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THE TAXONOMY OF THE MUSCOIDEAN FLIES, INCLUDING DESCRIPTIONS OF NEW GENERA AND SPECIES

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History

When we review the history of the classification of any highly specialized group of insects, provided it has attained a considerable degree of popularity among systematists, we find it to exhibit a well-marked series of oscillations between the two extremes commonly known as bunching and splitting. This is especially true of the dipterous superfamily Muscoidea.[1]

The systematists of the eighteenth and nineteenth centuries, according to the work they did on this superfamily, mark alternate periods of action and reaction which fall conveniently into five historical epochs.

Linné, Fabricius, and Latreille must be considered the pioneers. The system they established was followed by their immediate contemporaries. Very few others concern us here, but Geoffroy erected the genus *Stomoxys,* and Scopoli, Rossi, and Panzer did some work on the superfamily. As a natural result of approaching a quite new subject, these early workers did not always grasp the real value of characters. Largely because of the comparative dearth of material in those initial days of systematic work, they did not clearly discern anatomical values, and hence did not recognize many characters whose worth has since been well established.

Meigen introduced a new epoch in 1804, and considerably increased the number of genera by splitting up the original ones established by his predecessors. Collections had become richer in mate-

[1] It is to be noted that the superfamily Muscoidea, as herein restricted, includes but a portion of the forms to which the name was applied by its author, Mr. D. W. Coquillett. As now restricted, it includes practically the old calyptrate Muscidæ minus the Anthomyiidæ, or the same group as that treated by Brauer and von Bergenstamm—Muscaria Schizometopa, exclusive Anthomyiidæ. The Muscoidea is here divided into five families, as follows: (1) Œstridæ, (2) Macronychiidæ (being a part of the old Dexiidæ), (3) Tachinidæ (including the old Gymnosomatidæ, Phaniidæ, Ocypteridæ, Sarcophagidæ, and most of Dexiidæ as subfamilies), (4) Muscidæ, and (5) Phasiidæ (including *Rutilia* and its allies).

rial by this time, and Meigen's attention was naturally drawn to the discovery of further characters that could be used in classification. He was indorsed and followed by his contemporaries, Olivier, Fallen, Say, Wiedemann, who adopted his genera without proposing new ones, except that the last-named author erected the single genus *Glossina* for the tse-tse flies. Duméril erected the genus *Echinomyia,* and Le Peletier de Saint-Fargeau the single genus *Prosena.* Meigen's best work was in genera. His descriptions of species were in many cases faulty. On the whole, however, he is clearly to be looked upon as an epoch-maker.

The first really intuitive student of the superfamily was Robineau-Desvoidy who, in 1830, introduced the third epoch and very greatly increased the number of genera, besides defining more or less natural taxonomic divisions for their reception. It must be understood that very considerable accumulations of material from the Americas, both North and South, had reached Europe during the early part of the nineteenth century, besides much material from the African, Oriental, and Australasian regions. To most of this Robineau-Desvoidy had access. Notable among the accumulations were the rich collection of the Count Dejean, which had been added to constantly by Latreille, and the quite extensive material secured from all parts by the Museum of the Jardin du Roi in Paris. Palisot de Beauvois, Saint-Hilaire, Bosc, and many others collected in the Americas, and various representatives of the Jardin du Roi in other parts of the world. Besides these, many European entomologists sprang up who began to do much more thorough collecting at home. Thus a comparatively great wealth of material in the Muscoidea was brought together from all parts of the world, both at home and abroad, which stimulated Robineau-Desvoidy to a detailed study of characters in this superfamily. His "Essai sur les Myodaires" remains to this day a monument to his very considerable grasp of Muscoidean relationships. His posthumous work (1863) can not be considered as affecting in any way the status of the "Essai."

Macquart, almost contemporaneous with Robineau-Desvoidy, but possessed of less discernment, bunched the latter's genera to a very considerable extent. However, it must be pointed out in defense of Macquart that he was eminently a general dipterist, while Robineau-Desvoidy was preëminently a specialist in the Myodaria.

Zetterstedt erected only two genera in the superfamily, and practically employed Meigen's genera for all of his work. Perty, Bouché, Guérin, and Bremi each erected a single genus in the superfamily.

Robineau-Desvoidy's system, founded largely on habits, was in a degree faulty and insecure. Attention should be called to the fact,

apparently long since lost sight of, that Robineau-Desvoidy originated the idea of including the Œstridæ with his Calypterata (although renounced in his posthumous work), and the Conopidæ with the Myodaria (Conopidæ not included at all in posthumous work). The founding of the now obsolete division Calypterata is also to be accredited to him, though it is to be noted that he did not include the Anthomyiidæ therewith. The latter family was included in that division by subsequent authors. In this connection, see Osten-Sacken for statement that the term "Acalypterata" was interpolated in Robineau-Desvoidy's posthumous work by the editors (Berl. Ent. Zeit., 1896, pp. 329, 335-6).

Róndani marked a fourth epoch beginning about 1850. He revised in large part the work of Robineau-Desvoidy, still further increased the number of genera, was altogether a very close student of relationships, and possessed a remarkably clear insight into the affinities of the Muscoidea, in which he was essentially a specialist. His system was followed to some extent by his more immediate contemporaries, but Schiner, with a fine grasp of dipterous characters in general and little conception of the needs of the Muscoidea, was especially active in bunching his genera.

Schiner was a splendid general dipterist, but the method of treatment adapted to other groups of Diptera fails when the attempt is made to apply it to the Muscoidea. That is where Schiner, Macquart, and all the other conservatists fell. And it is to be noted that these conservatists were always general dipterists. They tried to apply the same system throughout the Diptera, but the Muscoidea need a distinct method of treatment, as will appear further on in this paper under that heading. Even such conscientious students as van der Wulp, Loew, Osten-Sacken, Williston, and others, who followed Schiner largely, but were somewhat less conservative than he, nevertheless fell far short of reaching a requisite degree of radicalism in their views as to a proper treatment of this superfamily.

Others who entered the ranks during this fourth epoch, Walker, Bigot, Bellardi, Jaennicke, Thomson, Meade, von Roeder, Kowarz, Mik, followed Schiner more or less, adopting Róndani and Robineau-Desvoidy at times on certain points, and gradually increased the stock of genera as seemed warranted along more or less conservative lines.

Robineau-Desvoidy had divided the Muscoidea into many smaller groups which he called stirpes, corresponding more or less in value to our present subfamilies. These were not recognized by Róndani, who grouped all into six stirpes. Neither Robineau-Desvoidy nor Róndani were really adopted by Schiner, who recognized eight

stirpes, mainly founded, however, on certain of Robineau-Desvoidy's. Schiner thus largely adopted Robineau-Desvoidy's stirpes in those divisions which he did recognize, but bunched his genera along with those of Róndani, Robineau-Desvoidy's reviser. The eight taxonomic divisions adopted by Schiner generally obtained throughout the epoch.

Róndani's system, unlike Robineau-Desvoidy's, took little note of habits, and, while less detailed, was more secure from being founded primarily on external anatomical characters. But these characters were liable to misinterpretation in certain cases.

Brauer and von Bergenstamm inaugurated the present and fifth epoch in 1880, which is destined to hold out for a greater degree of radicalism than its predecessors. They approached the subject largely in a new way, greatly lessening the difficulties of classification in the superfamily by recognizing a large number of sections which correspond to the subfamilies and tribes of the present paper. At the same time, they greatly multiplied the number of genera, whereby they were able to present comparatively concise diagnoses of these, as well as of their sections.

They adopted Robineau-Desvoidy's plan of grouping the forms into many small divisions, but they did not feel bound, as did he, to adhere to any definite scheme of life habits for indicating taxonomic limitations. In the main their divisions were made on quite original lines. However, many of Robineau-Desvoidy's old stirpes are still recognizable, now more or less revised, restricted or enlarged, and they must be considered as the original foundation of our present subfamilies and tribes. Brauer and von Bergenstamm's characters were better chosen and represent a more exhaustive study of the subject, as would naturally follow from their having enjoyed the greatly superior advantages derived from marked increase in biologic progress since the time of Robineau-Desvoidy and Róndani, and access to the greatly enriched collections of material drawn from all parts of the globe.

Until quite recently Brauer and von Bergenstamm's system has been followed rather indifferently—in some cases enlarged upon, in some revised—by students of the group contemporaneous with them and continuing in the work since their time. The general trend of sentiment now, however, is strongly in their favor, recognizing, as it does, the necessity of a subdivision of the superfamily into many subfamilies, tribes, and genera, so as to allow of more careful and concise diagnoses. While it is true that a middle course between the two extremes of conservatism and radicalism is usually the best one to follow, the present superfamily furnishes a notable exception

to the rule in that it can not be successfully treated on other lines than what are to be considered as quite radical compared with the treatment accorded to other superfamilies in the order.

In this historical review, Robineau-Desvoidy, Róndani, and Brauer stand forth prominently as the greatest students of the Muscoidea that the world has produced. Each had a deeper insight into the peculiar relationships and affinities of the superfamily and a closer grasp of the subject as a comprehensive whole than any of his predecessors or contemporaries.

The following is a tabular arrangement of the five epochs, with the respective students who belong to each, including the approximate periods during which they were more or less active in work on the superfamily. The asterisk indicates those authors who established one or more genera. The plus sign indicates work continued to the present time:

EPOCH I (prior to 1804).

Redi, 1671–1712 (general insects).
Réaumur, 1738–1740.
Scopoli, 1760–1763.
*Linné, 1761–1766.
Poda, 1761.
*Geoffroy, 1762 (one genus—*Stomoxys*).
*Fabricius, J. C., 1775–1805.
De Geer, 1776.
Schranck, 1781–1803.
Herbst, 1789–1801 (general insects).
Rossi, 1790.
*Latreille, 1792–1805 (*Trichopoda, Bucentes, Hypoderma, Ocyptera, Œdemagena*).
Panzer, 1793–1809.
Baumhauer, 1800.
Illiger, 1801–1807 (general insects).

EPOCH II (1804–1830).

*Meigen, 1804–1830.
Schoenher, 1806–1817 (general insects).
Gyllenhal, 1808–1829 (general insects).
Dufour, 1809–1833.
Olivier, 1811.
Germar, 1813–1821 (general insects).
Fallen, 1814–1825.
*Clark, 1815 (one genus—*Cuterebra*).
Lamarck, 1815–1822 (general invertebrates).
*Leach, 1817 (one genus—*Gastrophilus*).
Say, 1817–1832.
*Duméril, 1819 (one genus—*Echinomyia*).
*Wiedemann, 1821–1830 (one genus—*Glossina*).
*Le Peletier de Saint-Fargeau, 1825 (one genus—*Prosena*).

EPOCH III (1830–1850).

*Robineau-Desvoidy, 1830–1863.
*Perty, 1830–1834 (one genus—*Diaugia*).
Haliday, 1832.
*Macquart, 1834–1855.
*Bouché, 1835–1847 (one genus—*Compsilura*).
*Guérin, 1835–1850 (one genus—*Formosia*).
*Zetterstedt, 1838–1855 (*Wahlbergia, Cinochira, Gymnopeza*).
*Bremi, 1846 (one genus—*Amsteinia*).

EPOCH IV (1850–1889).

*Róndani, 1850–1865.
*Walker, 1850–1866 (*Doleschalla, Schizotachina, Hammaxia, Saralba, Toroca, Zambesa*).
*Egger, 1856 (*Zelleria, Halidaya, Frauenfeldia, Microphthalma*).
*Doleschall, 1856 (*Spiroglossa, Megistogaster*).
*Brauer, 1858–1889.
*Bigot, 1859–1893.
Bellardi, 1859–1862.
*Meinert, 1860–1880 (one genus—*Philornis*, larva).
*Loew, H., 1861–1872 (*Stegosoma, Blæsoxipha, Euthera, Himantostoma, Phylloteles*).
*Schiner, 1862–1868.
*Jaennicke, 1867 (one genus—*Archytas*).
*van der Wulp, 1867–1903.
*Thomson, 1868 (*Glaurocara, Tricharæa*).
*Osten-Sacken, 1877–1902 (one genus—*Urodexia*).
*Pokorny, 1880–1896 (*Parastauferia, Sarromyia, Steringomyia, Trigonospila*).
*Meade, 1881–1899.
*von Roeder, 1881–1896.
*Kowarz, 1882–1894 (*Ctenocnemis, Mikia*).
*Mik, 1882–1901 (*Crossocosmia, Zygobothria, Microtachina, Microtricha*).
*Williston, 1886 + (*Melanophrys, Acroglossa, Talarocera, Dichocera, Melanodexia*).

EPOCH V (1889 +).

*Brauer, 1889–1899.
*von Bergenstamm, 1889–1894 (co-author with Brauer).
*Portschinsky, 1890–1902.
*Schnabl, 1890–1902.
*Giglio-Tos, 1891–1897.
*Wachtl, 1891–1895.
*Townsend, 1891 +
*Girschner, 1893–1901.
*Meunier, 1892 +
*Strobl, 1892 +
Bezzi, 1892 +
*Pandellé, 1894 +
Becker, 1894–1901.
Snow, 1895.

Corti, 1895–1897.
*Austen, 1895 +
*Coquillett, 1895 +
*Hough, 1898 +
Kertész, 1899 +
Robertson, 1901 +
*Bischof, 1901 +
*Grimshaw, 1901 +
*Hendel, 1901 +
*Hutton, 1901 +
Villeneuve, 1902 +
Wainwright, 1902 +
*Speiser, 1903 +
*Johnson, 1903 +

Treatment

Speaking of the Muscoidea, Dr. Williston has said: "Species, genera, and even families, show such slight plastic or colorational differences that only the most patient study will define their limits. At the present time there is a decided tendency to base the classification of even the higher groups upon apparently trivial characters. Most naturalists have long since abandoned the idea that genera, or even families, represent anything but the conveniences of classification, and the recent writers on this family are probably right in seizing upon any characters that will satisfactorily group the vast number of species irrespective of their relative values. But it is very probable that, in the proposal of so many genera in such rapid succession, many characters have been employed which future research will show to be entirely inadequate. We yet know very little about individual variations in this family, or the real value of many of the characters now used. The absence or presence of a bristle may be found to represent a group of species, but we should first learn how constant the character is in species. * * * Seriously, is not the stock of Tachinid genera sufficiently large for the present? Would it not be advisable to study species more before making every trivial character the basis of a new genus?"—Insect Life, vol. v (1892-3), pp. 238-40.

