the *Blepharipezine* series of the leaf-ovipositing minute-egg forms; also that this character does not extend to all the leaf-larvipositing forms.

MYIOPHASIINE series—The females of *Ennyomma globosa*, parasitic in *Chalcodermus aeneus* in cowpea pods, probably deposit the living maggots at the weevil punctures of a certain age, and the very slender maggot bores in next the periphery of the hardened-sap pellicle which closes the puncture until it reaches the semiliquid frass, through which it can easily gain access to the host grub.

PHASIOPTERYGINE series—The peruvian species mentioned above, TD 4005, is *Phasiopteryx australis* sp. nov. It has been dissected and drawn. The uterus is about sixty millimeters in length, from one-sixth to one-half millimeter in width, and is perhaps the extreme development for relative length and slenderness in the superfamily, though *Phasiotacta* is a close second.

On page 78, T. A. E. S., XIII (March, 1895), I mentioned two specimens of a fly from Doctor Forbes, Ills., as doubtfully referable to *Ormia*, one of which was reared from *Crambus* sp. If these specimens belong to the *Oestrophasiine* series, as is quite

probable, this will form the only rearing record yet known of any immediate relative of this group. Here seems to be a hint explanatory of the remarkable specialization of the first-stage maggot in *Phasiapteryx*, for it is probable that *Oestrophasia* has a similar maggot. The larvae of *Crambus* work underground, in silk-lined galleries, feeding on the stems of growing plants, especially corn. The *Phasiapteryx* type of maggot would be quite well adapted to search out such hosts. Its smooth segmental plates would enable it to penetrate the silken walls of the galleries, where an ordinary maggot would become enmeshed. Yet one cannot help thinking that the *Phasiapteryx* maggot is rather needlessly specialized for such prosaic purpose. Perhaps *Oestrophasia* has a still different type of maggot.

Characterizations to fit the new generic and specific names used in this article will be shortly published, probably in the more exhaustive paper from which the whole of the present data are taken in advance. I must explain that I consider it quite obligatory upon me, in all cases of doubt as to the determination, to give new names generic and specific to the forms dissected, described and figured. These names will fix the forms so as to prevent any further doubt arising as to their identity. If this plan increase the synonymy, as it doubtless will to an extent, there is no positive harm done; while the positive good is secured of certainty in determination.

In the forthcoming more complete paper will also be given fuller explanations of the functions of the various parts of the female reproductive system; the necessity for the use of the terms preuterus, uterovagina, etc., which may be thought by some to be superfluous, with numerous plates illustrating all the reproductive types that have been drawn.

I wish to announce that, after an extended comparative study of many maggot types, I find the first-stage cephalopharyngeal skeleton to consist of seven original main sclerites, all paired, as follows:

1. PHARYNGEAL—"lateral pharyngeal" of Hewitt in whole or part; "upper pharyngeal" of Nielsen plus "lower pharyngeal" of same author in whole or part.
2. INFRAPHARYNGEAL—lower wing of "lateral pharyngeal" of Hewitt in part; "lower pharyngeal" of Nielsen in part.
3. DORSOPHARYNGEAL—"dorsal pharyngeal" of Hewitt.
4. HYPOSTOMAL—after Hewitt.
5. INFRAHYPOSTOMAL—"the plate below the skeleton" of Nielsen.
6. MANDIBULAR—after Hewitt.
7. DENTATE—after Hewitt.

A considerable number of minor sclerites occur in various forms, but all seem to be derived from the above seven main ones, except those of the oral region which belong to the pseudo-cephalon and are probably developed from it. I have an extensive series of drawings of a very large number of types of first-stage skeleton, which will be published in due time in connection with a comparative study of all the sclerites that go to make up the skeleton in the various forms.

Under the Sarcophagine series in these addenda is mentioned TD 354 from Massachusetts, which most clearly shows all the above main sclerites except the dorsopharyngeal. The infrapharyngeal is so clearly exhibited in this form as to prove beyond doubt, I think, its distinctness as one of the main sclerites. In most forms the infrapharyngeal, while more or less present, is so intimately connected or welded with the pharyngeal as to appear a part of the latter. This has misled Nielsen and others.

It is worth while mentioning in a speculative way that the above seven main pairs of sclerites may represent the seven embryonic segments absent in the muscoid maggot, which have been inverted to form the skeleton proper of the maggot mouth and pharynx. The head in the most primitive insects is believed to be composed of seven segments and the abdomen of ten, the three thoracic segments bringing the total number to twenty. There are twelve segments in the muscoid maggot besides the pseudocephalon. Dr. C. Gordon Hewitt's admirable monograph of *Musca* may be studied with much profit in this connection.

What I have heretofore called the clypeus in the fly (Taxonomy, pp. 22-24) seems to be a part of the everted dorsal wall of the pharynx chitinized. The true clypeus is apparently the lower portion of what I have called the facial plate. The labrum seems to have projected itself forward, carrying with it the epipharynx to form the dorsal part of the haustellum, and in this way becoming widely separated from the clypeus. Into the space thus left there appears to have been everted the chitinous portion of the pharynx to form the rostrum of the proboscis, which attaches basally in front to the epistoma or anterior edge of the clypeus. The morphological sequence of the parts is thus lost when the proboscis is extended, but when the latter is retracted the rostrum is inverted to a semblance of its original morphological position.

It should be stated that the ultimate categories of genera, or those which will eventually be found most serviceable for taxonomic recognition and which I shall call GROUP UNITS, may be considered as generally equivalent to tribes in other groups of insects. Most of the series given in these addenda are to be considered as such, and for that reason I have given them the names of the genera dissected and studied.

The article by me in a recent issue of "Science" entitled "On muscoid and especially tachinid synonymy, may be profitably read in connection with this preliminary outline of results to date in the Muscoidea.