These words, from the leading authority on American dipterology, written some fifteen years ago and shortly after the appearance of the first two instalments of Brauer and von Bergenstamm's work, may advantageously be taken as a text for some pertinent considerations at this time.

While the great multitude of forms in the Muscoidea seems at first sight chaotic and formidable, the student soon perceives that standing forth from the general mass there occur certain well-

marked generic types, such as *Œstrus, Cuterebra, Dexia, Macronychia, Phasia, Trichopoda, Meigenia, Masicera, Phorocera, Tachina, Gonia, Belvosia, Plagia, Thryptocera, Phania, Œstrophasia, Miltogramma, Pyrrhosia, Ocyptera, Gymnosoma, Echinomyia, Hystricia, Dejeania, Sarcophaga, Calliphora, Musca, Stomoxys, Glossina,* and at least a hundred others. These types correspond in value to the more settled genera of the older superfamilies, where intermediate forms are largely lacking. In the present superfamily, however, it is quickly seen that massed in between these many typical forms are numerous intermediate ones, which collectively vary in all directions and combine certain of the characters of the various types. These intermediates are the bridges for the passage of genera, so to speak—the inevitable precursors and resultants in the process of the evolution of genera. The same holds good of species. Numerous intergrades are found to group naturally around and between the various species. That these intermediates and intergrades are present is due to the fact that the Muscoidea are now—at the present day, geologically speaking—in their period of greatest prolificacy, a period characterized by a condition of multiform development. After the lapse of a great space of time, many of these intermediate forms will have dropped out of the struggle, leaving a residue more or less well defined from each other and thus much more amenable to taxonomic treatment. This is now the case with the older dipterous superfamilies, which have long since passed their period of greatest prolificacy.

It should be explained that the term "intermediates" is used to designate forms of generic rank or higher, and "intergrades" to designate those which are only of specific rank. The further term "intergradants" may be employed to designate individuals which connect species, but upon which it is not practicable to bestow names.

The Muscoidea are of very recent evolution—in fact, their evolution is still going on. Here are species, genera, and families in the making. The whole superfamily is one enormous assemblage of thousands upon thousands of forms distinguishable from each other by only slight differences and exhibiting characters which intergrade in all directions. That such a multitude of closely similar forms is exceedingly difficult to classify goes without saying. These forms can not be classified in the ordinary way, but demand special treatment adapted to the conditions.

The key to the whole situation, when it comes to methods of taxonomic treatment in this superfamily, is that we have here the task of defining not only the numerous well-marked types corresponding to the existing forms in the older and less specialized dipterous

superfamilies, but also a great mass of the intermediates, intergrades, and intergradants that have resulted during the long-continued process of the evolution of these types.

Brauer and von Bergenstamm recognized these conditions in the Muscoidea and treated the superfamily accordingly. As being highly apropos of this subject, the following remarks are quoted from the translation of these authors' Introduction (published in *Psyche*, vol. VI, pp. 313-16, and 329-32), the whole of which can be studied with much profit:

"It is a fundamental principle in the development of the whole dipterous stock that, from the lowest (*Orthorrhapha nematocera*) to the most differentiated or highest (*Cyclorrhapha schizometopa*), the actual value of the genus, and of the systematic series generally, becomes less and less. This proposition seems applicable to all groups of animals—in all cases the most recent forms are more closely related and more difficult to characterize than older ones. . . . The cause lies in the numerous intermediate forms occurring in a group of animals which has just reached its period of greatest prolificness."

As the same authors point out farther along in their Introduction, it is absolutely futile to attempt a classification of these flies along any other lines than a separation into many comparatively restricted categories. The authors are also correct in maintaining that the classification of all animals must be based on the entire development—not on the adult alone. The characters of the imago are most important for genera and species; those of the earlier stages are most important for families and higher categories, even up through orders and classes. In studying early stages, it may be pointed out that some characters will occasionally serve for generic separation, but much judgment must be exercised in deciding which characters are of value for this purpose, since conspicuous ones may in some cases possess less than generic value. Such are those of special adaptation to peculiar conditions of life.

The fact should be recognized, as suggested in the opening text to this chapter and emphasized in the quotation just given, that generic values are not necessarily uniform throughout the organic world. It is fallacious to attempt to set a standard whereby plant and animal genera, or animal genera alone, shall be gauged by a certain fixed measure of difference. This holds good even in different superfamilies of the same order or suborder of insects. The demands of the group in hand must be considered in each case. A superfamily in the multiform stage of development, contingent upon its being still in process of evolution, demands a less generic value

than an older and well established superfamily whose forms have become fixed through a long period of conformity to their environment. If this be not conceded, it becomes impossible to treat the younger superfamilies by any satisfactory system.

It will be alleged by some that such plan will result in multiplying genera unduly. There is, however, no doubt that the course adopted is warranted by the conditions. This conclusion has been reached after full and mature deliberation. The only possibility of successfully systematizing the superfamily, so that its myriads of forms can be designated definitely by name, lies in the recognition of genera founded upon comparatively slight characters—slight compared with those recognized as the standard in the older and less specialized superfamilies. The differences between genera are less pronounced in the more specialized than in the less specialized groups. All are genera, and of equal value systematically; but, as already pointed out, they can not be measured by a standard gauge.

The writer has always contended that a proper treatment of the Muscoidea demands the definition of smaller categories and more carefully restricted genera (see *Psyche,* vol. VI, p. 313, Sept., 1892). As the characters of the early stages are investigated, more light will be thrown on higher divisions in the superfamily. Such a vast assemblage of closely related forms is not amenable to separation, in the adults, into divisions conceived on lines of mathematical precision. Any system of classification must become more or less artificial if it attempts, in the presence of intermediates and the absence of a knowledge of early-stage characters, to mark off precise lines of division between categories of higher value. When the intermediates are lacking, or largely lacking, it becomes a comparatively easy matter to fix the lines of demarcation, and the system appears extremely natural simply through the absence of the immense mass of intermediate forms that at one time existed. But when these numerous intermediates and intergrades are extensively present, any attempt to apply an arbitrary system of classification to the group can not but result in disaster. A system can be thoroughly natural only in so far as it indicates natural types of families, subfamilies, tribes, and genera, and groups the intermediates and intergrades around them. Properly conceived and executed, such a system is the only natural one, since it must accord with the facts as known. At the same time the fact must not be lost sight of that taxonomy is at best merely a means to an end, and does not exist in nature. It is artificial in its original conception, because it is practically intended to ignore numerous steps in the development of life—steps that have been lost during the evolution of forms now existing, and

which, if still present, would make a taxonomic system simply impossible.

Taking these points into consideration, there is evidently but one course open. Draw lines of demarcation between the best marked types, and let the others, with their respective coteries of intermediate forms, fall in whatever divisions a preponderance of their characters in each case indicates. Definitions of characters for the higher divisions can not be exact, because the forms themselves in nature do not fall into well defined divisions.

Such a system as outlined would recognize typical forms as genera and species, and would then intercalate necessary additional genera and species for the convenient reception of the intermediate forms, which group around the typical ones and connect them with each other. The one great difficulty here will be to arrive at the true relationships of the intermediate forms, for their affinities are often so complex that it is very hard to decide with what genus or species they are most closely related. The real truth will ultimately be attained only after many years of continued research into their ontogeny, combined with an exhaustive study of the geological history of the superfamily.

What have been called typical forms, both genera and species, it is proposed to term *typic*. The additional genera and species to be intercalated between the typical ones it is proposed to term *atypic*. We will thus have a system of *typic genera* and *atypic genera* for the reception of typical genera and intermediates respectively, and *typic species* and *atypic species* for the accommodation of the typical species and intergrades respectively. This scheme accords with the facts, which do not conveniently admit of the employment of subgenera and subspecies. The latter concepts are here inapplicable on account of the nature and intricate relationships of the forms. To include subgenera, the genera would have to be too loosely characterized. Furthermore, this scheme preserves the binomial nomenclature, which is highly desirable. It can be designated in each case whether a genus is typic or atypic, if this is found desirable.

All the more primary divisions—those above the subfamilies, up to the very subordinal divisions themselves—can at present be only imperfectly characterized and defined. Here is where aid will be derived from early stage characters, when these become known. Even the Cyclorrhapha and the Orthorrhapha[1] can not be sharply

[1] The writer is aware that Osten-Sacken claims there is a clearer line of separation between the Nemocera and Brachycera than between the Orthorrhapha and Cyclorrhapha, but this is outside our subject.

differentiated from each other in the adults on account of intermediate forms. Less and still less grows the clearness of limitation as we descend through the series, sections, subsections and superfamilies to the families. Limitations clear a little in the families, but it is not until we get to the subfamilies and tribes that we can, from a study of the adults, begin to draw moderately well marked lines and set fairly concise limits. A moderate degree of conciseness is possible here only because we are now concerned with divisions sufficiently low in the taxonomic scale to allow the exclusion of refractory and disturbing elements, and if necessary put them alone by themselves. Many subfamilies and tribes are seen to stand out as natural groups of genera.

At first sight it would appear advisable to ignore the higher divisions, and drop at once to the very considerable number of subfamilies and tribes necessary to the system outlined. But it evidently serves a better purpose to recognize these higher categories, however much their boundaries may be obscured by connectant forms. They are certainly present, and their existence should not be lost sight of. Therefore they should be retained in any taxonomic system as indicating steps in the evolution of these flies. They may be kept somewhat in the background, with the caution that they can not be clearly and concisely defined until the ontogeny of the intermediate forms is known.

Many genera stand more or less apart and do not fall actually into any of the subfamilies. Very restricted groups of such genera, which may be termed refractory on account of either their complex relationships or their apparent neutrality with reference to the various subfamilies, will best be treated directly as tribes, without reference to any particular subfamily.

Some few genera will prove to be quite isolated, and yet not entitled to subfamily or tribal rank. A final system should aim at the definition of as many well-marked subfamilies and tribes as possible to concisely characterize, and the consequent reduction of the number of these isolated forms. A comprehensive table can thus be prepared, including the subfamilies, the non-referable tribes, and the non-referable genera in one synoptic treatment, which will be convenient for general use. Separate tables can follow defining the genera within each subfamily and non-referable tribe. No attempt should be made to force refractory genera into any subfamily or tribe where they do not fall naturally, or any tribe into any subfamily where it does not clearly belong, or to antagonize natural affinities in any way, or to combine refractory forms in one heter-

ogeneous tribe or subfamily. The refractory elements should rather be left to stand alone.

In such manner as the above will it be possible to work out a serviceable system of classification, which will indicate, so far as may be, the true relationships, and at the same time preserve approximately the relative values of taxonomic divisions in the Cyclorrhapha.

A very important point remains to be noticed: What is a species in this superfamily? The preceding remarks on intermediate forms apply especially to the higher divisions, but are also largely true of genera and species. The difficulties as to genera can be practically overcome by the erection of a sufficient number to accommodate all the intermediates. But who can tell what is a species in nature, and especially what is a species in the Muscoidea? It is clear that we must have a definition that will answer to the term. In large assemblages of insects, where intergrades and intergradants have not been lost, there is no such thing as a species in the generally accepted sense. No sharp specific distinctions can be drawn in such cases. The term is a necessary conception in taxonomy, however, and it is to be noted that the only reason for its employment is the necessity for being able to distinguish between assemblages of individuals that are unlike. Therefore it seems clear that the only safe course to pursue is to give a name to every assemblage that can be distinguished from other assemblages.

It is proposed to use the term "species" in a well-restricted sense. Typic species are already explained. The term atypic species will be used for recognizable assemblages of individuals grouping around typic species. The term "forms" may be used interchangeably as referring to either or both.

When two atypic species are connected by intergradant individuals, the former should be given names and the latter referred to as intergradants between the two atypic species. A few words of descriptive matter will serve to fix practically the exact taxonomic position of these intergradants. Such a course will afford students of bionomics an opportunity to attain some degree of definiteness in their investigations. As the names now stand in the Aldrich Catalogue, this element of definiteness is totally lacking. Many distinct forms are bunched under one name on almost every page. Absolute exactness is impracticable in this phase of nature, where variation through pressure of environment is constantly at work in the evolution of new forms. But a reasonable degree of definiteness is possible of attainment. So long as we can refer by name to recognizable forms, we may be certain that we are not going wrong. Such forms

should not be bunched merely because it is difficult to distinguish them. If it is possible to separate them, they should be separated.

The conviction is constantly growing among biologists that we really do not comprehend species. Multitudes of insect forms have been confused under one specific name since systematic entomology began. The scientific concept of the invertebrate species is gradually growing less vague and more restricted. There is practically no doubt that in most groups of insects, the Coccidæ excepted, there are many times more forms that will eventually be termed "species" than have heretofore been recognized. Every year new results obtained from a study of the early stages of insects force this conviction upon us. (The Coccidæ probably form an exception. Mr. J. G. Sanders is authority for the statement that the species have been largely split on characters pertaining to different ages of the same stage.) Without doubt, bunching is infinitely more harmful to a system of classification than splitting. Splitting, even if injudiciously done, does not give rise to actual error, but bunching produces all kinds of error in the bionomic literature, which errors, moreover, are irremediable except through a restudy of the specimens originally referred to. It goes without saying, however, that forms can be properly separated only on constant structural characters pertaining to the same age or stage of development, and on color, form, and size only when such are known to be constant. A plea is herewith entered for judicious splitting,[1] up to the limit of practicability. A reasonable degree of conciseness in the designation of forms of insects is absolutely unattainable by any other means.

A word is not out of place here bearing upon the causes of variation which give rise to vast multitudes of forms during the period of greatest prolificacy of a group in any order of life.

Mr. W. L. Tower, in his paper on *Leptinotarsa* (Carnegie Institution of Washington, Publication No. 48), has demonstrated that variation is not inherent in the germ plasm, but is invariably induced by external stimuli acting thereon. The demonstration consisted of several experiments in which the stimuli were directly applied to pregnant females of *Leptinotarsa*, so as to reach the germ plasm within the contained ova. This one point is by far the most important contribution to science that the author makes in the whole of his long and highly instructive paper. All variations are directly caused by the action of external stimuli—such as heat, humidity,

[1] This term is adopted in a serious sense because it is both apt and expressive. Splitting can be accomplished only along lines of formation or natural cleavage, and this is true of the proper division of taxonomic groups.

atmospheric pressure, food, etc.—in other words, by the pressure of environment, which means all stimuli taken together and acting together.

It is thus seen that climatic or meteorologic conditions are potent factors in the evolution of forms of life, and that as a rule one form does not inhabit two widely different life zones or areas. Few, if any, forms inhabit both temperate and tropical regions, or both humid and arid regions. The external stimuli natural to the different zones and areas result in the modification of forms coming within the sphere of their influence, and the consequent production of new forms. Thus the progeny of individuals of one and the same form, spreading gradually through areas where they become subjected to new sets of stimuli, are gradually differentiated into distinct forms through the pressure of environment. Dr. Merriam's exposition of this law in his address before Section F of the American Association for the Advancement of Science, at its 55th meeting (Proc. Am. Ass. Adv. Sci., 1906, pp. 387-9), is an admirable one, and can be studied with much profit. His observations, as there given, agree perfectly with the results of the writer's studies in Diptera. For instance, the arid and humid regions of North America will be found to possess very few species in common. These very different life areas are divided and subdivided by temperature as we go north or south, or ascend above sea level, and again and again subdivided by various climatic and other environmental factors. The result is many separate life areas, more or less restricted, each of which exhibits a distinct stamp of environment. Intergradations occur along the peripheries of the ranges of closely related species, when such lie contiguous, as they often do. These intergradants must not be confused with the normal specimens of the form as exhibited throughout the more central portions of the area of range. That the intergradants occur between two such forms does not invalidate the distinctness of the forms themselves.

It may safely be stated as a theorem in bionomics that, given an arid area and a humid area contiguous to each other, both originally stocked with individuals of the same form—whether of Diptera or any other order of life—the descendants of this form will not remain identical in the two areas throughout any considerable period of time. The theorem may be enlarged to include temperate and tropical contiguous areas, and many divisions and subdivisions of these and of the arid and humid areas as well. The resultant differentiation is brought about by dynamic variation, incited by the respective sets of external stimuli acting on the germ plasm of the ova con-

tained within pregnant females of the form, already referred to as demonstrated by Tower.

A careful study of these factors and of the results produced by them demonstrates the fallacy of the idea that forms from the north Atlantic coast region of the United States and the south Gulf coast region of Mexico are identical. In other words, forms originally described from Vera Cruz are not to be identified in Massachusetts material. Likewise, forms from arid regions are not to be identified in humid region material. Furthermore, European species are not to be identified in American material, except in the few cases of forms that have been imported through the agency of man. There exist today practically no Muscoidean forms common originally to Europe and North America. The Muscoidea did not originate from circumpolar stock. The forms that immigrated to northern America from Eurasia during the warm periods that existed in the subarctic region in interglacial times have long since given rise to new forms, and no longer persist in their original state.

There are certain more or less cosmopolitan flies, such as *Musca domestica, Stomoxys calcitrans, Lucilia cæsar, Calliphora erythrocephala*, and others, which find their natural environment in the wake of man. These are not so amenable to the above factors, but even they show some effects of their agency. A considerable number of such species doubtless accompanied primitive man in his wanderings through various parts of the earth. Other species are of comparatively recent dispersion through commercial agencies. Both classes have been involuntarily spread by man. The detection of the second class calls for extremely careful study and fine powers of perception. Still another and very recent class has been purposely spread by man for economic ends.

A word may be said as to the difficulty of distinguishing between many of the distinct but closely similar forms that occur in the Muscoidea. While many of these forms that closely resemble each other do so by virtue of their close relationship through common origin, it is evident that others of more diverse origin have developed a close resemblance through counterfeitism[1] attained by means of natural

[1] The writer herewith proposes a change from the use of the words *mimic, model,* and *mimicry*. The terms "mimic" and "model" have nothing, except usage and priority, to commend them. "Mimic" is exceptionally faulty, and does not nearly convey the intended meaning. In the strict sense of the word a mimic is one who, by sound or action, imitates another. The word does not imply any idea of form, color, or size. The word "counterfeit," however, embodies the full concept. Again, "model" does not carry the idea of size, and in an art sense only partially that of form; moreover, it is not necessarily

selection and the pressure of environment. This may be termed convergent evolution. Somewhat similar are cases of parallelism, or recurring types of structure in nowise related to one another, which are to be explained by use and adaptation to external conditions. A thorough study of larval and puparium characters will determine such cases beyond a doubt, but in many instances an intimate knowledge of the adults will enable one to separate these forms quite accurately. Parallel series in the adult of forms of common origin will usually show their distinctness very readily to the experienced eye without a lens. In this way the writer has often made a preliminary arrangement of much material, which subsequent study demonstrated to be correctly separated into distinct forms, many of them so closely resembling each other that they were extremely liable to be confused. A very serviceable guide in distinguishing between forms of common origin is the character and color of the pollen, which is present to a greater or less extent in all the forms. This, strange to say, is extremely constant throughout series of individuals of the same form and the same sex. In those forms which possess golden pollen on the head, the male as a rule has the golden shade more pronounced and extensive than the female. The color of the pollen of thorax, and especially that of abdomen, is very constant in both sexes. A slight difference in the shade of color of the abdominal pollen, such as that between a silvery cinereous and an ashy cinereous, will frequently serve to correctly separate closely related but distinct forms which might otherwise be confused. It is almost needless to say that reference is here made only to fresh and well-preserved specimens. Greased specimens must be restored before attempting to place them.

Illustrative of convergent evolution and parallelism, in which adults of two or more forms closely resemble each other through causes other

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imitated, often has no relation to color, and may even be a miniature or other representation and not the original at all. "Pattern," on the contrary, means the original, to be imitated as to form, size, and color, strictly speaking, and is the term used in mechanics in the exact sense of our concept.

By using these terms—counterfeit and pattern—we can adhere strictly to the significance of our diction. We would thus speak of an edible *counterfeit* (species) of an inedible *pattern* (species), which latter has been unconsciously and involuntarily adopted by the former as a subject for imitation, impelled thereto by certain accruing advantages. Both words express the sense exactly, and both can be used without change as either nouns or adjectives. Derivatively, instead of the objectionable term "mimicry," we have the very suggestive and thoroughly appropriate name *counterfeitism* to apply to a subject of rapidly growing importance. It would seem that neither priority nor usage have any claim to consideration in a case of this kind.

than those implied in close relationship, the following is an excellent case in point among the Coleoptera. Mr. W. Dwight Pierce makes the statement that three species of *Anthonomus* (*A. nigrinus, æneolus,* and *albopilosus*), which breed in the flower-buds of *Solanum* spp. (*S. carolinense, elæagnifolium, rostratum,* and *torreyi*) in Texas, resemble each other so closely in the adult that they are often confused by experienced coleopterists. Yet Mr. Pierce, who has studied the early stages of these species, has found that the anal characters of the pupæ serve to readily distinguish them. *A. æneolus* and *nigrinus* belong in the same group, are distinguished in the pupa by a slight difference in the proportions of the posterior terminal structures of the anal segment, and in the adult only by color. But *A. albopilosus* belongs in a distinct group, is inseparable in the adult except by leg characters, and markedly different in anal characters in the pupa. *A. albopilosus* is thus a case of convergence toward *æneolus* and *nigrinus*, which two are closely related forms. It should also be mentioned that *albopilosus* has been found recently breeding in great numbers in buds of *Croton* spp. Dr. Chittenden is authority, however, for its former breeding in *Solanum* spp.

The reasons for such convergent evolution or parallelism are often difficult to ascertain and are outside our subject. This case is introduced from the Coleoptera merely as paralleling certain very similar ones in the Muscoidea. For example, the species *Achætoneura datanarum, A. promiscua,* and *Parexorista futilis* seem to form a group similar to the above species of *Anthonomus*. The first two are closely related, and the third furnishes a case of convergent evolution in their direction. All three forms are entirely cinereous pollinose, have the anal segment brassy, and the parafrontals and parafacials golden pollinose. (*Achætoneura frenchi* has a different facies, but has been confused with the first two.)

Similar groups will be found in the genera *Tachina, Masicera, Phorocera,* etc. Another group is probably exemplified in *Myiophasia* spp., *Phasioclista metallica, Ennyomma clistoides,* and certain other species.

Such conditions as the above explain why specimens of tachinids looking strongly alike and bred from the same caterpillar, perhaps issuing on the same date, are at times found to belong to different forms and even to different genera. In such of these cases as are due to convergent evolution and parallelism, the larvæ and puparia will be found to exhibit better differential characters than the adults. No work connected with the taxonomy of the Muscoidea could more

solidly advance our knowledge of the subject than the careful and painstaking study and rearing of the early stages. It is a most promising and inviting field, and one whose problems are intimately woven with subjects of broad biologic significance.

It may be pointed out that the well-known promiscuity of oviposition with reference to hosts in the Muscoidea is another evidence, and a necessary result, of the geologically recent evolution of the superfamily. The Microhymenoptera are of far more remote evolution, as evidenced by the fact that each genus is restricted to a group of hosts. Microhymenopterous parasites bred from host larvæ belonging to different families may safely be pronounced offhand to belong to different genera. This demonstrates a fixed habit of oviposition that has endured through a long period of time. No such fixed habit is to be found among those Muscoidea parasitic upon lepidopterous larvæ, or among any of the superfamily except the Œstridæ.

It has been alleged that much of the so-called synonymy in this superfamily, as it stands in the Aldrich Catalogue, is due to a misguided erection of species on stunted specimens developed from underfed larvæ, through a lack of acquaintance with the breeding habits of the species. It is well known to all students of the Muscoidea that the females sometimes, if not frequently, carry the act of oviposition to an extreme, ovipositing upon larvæ that are already overstocked with eggs. This has been observed and recorded in a number of instances. It has been observed at the Gipsy Moth Laboratory of the Bureau of Entomology in Massachusetts that tachinids would oviposit at times upon larvæ covered with eggs, while masses of unstocked larvæ were abundant close by. Some of the unmolested larvæ were dissected and found unparasitized. This, moreover, was in the open, outside the breeding cages. However puzzling this may seem, it is certainly unsafe to draw conclusions as to habits from observations made in the gipsy moth area, since the equilibrium of the various forms is in a state of extreme unrest. This is due not only to the enormous increase of comparatively newly introduced host elements in the fauna, but also to the more recent introductions of new parasitic species, both tachinid and microhymenopterous. These agencies have so disturbed the balance between species that the resultant conditions have become highly artificial. Similar conditions could hardly arise except through man's interference. Had the gipsy and browntail moths and their parasites spread into Massachusetts from a contiguous area, the change of equilibrium between them and the resident fauna would

have taken place more gradually, and the balance between species would not have been so suddenly upset. It is not at all likely that tachinids oviposit so heedlessly as above observed, provided they are subjected to thoroughly normal conditions.

As far as the recognition of stunted and underdeveloped individuals of a form is concerned, there is rarely any difficulty provided one is familiar with the characters. The stunted specimens always exhibit practically the same characters, and if there is any exception the true status of a specimen is quite recognizable.

Characters

The following outline of the construction and development of the head capsule in *Calliphora,* principally drawn from Lowne (Anat. Blowfly, pp. 114-16), forms a fitting introduction to a consideration of characters, inasmuch as those of the head take precedence over all others in the taxonomy of the Muscoidea.

The Metacephalon comprises the segmented *post-oral* portion of the head.

The Paracephalon, which is formed of the two *paracephala,* or two *lateral procephalic* lobes of the nymph, comprises the *pre-oral* portion of the head.

The paracephala bear the compound eyes and antennæ.

They are united in front and below and form the epistoma and labrum.

The portion of the *facial paracephalon* behind the epistoma shows three distinct parts. These are two bladder-like swellings, the *anterior* and *posterior cephaloceles,* and the *antennal ridge* between them. The last is developed by a process from each of the two lateral procephalic lobes.

The anterior and posterior cephaloceles correspond with the thin portion of the blastoderm which intervenes between the two lateral lobes or paracephala.

The posterior cephalocele is the forehead (Vorderkopf) of the German embryologists. It bears the ocelli, and the front is developed from it.

The anterior cephalocele develops into the facial region.

Behind the front there are two plates which extend forward from the metacephalon; these form the *epicephalon (parafrontal-occipital ridge).*

That portion of the procephalic lobe which lies in front of the antennal ridge unites with its fellow, and curves downward and backward over the mouth to form the prefacial region.

When the posterior cephalocele is closed by plates of chitin, these are the triangular median epifrontal, and the two frontals (frontalia or frontal vitta).

The frontal sac or *ptilinum* consists of a great part of the posterior cephalocele withdrawn into the interior of the head between the frontals and the antennal ridge.

The *lunula* is thus an anterior chitinized portion of this sac or ptilinum.

The anterior cephalocele is the vesicle of the olfactory lobes.

The posterior cephalocele is the vesicle of the cerebral hemispheres and their median ventricle.

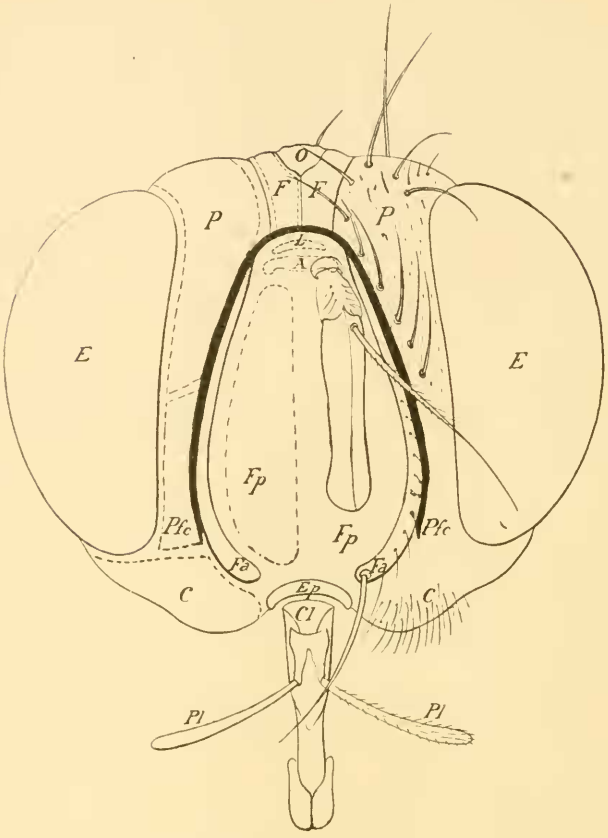
In the nymph the median parts of the head capsule lie in a deep cleft between the two lateral lobes or paracephala, and in close proximity to the ganglia with which they correspond, so that the head appears to be open on the median line. Sections show this to be a deep infolding of the inner edges of the paracephala (Lowne).

The two paracephala (two lateral procephalic lobes), having united on the median line, become the paracephalon of the imago.

The paracephalon is opened transversely by a horseshoe-shaped suture running up from the cheek border on each side and passing between the antennal ridge and the frontals, bridged by a widely distensible membranous tissue (the ptilinum), on the forward median portion of which is the lunula somite. This suture ends on each side at the *check groove*, which is formed in the integument by the mechanical strain on it when the suture is opened to thrust forth the ptilinum. The suture may be properly called the *paracephalic suture*, but the writer prefers to employ the term *ptilinal suture*.

The following is a detailed statement of the external anatomical parts to be studied in the superfamily Muscoidea, arranged primarily in the order of their importance, and severally in the order of their relative position. The characters of the superfamily are to be found in the various features exhibited by these anatomical parts, and are pointed out so far as possible under each head. The parts preceded by 1) afford characters of family, subfamily, tribal, and partly generic value, and those preceded by 2) characters of mainly generic value. The terminology is made to conform so far as possible to that already in use. New terms are introduced only in such cases as demand their use for reasons of clearness, conciseness, and permanence, and for such few parts as had no name and afford characters of taxonomic value.

The figure here introduced is diagrammatic and intended to show the main sclerites of the front aspect of the head, the characters afforded by which take rank over all others for taxonomic use within this superfamily.



Front view of head of a Muscoidean fly (half in diagram), much enlarged.

(Original, from drawing prepared by the Bureau of Entomology.)

The heavy black line indicates the *ptilinal suture*. O = *Ocellar plate*. FF = *Frontalia*. PP = *Parafrontals*. Pfc Pfc = *Parafacials*. CC = *Cheeks*. EE = Compound *eyes*. L = *Lunula* (postfront of larval insects). A = *Antennal ridge* (mesofront of larval insects). Fp Fp = *Mesofacial plate* (plus facialia equals prefront of larval insects). Fa Fa = *Facialia*. (Parts from lunula to facialia both inclusive taken together constitute the homologue of the *front* of larval insects.) Ep = *Epistoma*. Cl = *Clypeus*. Pl Pl = *Palpi*.

EXTERNAL ANATOMICAL PARTS AND CHARACTERS

(Head)

1) Ptilinal suture (through which is protruded the *ptilinum* of Robineau-Desvoidy) evenly rounded and widened above, narrowed above, subangular at top; its sides parallel, divergent, convergent; its termini high or low where they join the cheek grooves; position of its termini with relation to lower eye-border, epistoma and vibrissal angles.

[Before *ptilinal suture*]

1) PTILINAL AREA (area enclosed by ptilinal suture = *facial depression* of descriptions plus *antennal somite* plus *lunula; front* of Berlese) of what form, width above and below compared with adjacent parts of parafacials and parafrontals.

1) FACIAL PLATE (*clypeus* of Brauer and von Bergenstamm; *face, facial plate, mesofacial plate* of Lowne plus *epistoma; facial depression* of authors, *prefront* of Berlese, *transverse impression of face* of Hough—in each case minus *facialia* and plus *epistoma*) produced and swollen in middle like the bridge of the nose, merely swollen nose-like below, tube-like, projecting forward in profile below, flat, even, elongate, reaching almost to lower margin of head, extending obliquely downward and posteriorly, reaching straight down between vibissal angles, widened below same; shortened in front view, ending high above lower margin of head; widened below, oval, triangular, comparative width above and below, narrowed high or low by the facialia or by the vibrissal angles.

1) MESOFACIAL PLATE (do. of Lowne; *facial plate* minus *epistoma*).

1) FOSSÆ OF FACIAL PLATE (*foveæ* plus *foveal sinuses*) long, short, wide, narrow, deep, shallow, curved, straight.

2) FOVEÆ (*foveæ* of Robineau-Desvoidy; *antennal grooves* of descriptions; simply depressions in the *facial plate*) deep, shallow, elongate, short, double, single, and confluent.

1) FOVEAL SINUSES (more or less linear grooves which in certain cases form outlets of the *foveæ* anteriorly) linear, widened, deep, faint, convergent, divergent, etc.

2) FACIAL CARINA (*keel* of descriptions) present, absent, developed only above, weak, strong, high, sharp, knife-like, thin, thick, flattened, rounded, widened, canaliculate or furrowed on its median line, or simple.

1) FACIALIA (*facialia* of Robineau-Desvoidy and Osten-Sacken; *facial ridges* of descriptions; *facial edges of paracephalon* of Lowne; *Vibrissenleisten* of Brauer and von Bergenstamm; *vibrissal ridges* of Hough) parallel, gradually convergent below, short, long, bare, ciliate, narrow, sharp, widened, flattened, divergent, or absent.

1) FACIAL BRISTLES (those on *facialia; Vibrissen* of Brauer and von Bergenstamm) ascending less than half way on facialia, or half way, or to point opposite lowest frontals, or nearly or quite to base of antennæ; in one or two rows, bushy, in irregular position, short, weak, long, represented by many rows of fine hairs, normal with hairs among the bristles, only one or two above vibrissæ, or wholly absent.

1) VIBRISSAL ANGLES (*Vibrissenecken* of Brauer and von Bergenstamm; angles or corners where the *facialia* and *peristomalia* meet) pronounced, weak, high above the lower margin of head, set low, rounded, sharp, or absent.

2) VIBRISSAL PAPILLÆ (*Vibrissenwülste* of Brauer and von Bergenstamm; sometimes present at *vibrissal angles*) prominent, pronounced, flattened, weak, inconspicuous, or absent.

1) VIBRISSÆ (the two longest or strongest bristles, one at each *vibrissal angle; Vibrissen* of Brauer and von Bergenstamm) approximated, widely separated; their insertion on, close to, well removed from the oral margin, or on, close to the under margin of the head, or on the upper edge of the oral margin when this is turned up and broadened, or on or near end of facial plate,

on a level with uppermost front edge of oral margin, or above or below same.

1) Peristomalia (*lateralia* of Robineau-Desvoidy; peristomal ridges, the ridges on lower edges of *peristomæ* or *cheeks*, extending to *vibrissæ*) with one or many rows of bristles, extending how far up; parallel above oral margin, divergent, convergent; parallel, divergent, convergent posteriorly below oral margin; effect on epistoma.

2) Peristomal bristles (those on *peristomalia*) strong, weak, in one or more rows, or few and with row of hairs.

1) Epistoma (*epistoma* of Rob.-Desv.; *Mundrand* of Br. and v. Berg.; the portion of *facial plate* below *vibrissal angles* and enclosed between the *peristomalia*, its point of junction with the *mesofacial plate* being indicated by the *vibrissal angles*) projecting nose-like, prominent in profile, retreating, set back or removed, produced downward or anteriorly, turned up, drawn out tube-like, transversely cut off, broad, narrow, thin; thickened, widened on edge, callous or indurated, projecting forward and downward below vibrissæ; drawn up in middle to form anterior part of narrow oral slit, its sides thereby becoming nearly parallel; square, or curved in front outline. [The characters of the epistoma are usually best included in those of facial plate, of which it forms a part.]

Oral margin (the anterior edge of the *oral cavity*, being the lower edge of *epistoma*).

1) Oral cavity covered over transversely in front with an oblique posteriorly-extending skin or membrane developed probably from the clypeus, open, elongate, short, wide, narrow, deep, shallow, slit-like, or closed.

1) Clypeus (*clypeus* of Rob.-Desv., Lowne, and Berlese; the anterior or dorsal plate of the cephalopharyngeal skeleton, or fulcrum, of the rostrum) distinct, rectangular, triangular, developed into a plate closing oral cavity, or vestigial.

1) Mouth parts normal, vestigial, immovably fixed at base of shallow oral cavity, hidden in a narrow deep oral slit, or wanting.

2) Proboscis short, fleshy; not longer than head height, shorter or longer than same; very elongate, bristle-like, twice geniculate, once geniculate, slender and horny, large, stout, vestigial, or absent.

2) Labella well developed, large, broad, small, vestigial.

2) Palpi absent, vestigial, filiform, club-shaped, strongly elongate, normal.

1) Longitudinal axis of head at oral margin longer than that at insertion of antennæ, or the two equal, or the former shorter.

1) Facial profile advancing thereby, or more or less straight or concave, or receding or convex.

1) Facio-peristomal profile angular, rounded, strongly or gently convex.

1) Antennæ (arising from *antennal ridge* of Lowne; from *antennale* or *2d somite of front* of Berlese) inserted above, on, or below a line drawn through middle of eyes; above or below middle of extreme head height, widely separated or closely approximated.

1) Second antennal joint strongly elongate compared with first, longer than shortened third joint, normal, with or without strong bristles on front edge.

2) Third antennal joint entire, fissiform in one or both sexes, elongate, narrowed, widened, enlarged, with curved point on front apical corner, normal.

1)2) Arista bare, microscopically pubescent, hairy, pectinate, partly or wholly plumose, geniculate, flattened, thickened in what part of its length; first

and second joints elongate, short, strongly elongate; or only second joint strongly elongate, its length compared with its width or with the third joint.

1) LUNULA (*postfront* of Berlese) enlarged in middle inferiorly and superiorly into a more or less diamond-shaped or rounded plate, like an extension of the facial plate into a secondary one; elongated below between the antennæ into a keel-like prolongation, widely separating the antennæ, or normal.

NOTE.—The lunula reaches its greatest development in the *Syrphoidea*.

(N. B.—MESOFACIAL PLATE [= 2 *mesofacials* of Lowne + *carina* if present, since latter is formed by inner edges of the two mesofacials] + 2 FACIALIA + ANTENNAL RIDGE + LUNULA = homologue of FRONT of larval insects [= PTILINAL AREA]).

[Behind *ptilinal suture*]

2) EYES absolutely bare; thinly microscopically hairy, sometimes distinctly so, sometimes indistinctly so; thickly pubescent, sometimes more so in male, less so in female; reaching as low as vibrissæ, or lower, or only to middle of face, or very short. [N. B.—In comparisons last mentioned, hold head in full profile with plane of posterior aspect of occiput perpendicular.]

2) VERTEX wide, narrow, comparative width in sexes.

2) VERTICAL BRISTLES present or absent, or present only in female; proclinate, reclinate, divergent, convergent.

2) POSTVERTICAL BRISTLES (+ *postocellar bristles* = *lesser ocellar bristles* of Hough) large or small, separated or approximated, how many pairs.

1)2) FRONT prominent in profile; flattened, or only anteriorly so; bulging, narrow, wide, widened anteriorly, conically produced, of equal width, or not so.

1) OCELLAR PLATE (*stemmata* of Rob.-Desv.; *epifrontal* of Lowne) triangular, rounded, large, small.

1) OCELLI separated, approximated.

1)2) OCELLAR BRISTLES (*Ocellenborsten* of Brauer and v. Berg.; *greater ocellar bristles* of Hough) strong, weak, proclinate, reclinate, divergent, vestigial, or absent.

1)2) POSTOCELLAR BRISTLES (a second or posterior pair sometimes present on ocellar plate just behind the two posterior ocelli; + *postvertical bristles* = *lesser ocellar bristles* of Hough) present, absent, or represented by fine hairs only.

2) PREOCELLAR BRISTLES (do. of Hough; small pair on frontalia in front of anterior ocellus) present or absent.

2) FRONTALIA (*frontalia* of Rob.-Desv.; *frontals, mesofrontals* of Lowne; *frontal vitta* of descriptions) polished, opaque, wide, narrow, long, short, equilateral; widened or narrowed anteriorly or posteriorly, or in middle; square in front, notched in front or behind.

2) PARAFRONTALS (*optica frontis* of Rob.-Desv.: *parafrontals* of Lowne; *sides of front* of descriptions; *geno-vertical plates* of Hough) swollen, dilated, bare except for frontal and fronto-orbital bristles, hairy, bristly, short, long, wide, narrow, equilateral; widened before or behind, or both; prolonged anteriorly.

1) FRONTAL BRISTLES (those inserted on the inner edges of the *parafrontals*, always convergent, often extending posteriorly only to point about half way between *ptilinal suture* and *vertex; transfrontal bristles* of Hough) in a single row, in two or more rows; descending below base of antennæ, continuation

below represented by row on parafacials descending nearly as low as oral margin, or about half way down, or less than half way, or not descending below base of antennæ; or represented only by one or more rows of weak bristly hairs on parafrontals.

2) Upper fronto-orbital bristles (those on posterior portion of *parafrontals* immediately in front of the *vertical bristles* and often appearing as a continuation of frontal rows posteriorly, always reclinate; *ascending frontal bristles* of Hough) in line with frontal bristles, or with middle fronto-orbital bristles; position, direction, number; or absent.

2) Middle fronto-orbital bristles (*Orbitalborsten* of Brauer and v. Berg.; *fronto-orbital* of Osten-Sacken; *orbital bristles* of descriptions; they are usually a little nearer the orbit than the preceding, and always proclinate) present in both sexes, or in female only, strong, weak, divergent, convergent; one, two, three, or a row, or represented only by weak hairs; or absent in both sexes.

2) Lower fronto-orbital bristles (*lower fronto-orbital* of Osten-Sacken and Williston; occurring occasionally in the Acalypterata, but rarely in the Muscoidea) present or absent, number.

1)2) Parafacials (*optica faciei* of Rob.-Desv.; *Wangen, genæ* of Brauer and v. Berg.; *sides of face* of descriptions; *genæ* of Hough) widened above, or not so; bare, hairy, bristled; widened below and narrowed above, more or less swollen, very wide, very narrow, elongate, short; or narrowed, shortened, or abbreviated below.

2) Facio-orbital bristles (those on *parafacials*) present or absent, number, position, direction.

1) Cheeks (*peristoma* of Rob.-Desv.; *Backen, peristoma* of Br. and v. Berg.; *buccæ* of Hough) wide, narrow, very narrow; width equaling or exceeding eye height, or equaling what proportion of eye height; naked, hairy, bristly, or so only below or behind. [N. B.—Br. and v. Berg. give apparent height (not width) of cheeks as seen in profile, with eyes included. Their actual greatest width (distance from peristomal margin to eye) should be compared with eye height, as seen in front view.]

1) Cheek margins (portions bordering on *parafacials* and *ptilinal area*) ascending, encroaching on face, more or less circumscribing the facial plate.

2) Cheek grooves (*mediana* of Rob.-Desv.) present, well defined, curved, wide, deep, shallow, position, vestigial.

2) Cheek bristles (strong bristles which sometimes occur on *cheeks* near lower border, slightly outside of *peristomalia*) present or absent, number, direction, position.

2) Posterior orbits (bare space between posterior eye margin and row of hairs fringing *occiput*) widened below, narrowed above, of even width, wide, or narrow.

2) Lower margin of head (lower border as seen in profile) straight, bulged downward or outward posteriorly, long, short.

2) Occiput (all the portion of the head behind the plane which defines the limit of the *posterior orbits,* as marked by the fringe-like row of small bristles or hairs bordering same and called by Hough and others *cilia of posterior orbit*) evenly swollen, flat; flat above and swollen below, bulging the cheek profile posteriorly.

1)2) Parafrontal-occipital ridge (ridge-like sclerite formed by what seems a continuation of *parafrontals* over *vertex* on *occiput* and which bifur-

cates above *great central foramen; cerebrale* of Rob.-Desv.; *epicephalon* of Lowne).

1)2) Occipito-central bristle (do. of Hough; small bristle on *parafrontal-occipital ridge* just below *inner vertical bristle* before bifurcation of ridge) present or absent, character of.

1)2) Occipito-lateral bristle (do. of Hough; small bristle on *occiput* just below *outer vertical bristle*) present or absent.

2) Occipital area (the characteristic hairy area of occiput which sometimes invades the *cheeks* posteriorly) invading cheeks, or restricted to occiput.

2) Longitudinal diameter of occiput (shows its degree of swelling at any specified point) above or below compared with eye width in profile.

2) Beard (pilosity arising and depending from lower portion of *occiput*, and in certain cases clearly defining a portion of *cheeks* invaded by *occipital area*) long, short, thick, thin.

(Thorax)

1)2) Sternopleural bristles one, two, three, or more, in what arrangement.

1) Hypopleural bristles strong, weak, or represented only by hairs.

1) Pteropleural bristles strong, weak, or hair-like.

1) Mesopleural bristles very strong, or normal.

1) Propleural bristles strong, weak, number, direction.

1) Notopleural bristles (*posthumeral* of Osten-Sacken) strong, weak, number.

2) Postsutural bristles (*dorsocentral* of Girschner behind suture; *outer dorsocentral* of Osten-Sacken behind suture) strong, weak, relative strength, number, position.

2) Dorsocentral bristles (*dorsocentral* of Girschner before suture; *outer dorsocentral* of Osten-Sacken before suture) strong, weak, relative strength, number.

1)2) Acrostichal bristles (2 middle rows both before and behind suture) strong, weak, number, position.

2) Humeral bristles strong, weak, number, direction.

1) Intrahumeral bristles (*posthumeral* of Girschner) present or absent, number, position.

1) Presutural bristles (+ *posthumeral* of Girschner = *intrahumeral* of Osten-Sacken) strong, weak, position in relation to preceding.

1) Intraälar bristles strong, weak, whether one in front of suture.

2) Supraälar bristles (+ *postalar* = *supraälar* of Osten-Sacken) strong, weak, number.

2) Postalar bristles strong, weak, number.

1)2) Scutellar bristles strong or weak, comparative strength of the various pairs, number of lateral pairs; a weaker apical pair present or absent, erect, suberect, directed posteriorly, decussate, or divergent; discal pairs present or absent.

(Wings)

2) Wings broad, long, narrow, short; costal margin swollen or dilated in male, or in both sexes, or normal.

2) Costal spine distinct, strong, weak, double, or absent.

2) Longitudinal veins bristly, to what extent, or bare.

1)2) Fourth longitudinal vein incomplete, straight, not forked, reaching neither the wing margin nor the third vein, normal, ending at or before wing-tip, angular or rounded at bend, bowed or not beyond bend, bend approximated to or removed from hind margin of wing; last section forming petiole of apical cell when latter is petiolate, or third vein in such case forming petiole; or forked and main vein represented beyond apical crossvein by only a short stump, or by a mere wrinkle or fold in the wing-integument, or by a long stump.

2) Apical crossvein (this term should be employed only when the fourth vein is furcate, or shows indication of previous furcation in a stump, fold or wrinkle) bent in, straight, oblique, long, short, absent.

1) Fifth longitudinal vein bent up to fourth vein, not forked; or furcate, giving off posterior crossvein; represented beyond latter by a short stump, or a long one, or only by a wrinkle, or partly by stump and wrinkle, or continuous to wingborder.

1)2) Posterior crossvein (term not to be employed in the few cases where fifth vein shows no sign of furcation) oblique, in line with apical crossvein or with last section of fourth vein, or still more oblique than latter, or normal; nearer to bend of fourth vein (or to origin of apical crossvein) than to small crossvein, or nearer to latter, or about in middle between the two; trisinuate, bisinuate, singly curved, straight.

2) Small crossvein on, before, or behind middle of discal cell; short, long, straight, oblique, direction.

1)2) Apical cell (*first posterior* of descriptions) ending near wingtip, or far before; open, closed in margin, or long or short petiolate, or extremely short petiolate; wide, narrow, short, elongate, tapering equilaterally at apex.

2) Tegulæ large, small, relative size of two scales; deeply smoky or infuscate, or white, or yellow; bare, pubescent, or hairy.

(Abdomen)

1)2) Abdomen (shape of whole) linear, cylindrical in one or both sexes, widened on some portion, conical or oval in both sexes, swollen, convex dorsally, concave ventrally, flattened in one or both sexes, or laterally compressed.

1) Abdominal segments apparently four, or how many visible from above; how many actually present, which ones shortened, and relative development of their respective *dorsal* and *ventral plates*. [See notes on *Gymnosoma*, *Trichopoda*, *Rhachoëpalpus*, etc., under head of Descriptions. In many cases, at least, there are more segments in the Muscoidean abdomen than have heretofore been recognized, an undeveloped basal segment being quite hidden from view, and only visible with difficulty on the sides below. Its dorsal and ventral plates are easily seen on detaching the abdomen. In order to avoid confusion, the old terms "first," "second," "third," and "fourth" segments are retained as referring to those apparent from above in the undetached abdomen.]

2) Abdominal macrochætæ present or absent, bristle-like, true, very strong, thorn-like, discal and marginal, or only marginal; discal present on second and third segments (counting *apparent* segments from above), or only on third and fourth, or only on fourth; marginal present on all, or absent on first, or absent on both first and second segments.

1) Ventral membrane (membrane connecting the *ventral* and *dorsal plates* of the *abdominal segments*) visible, concealed by the sides of the dorsal sclerites or plates, or apparently absent.

1) Ventral plates free, or not so; or that of second segment in both sexes with its edges upon and covering the edges of the corresponding dorsal plate, the other ventral plates free, or this true of only one sex; how many ventral plates, last one in male deeply or weakly Y-cleft or V-cleft, or entire.

2) Ventral carina present in female, absent, rudimentary, more or less developed, emargination of plates of same, or latter entire.

2) Ovipositor elongate, short, tapering, stout, furnished with terminal hooks, appressed, exserted; directed downward, or forward, or posteriorly; integumental, membranaceous, or horny.

2) Hypopygium prominently exserted, elongate, appressed, directed downward, short, rounded, bulb-like, tube-like, of what formation and characteristics.

(Legs)

1)2) Legs strongly elongate, only moderately so, short, or only one pair elongate, relative length of pairs; bristly, bare, shaggy-haired, with or without macrochætæ.

2) Hind femora ciliate or not so, character and position of the cilia.

2) Hind tibiæ completely and densely feather-barb-ciliate, only comb-ciliate, subciliate, with some longer bristles; cilia flattened and widened, scale-like, bristle-like, or of what character.

2) Middle tibiæ with or without strong bristles or macrochætæ on outer side, or on any portion.

2) Tarsi slender, swollen, compressed, short, elongate, relative length of pairs in each sex; last joint or more of which pairs oval, thickened, swollen, or compressed, in one or both sexes.

2) Metatarsi short, elongate, comparative length with relation to other tarsal joints of same pair, comparative length of pairs, slender, stout.

2) Front tarsi widened in female, or widened and flattened, or only flattened, in one or both sexes.

2) Claws and pulvilli elongate in male, or in both sexes, or short in both, or only anterior ones elongate in male; claws stout, slender, curved, shape and character; pulvilli of what shape and character.

While the foregoing enumeration of anatomical parts affording characters of taxonomic value in the superfamily is not necessarily complete, it is believed that it brings out practically all the characters requisite to a proper separation of the forms in the adult.

Of all these characters, those of the head take first rank. For this reason much space has been devoted to their consideration—in fact, nearly twice as much as to all the other characters together. It is conceded that the Schizophora are the most specialized insects, the most highly developed from the standpoint of ontogeny, as evidenced by their remarkable and practically complete reorganization of larval parts within the nymph. Everything points to the Muscoidea as the most highly organized Schizophora, and this is emphasized by their acute sensory development. It is therefore naturally to be expected that certain non-functional parts of the head, which is the chief seat

of the specially developed senses, should afford the most important characters for taxonomic use.

Here, and practically here alone in the Muscoidean anatomy, are to be found certain useful atavic characters pertaining to organs not of any functional importance in the economy at present, but possessing phylogenetic significance as indicating origin and relationships. These are of especial value for the separation of families and subfamilies. It has long been recognized that rudimentary organs in recent forms bear a significant relation to those of their allied predecessors. Such are physiologically non-functional now, and appear in more or less developed condition only in the embryo, but were functional throughout life in the early fossil forms. They have been lost through disuse, involving a process of degeneration or retrogressive development. If, then, these organs present sufficient variation, their rudimentary presence is of much importance to us in the preparation of a natural taxonomic system. Atavic characters, to be of use, must be exhibited by parts which vary sufficiently to offer conveniently distinguishing marks. To be of use in the separation of higher, or family, divisions, the parts must present just enough variation to offer distinctive characters that will hold throughout considerable aggregations of forms.

Such are the characters afforded by the *facial plate* in its lower extent, and by the *facialia*, *vibrissal angles*, and *peristomalia*. The parts in question present sufficient variation to afford distinguishing characters. These are all atavic, and possess in consequence a high phylogenetic significance. They are connected with the portions of the head whose development in the nymph is not influenced by the coincident development of functional parts. While the development of the highly sensory third antennal joint affects in a degree the upper portion of the facial plate and determines the character of the foveæ, its influence does not extend below the vibrissal angles.

Atavic characters are afforded by the wing veins in a remarkable degree, but the general plan of venation is too uniform to afford us good family characters. They can be used in higher and lower divisions. It may further be noted that, since the wings are so highly functional in a mechanical (not sensory) way, the characters derived from lesser variations in venation would in any event be secondary in importance to the head characters just mentioned. It must be borne in mind that the wings are of great functional importance, and the veins bear the mechanical strain incident upon their use, while the special head characters above pointed out, whose importance as affording distinctions for higher divisions has been dwelt upon, are in nowise connected with any present function,

either mechanical or sensory, in the economy of the adult insect. The type of venation furnishes atavic characters of value in separating higher divisions. The bristles or hairs of certain thoracic plates likewise furnish atavic characters of high value here.

Atavic characters also occur to a limited extent in the abdomen, chiefly in the atrophied basal segment, which can be clearly made out only by detaching the parts. These are also too uniform to be of use for the separation of the larger divisions, so far as we yet know. But their comparative study offers promising results.

Practically all the other portions of the Muscoidean anatomy are preëminently functional, even including the halteres, tegulæ, etc., and the parts of the head other than those enumerated above. The frontalia and lunula may be practically non-functional, but they likewise do not present sufficient variation to offer any useful characters for family separation. The second antennal joint is probably not functional, although in the Nemocera it is the seat of the so-called "Johnston's organ," whose function is supposed to be auditory. This organ does not appear to be developed in the Cyclorrhapha. Practically the only character afforded by the second antennal joint, however, is that of relative length compared with the first joint, and this is at best available only for subfamily and generic separation. The arista is doubtless functional. A consideration of certain characters of functional parts, and especially of the physiological functions of certain of these parts whose characters have in the past been largely used in taxonomy, is now taken up.

Antennæ proper.—The first and second antennal joints are practically non-functional. The third joint is highly functional, and hence does not afford reliable taxonomic characters for higher divisions than species, and within certain limits for genera. The relative length of third joint to second affords no valid character, and especially gives a wrong impression in those forms having the second joint elongate. The first joint is almost universally short, but the second is often more or less elongated, and in some cases strongly so. The relative length of second joint to first affords a good generic character. The third joint affords excellent specific characters, so far as its relative length and size go, with proper recognition of sexual variations. Its shape may furnish characters of generic, or even of tribal, value.

The olfactory sense is very highly developed in the Muscoidea. Blow flies will come for miles to decaying, and even to fresh, meat shortly after its exposure to the air. Most other members of the superfamily possess this high olfactory sense, though in some it is developed in a varying degree. The sense of smell in these flies is

located in the third joint of the antennæ, which contains numerous olfactory pits communicating with the main nerve trunk by means of minute nerve-ends.

According to Gustav Hauser (Zeitschr. f. Wissens. Zoöl., XXXIV, pp. 367-403, 1880), who studied over sixty species of Diptera in this connection, the Muscoidea and other cyclorrhaphous Diptera, and also the Brachycera, have the olfactory pits without exception confined to the third antennal joint. Their number varies greatly in different forms of Cyclorrhapha. Certain syrphids, as *Helophilus florcus*, have only one pit on each disk of the third joint, while *Echinomyia grossa* has two hundred. In certain forms the pits are compound, containing from ten to one hundred olfactory hairs arising from the coalescence of the several original pits. No compound pits occur in the Tipulidæ, but only simple ones with a single olfactory hair, such as are found in the brachycerous (s. str.) forms only. The latter have also compound pits, containing from two to ten nerve-terminations.

The olfactory pits are sac-like invaginations of the external chitinous integument, and are of various shapes in different forms of diptera. They are always open externally, and never closed by a membrane. In the Cyclorrhapha, and the Muscoidea especially, the pits differ but little in the various forms. Hauser (l. c.) figures and describes at length those of *Muscina stabulans* as generally typical of not only the Cyclorrhapha, but the Brachycera s. str. as well. He gives a figure of the third antennal joint in longitudinal section showing simple and compound pits, the pits themselves being shown in both transverse and longitudinal section and from above. The main nerve trunk, accompanied by the much smaller tracheal trunk, passes through the second antennal joint entire and without division, but on entering the third joint gives off a very small branch to the arista, to which also runs a small branch of the trachea. The bulk of the nerve trunk continues undivided and undiminished into the mass of the third antennal joint, where it branches in all directions, but especially apically and inferiorly (opposite the edge bearing insertion of arista), the main trachea following it with less branching. This centralization of nerve-branches, nerve-ends, and olfactory pits in the apical and ventral tracts of the third antennal joint—that is to say, outside the aristal area—bears out the conclusion that the arista was originally terminal and that the highly functional extra-aristal area of the joint has simply grown away from it as fast as more space was required by the advancing development of the olfactory sense.

It has been conclusively proved by the experiments of Hauser and others that the sense of olfaction is located exclusively in the antennæ in *Sarcophaga, Calliphora,* and *Cynomyia,* and not at all in the palpi. This has also been demonstrated in many Hymenoptera, Lepidoptera, Orthoptera, and Staphylinidæ; but in certain Hemiptera experimented with it was found that the loss of their antennæ did not affect in any way their sense of smell. Certain Coleoptera were only partially affected by the excision of their antennæ.

The olfactory organs of the Muscoidea consist of (1) a thick nerve trunk arising from the brain and passing into the antennæ; (2) a sensitive apparatus at the end, consisting of rod-like modified hypodermis cells, connecting with the nerve-fibre terminations; (3) a supporting and accessory structure consisting entirely of pits. The same is true of the other Diptera, the Lepidoptera, Orthoptera, and probably the Hemiptera; but in the Neuropteroid orders, the Coleoptera, and the Hymenoptera, the accessory structure consists of peg-like projecting epidermal invaginations filled with a serous fluid. Both pegs and pits occur, however, in the Coleoptera and Hymenoptera, while only tactile hairs were found by Hauser in *Pyrrhocoris* of the Hemiptera, though Lespès has recorded the presence of pits in that order.

It should be mentioned here that another sense, capable of distinguishing between various degrees of atmospheric pressure, is believed to reside in certain sensory structures, like the sensillum placodeum, found in the antennal joints of bees and wasps. It is evident that insects have some means of perception, through certain sense-organs, of approaching changes in meteorologic conditions.

Arista.—The arista is the persistent rudiment in the Cyclorrhapha of the terminal antennal joints still to be found in many of the lower groups of Orthorrhapha. In the development of the third antennal joint of the Muscoidea as a special olfactory sense organ, the arista has become dorsal or basal, being left to occupy a position to one side during the extraordinary development of the joint away from it. It is invariably situated close to the base of the front edge of the joint. Its persistent retention in this position indicates that it is to some extent functional.

It is a rule in nature, which carries no exception, that there is a reason for everything that exists. Therefore there is some cogent reason for the pubescence, plumosity, and nudity of the arista, as well as for its presence. The arista has become subordinated to the third joint, but retained as an accessory. It therefore must be functional. The point is to discover its function, which must be the key to the explanation of its varying degrees of pubescence and plumos-

ity. The joint is mainly olfactory, and certainly highly sensory. As such it is highly important to the insect. The arista is directed forward, outward, and downward from its insertion on the anterior basal edge of the joint. This would indicate that it is primarily functional as a tactile sensory organ for the protection of the highly functional third joint. Such an indispensable organ in the economy of the insect as the third antennal joint would naturally demand the presence of some tactile sense organ extended before its exposed surfaces, to serve as a warning against contact with foreign objects. In other words, the arista has taken to itself the original function of the antenna, on account of the latter being practically turned into an olfactory sense organ. The bristles of the facial and frontal areas protect the other parts of the head from injurious contacts.

What light does this function of the arista throw on the question of its nudity, pubescence, or plumosity? Simply that the separate hairs have a tactile function, pointing in all directions from which danger may come. It is to be noted that the plumosity is always stronger on the upper or outer than on the under or inner side. Those forms which have the basal joints of the arista elongated lack the plumosity. This elongation of the basal joints indicates an increased freedom of movement of the arista. When bare of plumosity the arista either is long and tapering, indicating a somewhat restricted movement in the comparatively short basal joints, or it is short, stout, and geniculate, with greatly elongated basal joints, indicating much freedom of movement. The nudity of the arista may be generally taken to indicate greater freedom of movement in its basal joints, and its shortening, when combined with geniculation, still further increase of movement. In any case, the function of the organ is seen to be a tactile one, intended to guard the highly sensory olfactory pits and nerve-ends located in the third antennal joint.

Those forms which have the arista more or less atrophied doubtless have the third antennal joint less highly olfactory and more tactile in function.

From this functional nature of the arista we can only conclude, in accordance with the general and almost invariable rule, that it possesses little value for the definition of subfamilies and higher groups, but that its characters may well be employed in the separation of tribes, genera, and species.

Eyes.—The organs of vision are with little doubt more highly developed in the Muscoidea than in any other superfamily of non-aërial insects. These flies possess, on the whole, a distinctively terrestrial life-habit, in contradistinction to an aërial one. The relatively small percentage of achætophorous and subachætophorous

forms, and even the few of these possessing the aërial or hovering habit, maintain practically the same type of eye-structure, extensive holopticism of the type obtaining in the Bombyliidæ and Tabanidæ being present in none of them. Partial holopticism is present in very few, and there is a considerable approach to this condition in certain others, but dichopticism is practically the rule. In no other group of insects of a generally terrestrial life-habit is there so relatively large an area of the head occupied by visual surface.

This and other facts further argue for an average higher development in the Muscoidea of the visual sense *per se* than in any other equally extensive group of insects, or perhaps in any other group whatever. The Odonata, Hymenoptera, Lepidoptera, brachycerous and nemocerous Diptera, and some other insects which equal or surpass them in relative visual area of the head, do so by virtue of the correlative evolution of visual surface and aërial life-habit. But their eye structure is less highly developed. While the number of facets in general in the Muscoidea is not nearly so great as in Odonata, certain Lepidoptera, and even Coleoptera, their eye is of a higher order of organization. The Muscoidea possess what is called the pseudocone eye, which is the most highly evolved type of the facetted eye.

It is generally conceded that insects possess what may be termed microvision. Their ability to perceive certain minutiæ approaches that of the human eye supplemented with the microscope. The presence of this microvisual sense in insects is the cause of the marvelous beauty of coloring and sculpture exhibited by their external parts, and which is revealed to us in detail only by the use of a lens. In other words, the facetted insect eye gains impressions from light rays by which the unaided vertebrate eye is unaffected. Most birds, especially the condor and other birds of prey, and some mammals, as the big-horn sheep of our western mountains, have a specially developed far-sight, approaching in a degree the power of the human eye aided by the telescope. Contrasted with this is the extreme near-sight of insects, which do not see in general more than a few feet, and which see best at very close range.

Johannes Müller's mosaic theory of insect vision, which gained such wide credence, especially as modified by Huxley, really seems untenable and quite at variance with well-known facts. It presupposes a very imperfect vision, which can not be the case. Lowne's dioptric theory, which indicates a perfect microvision, with sharpness and clearness of sight, would appear to be the correct one. Yet subsequent investigators, notably both Hickson (1885) and Hewitt (1907), hold that Lowne's interpretation of the functions of the

compound eye structures is incorrect. However this may be, it seems certain that insects possess a clear and perfect vision.

Mouth parts.—Kraepelin has recorded taste-pits, with hairs or pegs arising from them, on the proboscis of *Musca* (Zeitsch. f. Wissens. Zoöl., XXXIX, 1883).

The palpi are probably not generally gustatory in function in the superfamily. In certain of the forms they are with little doubt practically non-functional, and some forms have in consequence more or less completely lost them. In others their very considerable, sometimes extreme development, indicates some function, which may be either gustatory or tactile. In certain insects they are olfactory in function, but probably not in the Muscoidea. They furnish characters of not more than generic value.

Wings.—The venational characters are in the main quite constant. The wings themselves are highly functional, but this does not necessarily imply that the style of venation is functional. However, as already pointed out, the plan of venation is so comparatively uniform in the superfamily that it yields no characters for separation of families. The venational characters are of very great importance in separating this superfamily from the Anthomyioidea, but do not become again available for taxonomic use in the Muscoidea until we descend to tribes and genera.

It is reasonable to attach high importance to the main features of the dipterous wing venation, since the wing system of Diptera is a very highly specialized type. The hind pair has undergone atrophy, its rudiments being diverted to another function, and the entire flight function, at least so far as propelling power goes, has been concentrated in the front pair. As a natural consequence of this high wing specialization, the venation is a practically non-functional system of long standing, extending over a sufficient period of time to allow its systemic features to become well fixed and quite constant. There are a few minor venational characters that can not be relied upon in certain restricted groups. The last section of fourth vein (or apical crossvein) may vary in degree of curvature, but not in kind. The hind crossvein may vary in strength of sinuosity, but the double curve is never entirely lost in the same form.

There is some ambiguity involved in the term "apical crossvein," as it has been used in the past. In certain genera it is impossible to decide its true limits. The use of the term should therefore be restricted to those cases in which its entire course is exactly defined. The apical crossvein has resulted from a bifurcation of the fourth vein at its point of flexure. In those genera showing what has been called a "stump, or a wrinkle, at bend of fourth vein," the point of

bifurcation, and therefore the true origin of the apical crossvein, is apparent. In such cases the term should be used. It should not be used in those other genera in which no point of bifurcation is indicated, this having not arisen during their development. In such cases the term "fourth vein" is correctly applicable to the whole, whereas the term "apical crossvein" can not be so applied, especially in *Hyalomyia, Phorantha, Alophora, Beskia, Sciasma, Stomatodexia,* and many other genera. The latter class of genera represents a lesser specialization than the class showing a stump or wrinkle, and therefore is an older type, and indicates a more ancient assemblage of forms. Following Williston, the last three sections of fourth vein, when latter exhibits no furcation, but is more or less angularly bent, may very appropriately be termed the antepenultimate, penultimate, and ultimate.

Halteres and tegulæ.—The sense of audition is acutely developed in insects, at least in the majority of the forms, as evidenced by the sounds they produce. There is nothing to indicate that the Muscoidea are in any way an exception. Air waves which produce no effect whatever upon our ears doubtless register impressions upon the auditory nerve-ends of Diptera. Auditory organs are located near or at the base of the wings in Diptera, Coleoptera, Lepidoptera, Neuroptera, Orthoptera, and Hemiptera. They are less perfect in the Lepidoptera, Neuroptera, and Orthoptera, and only faintly represented in the Hemiptera, in which four orders other chordonotal structures have succeeded and more or less supplanted them. In the Culicidæ, and perhaps in other of the nemocerous groups, the antennal hairs are auditory. This has been established in the male mosquito.

In the Diptera the nerve supplied to the halter is next in size to the optic nerve, the latter being the largest nerve in the body. At the base of the halter is a number of vesicles arranged in four groups, to each of which groups the nerve sends a branch. These vesicles are perforated and contain a minute hair, and the vesicles of the upper groups are protected by chitinous hoods.

Sharp (Cambridge Nat. Hist., VI, p. 448) says of the halteres: "They possess groups of papillæ on their exterior surface, with a chordotonal organ inside the base. Each halter is provided with four muscles at the base, and can, like the wings, execute most rapid vibrations. Seeing that they are the homologues of wings, it is remarkable that in no Diptera are they replaced by wings, or by structures intermediate between these two kinds of organs." This is because they have taken on special functions.

E. Weinland (Zeitschr. f. Wissens. Zoöl., LI, pp. 55-166) has concluded from his studies of the halteres that these organs are functional in determining the direction of flight. They can be used to steer a course in the vertical plane as well as in other directions. He also concluded that the chordotonal structures in the base of the halteres allow the perception of the steering movements of these organs. But it is highly probable that the great nerve trunk supplied to the halter is not primarily subservient to this dirigible function, but rather to that of audition, at least in the higher families. In the Nemocera the halteres may be mainly dirigible or equilibratory in function, since the auditory organs are located in the antennæ. In the Cyclorrhapha, however, it seems safe to assume that their function is primarily auditory. As Lowne suggests, the halteres are doubtless microphones of a most efficient nature, capable of perceiving sound waves of such low intensity that they do not affect the vertebrate ear. They possess a function of coördination, similar to that of the semicircular canals of vertebrates, and thus are organs combining the functions of equilibration and audition.

The tegulæ of the Schizometopa and some other Diptera are very likely functional in collecting sound-waves, increasing the perceptive power of the chordotonal organs of the halteres, thus being analogues of the external cartilaginous ear-lobes of the mammalia. They also doubtless serve secondarily as a protection to the highly sensory halteres. It seems safe to assume that in those dipterous groups having no tegulæ the halteres perform chiefly a function of equilibration, but that in those groups furnished with tegulæ the halteres are mainly organs of audition. In other words, the presence of well-developed tegulæ indicates the presence of a highly developed auditory sense in the halteres. Mere protection to the latter would not demand such structures as the tegulæ, while it can not be denied that they are admirably adapted to such a function as the collection of sound-waves.

Whatever may be finally determined as to their functions, it is certain that the halteres are highly specialized organs. The tegulæ, without doubt accessory to them, are by inference equally functional and of coincident evolution with some function pertaining to them. The latter, therefore, can not be accepted as affording characters of value for the separation of large groups, but are rather of decidedly inferior rank in this respect to the veins of the wings. They occur in other groups entirely outside of and removed from the Schizophora, and even from the Cyclorrhapha. Their presence in the Anthomyioidea is therefore not necessarily to be construed as indicating a close relationship between that superfamily and the Muscoidea.

The Acroceridæ, for instance, are to be noted as an extra-cyclorrhaphous group which has developed very large tegulæ, wholly concealing the halteres and probably accessory to a highly developed auditory sense in the latter. It seems to be chiefly groups containing a large percentage of endoparasitic forms which are provided with tegulæ, and it is possible that a greatly increased auditory perception is necessary to these forms as an aid to them in the search for and ultimate detection of their hosts.

The validity of the time-honored separation of the Calypterata and Acalypterata on the characters of the comparative presence or absence of tegulæ alone may well be open to serious doubt. The unflexed fourth vein, which from its doubtless far greater age should be a much more valid character, would indicate a closer relationship of the Anthomyioidea with the Acalypterata than with the Muscoidea. Yet this does not appear to be the proper and natural grouping. It rather seems preferable to adopt Brauer's names Schizometopa and Holometopa as founded on characters of greater value than either those afforded by relative development of tegulæ or those of wing venation, and to recognize therefore the Anthomyioidea as a superfamily of the Schizometopa. While the result is mainly the same, the divisions become founded on valid rather than on mutable characters. The tegulæ have developed, though not uniformly, in the Schizometopa. They have also developed to a certain extent in some of the Holometopa. This fact demonstrates their unfitness for taxonomic use in these divisions. There is a distinction between the characters of a functional organ and the character of the presence or absence of such organ. Moreover, it may be noted that Robineau-Desvoidy's division Calypteratæ was applied by him to the superfamily Muscoidea of the present paper in the main sense, as is further brought out under the head of Synopses.

Abdomen.—The number of abdominal sclerites should be of subfamily significance at least, and the form of the abdomen is almost invariably of generic value.

Macrochætæ and bristles.—Chætophorousness in the Diptera finds the climax of its development in the tachinoid stock of the Muscoidea. While chætophorous characters are, evolutionally, of recent origin, yet the arrangement of the macrochætæ of the head, thorax, abdomen, and legs becomes highly important in separating tribes, genera, and species. The characters to be derived from the macrochætæ of the head rank even higher and serve for the separation of subfamilies in certain cases. In one or two groups, the Gymnosomatinæ and Phasiinæ, the peculiar chætotactic characters of the head are correlated with an absence of macrochætæ on the abdomen, while in cer-

tain other groups, as the Hystriciinæ, a different type of them is correlated with a true spinose development of the abdominal macrochætæ. The cephalic bristles are uniformly present in the superfamily, though sometimes weakly developed, whether the abdominal ones are present or absent. The same is usually true of those of the thorax and scutellum. The function of the macrochætæ and bristles of the abdomen is doubtless tactile. They are capable of movement in life.

In most insects the antennæ, and to a less extent the palpi, are the main seat of the tactile sense. The cyclorrhaphous Diptera, however, have the antennæ so modified as to preclude this function. It is probable that the vibrissæ are functionally tactile, and the frontal and vertical bristles as well. The vibrissæ project straight out in front near the ends of the ptilinal suture, and naturally serve as anterior tactile organs for the protection of the lower portion of the head. Likewise the frontal bristles serve as anterior and superior cephalic, and the vertical bristles as superior and posterior cephalic tactile organs. The fact that the vertical bristles are almost invariably stronger and longer than the frontal bristles strengthens this view. The inner vertical bristles correspond in development to the vibrissæ.

The macrochætæ of the thorax, scutellum, and abdomen serve as lateral and dorsal tactile organs, those of anal and preanal segments always being the strongest of the abdomen and those of scutellum the strongest of the thorax. The scutellar are doubtless the main dorsal tactile organs, and the anal the main posterior ones. The abdominal macrochætæ, when dense and of spinose character, possibly serve also as a defense against insectivorous animals, as in *Dejeania, Paradejeania, Bombyliomyia, Hystricia, Hystrichodexia,* and others.

The macrochætæ, especially those of the abdomen, constitute the most recent form of specialization in the Myodaria, and are especially characteristic of the Muscoidea. As such, and considering further their probable functional character as tactile sense organs, those of the abdomen at least can not be expected to furnish valid characters for the separation of higher categories in these flies than species, genera, and at most tribes.

The macrochætæ of the head, thorax, and scutellum appear to be of far longer standing than those of the abdomen. With the exception of most of the Œstridæ, they are present not only in all Muscoidea, many of which lack abdominal macrochætæ, but also in practically all of the Myodaria except the Œstridæ already named and Conopidæ, which two families stand well apart from the other Myo-

daria. The bristles of certain of the thoracic plates are here used as main atavic characters for separating the Muscoidea from the Anthomyioidea, as will appear later on under Synopses, accessory supporting atavic characters being furnished by the type of venation.

An extra-tactile function is no doubt discharged by certain of the cephalic bristles in the Muscoidea. The orbital bristles (middle fronto-orbital especially) of the females, which are usually wanting, or of less number, in the males, have probably arisen in those forms where present for the purpose of enabling the males to recognize the opposite sex. They are especially conspicuous in profile, when the strongly proclinate middle fronto-orbital are prominently contrasted with the reclinate upper fronto-orbital bristles. A front view would reveal the female in the wider front in most of the forms. The fact that in some forms the males as well have the orbital bristles does not militate against this view, but is explained by a transference of the female character to the male through heredity. The breast nipples of male mammals furnish an example of such hereditary transfer of a female character to the male, with absolutely no functional cause.

The bristles of the facialia and the frontal bristles possibly serve for the recognition of forms among themselves. They are most developed in the more inconspicuously colored forms, which run closely together in general habitus. Further confirmatory evidence is found in the fact that conspicuously colored and otherwise striking species often have the cephalic bristles but little developed. It is to be noted, however, that certain of the latter lack abdominal macrochætæ as well. An absence of abdominal bristles is usually correlated with a weakness of cephalic bristles, doubtless due in these cases to the marked development of an aërial life-habit.

Secondary Sexual Characters.—These should be accorded generic rank when they can be correlated with equally constant characters in the opposite sex. The secondary sexual characters in the Muscoidea are to be found in the comparative width of front, presence or absence of orbital bristles, size and length of third antennal joint, sometimes form of latter, varying degrees of holopticism or dichopticism, comparative length of claws, ventral carinæ, and certain anal processes of abdomen; also often in the shade of coloration and distribution of pollen, especially on the parafrontals and parafacials, less often on the thorax, and sometimes in the distribution of ground color and even of the pollen of the abdomen.

Synopses

It seems desirable to state at the outset that the subject of taxonomic divisions is approached in this paper entirely without prejudice. The main lines of interest in all departments of biology lie in problems of descent, distribution, and bionomics, and the only desirable point as regards classification is to secure a correct delimitation of forms so that they can be definitely referred to by name.

This paper also distinctly disclaims any attempt or intention to present a taxonomic system that is entirely original, likewise any attempt to follow any particular author or authors—in either case to the exclusion of any useful and valid characters already pointed out by previous authors. This is not intended to be a revolutionary scheme of classification in any sense, nor one that will upset any previously conceived ideas of recognized taxonomic value. Rather have all available characters been used that could be brought together for a clear definition of the various divisions in each case, those of value being adopted wherever they were to be found, whether old, recent, or newly worked out. As a matter of fact, the present paper is naturally based largely on Brauer's extensive and careful work, but the latter is not by any means followed blindly or undeviatingly, and points are at the same time drawn from Robineau-Desvoidy and Róndani. Brauer based his work to a very considerable extent upon the work of the latter authors, and Róndani drew many valuable ideas from the work of Robineau-Desvoidy, whose reviser he became. As already pointed out, these three students are the ones to whom we owe most for our present knowledge of the Muscoidea, and of these Brauer naturally accomplished the most, since he enjoyed the greatest advantages. Any one who will conscientiously study this superfamily can not fail of the conviction that Brauer and von Bergenstamm's work, while not by any means perfect, is by far the best that has ever been produced on these flies. The object of the writer of the present paper has uniformly been to sift the entire subject, retaining the good, discarding the useless, and adding such ideas of value as it has been possible to develop independently.

The following tabular arrangement of taxonomic divisions is intended to convey at a glance an idea of the system of classification adopted:

Order Diptera.
Suborder Cyclorrhapha.
Series Schizophora.
Section Myodaria.
Subsection Schizometopa.
Superfamily Muscoidea.
Family Tachinidæ.
Subfamily Tachininæ.
Tribe Tachinini.
Genus Tachina.
Species larvarum.

The suborder Cyclorrhapha is without doubt one of the most natural divisions of the Diptera, and yet its line of demarcation from the Orthorrhapha is obscured by intermediate forms. For details on the limitation of the suborders of Diptera the student is referred to the works of Brauer, Osten-Sacken, and Williston.

As to the limits of the series Schizophora, and the final conclusions to be reached regarding the forms which naturally belong within its boundaries, a word may be said with special reference to the Pupipara. It seems quite evident that some, at least, of the latter are simply degradedly specialized Schizophora. There are strong points of resemblance, both in structure and in reproduction, between *Ornithomyia* and *Glossina*. The venation is fundamentally of the same plan. In *Ornithomyia* the hind crossvein has been lost. The apical crossvein is absent, and probably never was present. In *Trichobius* the apical crossvein is not present, but the posterior one is, and there is even a second posterior crossvein which has been developed between the fifth and sixth veins. *Trichobius* has lost all but a trace of the auxiliary vein. All the winged Pupipara show a venation which indicates evolution from a Myodarian prototype. Many of them seem quite closely allied structurally with the Myodaria, and it is also to be noted that we have as yet no proof of any pupiparous habit in either the Streblidæ or the Nycteribidæ. In fact, it is highly improbable that such exists. Kolenati, as long ago as 1863, stated that the larvæ of Streblidæ live in bats' excrement. If this is true, it is probable that the Nycteribidæ also have a coprophagous larval habit. Müggenburg has investigated the morphology of the Nycteribidæ, and asserts that they possess no trace of a ptilinum. On the other hand, he asserts that in *Braula* a ptilinum exists, and that the mouth parts are essentially similar to those of the Hippoboscidæ. It is probable that the Streblidæ and Nycteribidæ are derived from an extra-myodarian cyclorrhaphous stock. Müggenburg states that the Hippoboscidæ and *Braula* are descended from genuine muscid stock, and that the Nycteribidæ are probably derived from some other stock within the Cyclorrhapha. He strongly indorses Brauer's judgment of the Pupipara as being nearly related to the Myodaria.

Robineau-Desvoidy's name Myodaria is adopted for the Eumyidæ of Brauer, the Muscidæ s. lat. of authors. In the sense in which it is here used, it includes both the Œstridæ and the Conopidæ. Both Robineau-Desvoidy and Brauer were correct in their views on the inclusion of these families in the section. It seems that Brauer did not study Robineau-Desvoidy's *Essai* sufficiently to know that the latter author had, in 1830, included the Œstridæ with his Calyp-

teratæ. Brauer claimed that the idea was original with him, and probably arrived at his conclusions on both the Œstridæ and the Conopidæ quite independently (see *Psyche*, vol. 6, p. 259. The author was unaware at that time of the above facts). Brauer claimed to have studied Robineau-Desvoidy's posthumous work exhaustively, and probably neglected the *Essai*. In the former the Œstridæ are separated entirely from the Myodaria, which would explain the above oversight on Brauer's part.

Reference has already been made to the advisability of employing the subsection name Schizometopa. Robineau-Desvoidy, when he wrote his *Essai*, had practically the same idea of the limits of the superfamily as those here arrived at quite independently. He excluded the Anthomyiidæ from his Calypteratæ, which division thus coincides in the main with the present superfamily Muscoidea, as here restricted. Latreille originally applied the name Creophilæ to these flies, and Macquart and Westwood used this name. The division Calypteratæ of Robineau-Desvoidy was later made to include the Anthomyiidæ on account of the presence of tegulæ in that family. As has been already pointed out, the tegulæ do not afford characters of sufficiently high value to be applied to these divisions. Therefore, for several very cogent reasons, which are self-evident, it becomes not only advisable, but necessary, to drop both Creophilæ and Calypterata as subsection names. The superfamily name Muscoidea covers the field to which they were originally applied, and the name Schizometopa designates the subsection.

The failure heretofore, chiefly on the part of Schiner and his followers, to properly define the grand divisions of the Myodaria, and especially the families of Muscoidea, has been due to the attempted application, in a case demanding primary, constant, and approximately well-defined characters, of two secondary and gradating characters—namely, the presence or absence of tegulæ and aristal pubescence. These two characters are unserviceable, both because they intergradate to such an extent as to preclude the drawing of any natural lines of separation, and, further, because the parts exhibiting them are so functional that they afford characters of only secondary value or less. It was inevitable that a system founded on such characters could not stand, for the natural boundaries do not exist where it was endeavored to set them.

In the present paper the Muscoidea and Anthomyioidea are separated in such a manner, on atavic chaetotactic and venational characters, as to throw a few forms heretofore classed with the old Muscidæ s. str. into the Anthomyioidea, which arrangement is believed to represent their relationships more truly.

It is also believed that the five families into which the Muscoidea are divided will ultimately be found to closely correspond in value with the families now recognized in the other divisions of the Cyclorrhapha.

Professor J. H. Comstock published a very able paper in the Wilder Quarter Century Book, setting forth certain suggestions as to taxonomic work. The idea is there elaborated that, in order to determine the proper taxonomic system for a given group of insects, the forms should be arranged independently on each one of their many characters in turn, and the final mean between all these separate arrangements should then be determined. This mean would indicate the correct taxonomic system. It is understood, of course, that the varying values of the various characters should be taken into consideration in such a procedure. It has been the aim to present a systematic arrangement in this paper to agree quite closely with the results that might be obtained from such a final average between characters in this superfamily.

In the following synoptic treatment of taxonomic categories a plan is followed which has been devised and perfected by Dr. A. D. Hopkins, to whom thanks are due for an exposition of it. This synoptic plan possesses decided advantages over any scheme of the kind yet devised, and is really a perfected system on the lines of that used by Brauer and von Bergenstamm, and some other European systematists. The present synopses are carried down to families only, and do not exhibit the plan in detail. It will be a labor of years to perfect the arrangement of the forty or more subfamilies, the numerous tribes, the two or three hundred American typic genera and five hundred or more additional atypic genera in this superfamily, to say nothing of the multitude of typic and atypic species. The synoptic plan referred to is carried out in detail by employing the following system of characters in turn: I, II, III, etc.; A, B, C, etc.; a1, a2, a3, etc.; b1, b2, b3, etc.; c1, c2, c3, etc.

Order DIPTERA

Lunula absent.....Suborder ORTHORRHAPHA
Lunula present.....Suborder CYCLORRHAPHA

Suborder CYCLORRHAPHA

Ptilinal suture absent.....Series ASCHIZA
Ptilinal suture present.....Series SCHIZOPHORA

Series SCHIZOPHORA

Head closely united to thorax or folding back into dorsal groove on same. Section PUPIPARA
Head separated from thorax by a free neck.....Section MYODARIA

Section MYODARIA

Front in both sexes of equal width, or if wider in female the greater width is due to a widening of the frontalia and the tegulæ are absent; tegulæ never well developed (includes Conopidæ).....Subsection HOLOMETOPA

Front in male narrower than in female, the wider front of female never due to a widening of the frontalia, tegulæ never absent; if the front is not wider in female the tegulæ are well developed..Subsection SCHIZOMETOPA

Subsection SCHIZOMETOPA

Hypopleural and pteropleural bristles and hairs always absent, fourth longitudinal vein lying partly in the hind margin of the wing behind middle of extreme wing-tip, proboscis never adapted for bloodsucking, if three sternopleural bristles present their formula is 1:2.

Superfamily ANTHOMYIOIDEA

Either hypopleural or pteropleural bristles or hairs always present, fourth longitudinal vein rarely continuous with hind margin of wing behind middle of extreme wing-tip except when proboscis is adapted for bloodsucking,[1] if three sternopleural bristles present their formula is either 2:1 or 1:1:1 .....Superfamily MUSCOIDEA

Superfamily MUSCOIDEA

Facial plate strongly produced below vibrissal angles like the bridge of the nose, the produced portion convex laterally and not flattened, the vibrissæ separated by this bulging and situated high above the oral margin; the mesofacial plate and epistoma completely fused into one piece.

(PHASIID Stem) Family PHASIIDÆ

Facial plate not so produced, at most projecting nose-like below with flattened slope, or if latter is somewhat convex (Gymnosomatinæ) the vibrissæ are inserted quite near oral margin.

I

I

Facial plate always receding below vibrissal angles and oral margin never prominent, thus giving the facio-peristomal profile an evenly and gently convex outline; vibrissal angles situated at or above the lower two-thirds point between oral margin and base of antennæ, always very much higher above median oral margin than length of second antennal joint, at least twice as high, the mesofacial plate in consequence greatly shortened, never widely produced downward, if not completely cut off by vibrissal angles then at least very strongly constricted thereby, the peristomalia either approximated and forming parallel lines for a considerable distance or bowed outwardly and more or less widely separated so as to enclose the epistoma as a more or less distinct sclerite of the facial plate between them; antennæ almost always very short..(ŒSTRID-MACRONYCHIID Stem)

A

[1] *Mesembrina* and *Eumesembrina* are the only exceptions known to the writer, aside from the bloodsucking forms.

Facial plate below vibrissal angles never receding conspicuously, the oral margin always more or less prominent, the facio-peristomal profile in consequence never evenly and gently convex; vibrissal angles approximated to oral margin and never placed much higher above its median portion than length of second antennal joint, distinctly below two-thirds point of face, the mesofacial plate elongate, never very strongly constricted, if constricted at all the constriction is close to oral margin; antennæ usually long .....(Tachinid-Muscid Stem)
B

A

Vibrissæ and macrochaetæ absent; mouthparts wanting or rudimentary, nonfunctional .....Family Œstridæ
Vibrissæ and macrochætæ present, mouthparts functional.
Family Macronychiidæ

B

Macrochætæ developed, or if not (Gymnosomatinæ only) then the more or less red abdomen highly swollen or inflated and covered with very short, fine, black, bristly hairs; ovipositor never *Musca*-like.
Family Tachinidæ

Macrochætæ not developed, or if so (*Reinwardtia* only) then no frontoorbital bristles present and ovipositor integumental, long and *Musca*-like; abdomen never swollen or inflated.....Family Muscidæ

The series Aschiza (Becher and Brauer) includes the Phoridæ, Pipunculidæ, Platypezidæ, and Syrphidæ. The series Schizophora (Becher and Brauer) includes all the rest of the Cyclorrhapha.

The section name Pupipara might well be replaced with Nymphipara (Réaumur), which has priority. The section Myodaria (Robineau-Desvoidy) corresponds to the Eumyidæ of Brauer, and to the Muscoidea of Coquillett plus the Conopidæ.

The subsection Holometopa (Brauer) includes the Malacosomæ, Palomydæ, Phytomydæ, etc., of Robineau-Desvoidy, and corresponds in the main to the Acalypteratæ of authors plus the Conopidæ. The subsection Schizometopa (Brauer) corresponds in the main to the Calypteratæ of authors, not of Robineau-Desvoidy.

The superfamily Anthomyioidea (Townsend) corresponds to the Mesomydæ of Robineau-Desvoidy; and to the Anthomyiden of Girschner minus most of the Muscinen of Girschner. The superfamily Muscoidea (Townsend) corresponds to the Creophilæ of Latreille, Westwood, Macquart; to the Calypteratæ of Robineau-Desvoidy; to the Muscaria Schizometopa (exclusive Anthomyiidæ) of Brauer and von Bergenstamm; and to the Tachiniden of Girschner plus most of the Muscinen of Girschner.

For detailed characters defining the suborders, series, and subsections, see the works of Brauer, Becher, Williston, and Girschner.

From the section Myodaria inclusive down to the families, and in some cases the subfamilies, the divisions are particularly difficult of exact definition, from adult characters alone, on account of the numerous intermediates. A study of the characters of the early stages is needed to determine beyond question the location of certain intermediate forms.

The family Macronychiidæ includes those forms approaching the Œstridæ in the character of the facial and peristomal development of the head, and which have heretofore been classed partly with the true tachinids and partly with the true dexiids. It corresponds practically to the group Macronychiidæ of Brauer and von Bergenstamm, but it should be noted that *Megaprosopus,* and not *Macronychia,* is the real type of the family.

The old family Dexiidæ can not be maintained. With the exception of the few just mentioned as included in the Macronychiidæ, its forms all fall in the Tachinidæ, of which they constitute several subfamilies and tribes.

Concerning the three types to be distinguished in the Muscoidea, it may be pointed out that the most generalized type seems to be the Phasiid. The primeval stock was the possessor of a Phasiid-like facial-plate development, in all probability, more or less after the Syrphoidean style. From this stock sprang the three present stems.

Phasiid—Facial plate of the primeval type practically preserved, the mesofacial plate and epistoma becoming solidly anastomosed into one piece, retaining the characteristic bridge-of-the-nose production below. Both antennæ and mouthparts, especially the latter, well developed.

Tachinid-Muscid—Mesofacial plate much increased and epistoma more or less reduced from the preceding, losing the bridge-of-the-nose production, but retaining a more or less prominent oral margin, the mesofacial plate gaining a length and width sufficient to accommodate the greatly developed antennæ. The epistomal development is largely retained to accommodate the very functional mouthparts.

Œstrid-Macronychiid—Mesofacial plate much reduced and epistoma (except in Hypodermatinæ) greatly narrowed and rounded off, losing the prominent oral margin entirely. Antennæ and mouthparts approaching atrophy from disuse.

The following detailed notes on the connectant forms appearing to lie more or less between the superfamilies Muscoidea and Anthomyioidea will be useful for comparison with the synoptic table just given. The former superfamily includes the bulk of the old Muscidæ, the Sarcophagidæ, Dexiidæ, Tachinidæ, et al. (Phasiidæ, Gymnosomatidæ, Ocypteridæ, Phaniidæ), and the Œstridæ; the latter superfamily includes the Anthomyiidæ as herein accepted. The

forms which are here referred to the latter, and upon which there has in the past been any question as to position, are:

ANTHOMYIOIDEA

Myiospila meditabunda et spp.—No hypopleural nor pteropleural bristles or hairs. Sternopleural bristles 1. 0. 2. A weaker sternopleural bristle below first one, so as to appear 2. 0. 2. Venation like *Stomoxys*.

Muscina stabulans et spp.—No hypopleural nor pteropleural bristles or hairs. Sternopleural bristles 1. 0. 2. Venation like *Stomoxys*.

Muscina cæsia (det. Coquillett).—No hypopleural nor pteropleural bristles or hairs. Sternopleural bristles 1. 0. 2. Venation typical anthomyiid.

Cyrtoneura podagrica, gluta, et spp.

Pararicia pascuorum et spp.

Clinopera frontina et spp.—No hypopleural nor pteropleural bristles or hairs. Sternopleural bristles 1. 0. 2.

These forms have heretofore been classed in the old Muscidæ s. str. by Williston, van der Wulp, and Brauer. It is believed they should be excluded from the Muscoidea on the general averages of their characters.

MUSCOIDEA

The following forms here included in the Muscoidea were referred by Girschner to his Anthomyiden:

Musca domestica, corvina, et spp.—No hypopleural hairs. Distinct pteropleural hairs. Sternopleural bristles 1. 0. 2, but in some the last two bristles are separated so as to appear almost like 1. 1. 1. Typical Muscoidean venation.

Stomoxys calcitrans et spp.—Hypopleural hairs, also pteropleural hairs. Sternopleural bristles 0. 0. 1. Fourth vein bent, arcuate, partly continuous with hind border. Proboscis adapted for bloodsucking.

Lyperosia irritans et spp.—No hypopleural bristles. Pteropleural hairs present. Sternopleural bristles none, 0. 0. 0. Aberrant venation; fourth vein hardly bent, yet apical cell narrowly open at wing-tip; third vein bulged upward, convex in front or above. Proboscis adapted for bloodsucking.

Hæmatobia stimulans et spp.—No specimens for study.

Graphomyia maculata, americana (det. Coquillett), et spp.—Hypopleural hairs present. No pteropleural bristles or hairs. Sternopleural bristles 0. 0. 2. Fourth vein arcuate at bend.

Synthesiomyia brasiliana et spp.—Hypopleural hairs strong, quite bristly No pteropleural hairs. Sternopleural bristles 1. 0. 2. Fourth vein arcuate at bend.

Glossina longipalpis et spp.—No hypopleural hairs or bristles. Distinct black pteropleural bristles, with yellowish hairs also. Sternopleural bristles 1. 0. 2. Venation aberrant, in Œstrid direction; apical crossvein continuous with posterior crossvein, fourth vein deeply arcuate before small crossvein so that latter appears continuous with the section of fourth vein following it.

Morellia violacea (det. Coquillett, Brazil), *micans* Macquart (det. Coquillett, Maine), et spp.—No hypopleural hairs. Pteropleural hairs present, bristly hairs in *micans*. Sternopleural bristles 1. 0. 2. Fourth vein arcuate at bend.

Mesembrina mystacea et spp.—No hypopleural hairs or pile. Pteropleural black pile present. Sternopleural bristles 1. 0. 1, but often hard to distinguish from the black hairs or pile. Venation like *Stomoxys,* also like *Myiospila,* fourth vein partly continuous with hind border. This and the five following genera have the inner side of middle tibiæ furnished with one or more strong bristles.

Metamesembrina (gen. nov.) *meridiana* Linné (det. Brauer and von Bergenstamm, Alaska).—No hypopleural hairs or bristles. Pteropleural bristly hairs present. Sternopleural bristles 0. 0. 1. Fourth vein reaching front margin of wing before tip and arcuate at bend.

Eumesembrina (gen. nov.) *latreillei* Robineau-Desvoidy, et spp.—No hypopleural hairs. Pteropleural hairs present. Sternopleural bristles 1. 0. 2. Venation as in *Mesembrina,* but fourth vein more continuous with hind margin.

Dasyphora pratorum et spp.—No specimens. Venation of *Lucilia* (acc. Brauer and von Bergenstamm).

Pyrellia cadaverina (1 spm. det. Brauer and von Bergenstamm), *serena* Meigen (det. Coquillett), et spp.—No hypopleural hairs. Pteropleural hairs present, bristly and short in *cadaverina.* Sternopleural bristles 1. 0. 3 (sometimes 4); in the single specimen of *cadaverina* 1. 0. 2 on one side and 1. 0. 4 on the other, but probably normally 1. 0. 3. Fourth vein arcuate at bend.

Pseudopyrellia cornicina et spp.—No hypopleural hairs. Pteropleural hairs present. Sternopleural bristles 1. 0. 2, but the hind pair with anterior bristle placed nearly as high as the posterior one. Fourth vein arcuate at bend.

Phasiophana obsoleta et spp.

Cyrtoneura sp. (det. Brauer, N. C. and Cala.).—No hypopleural hairs Pteropleural bristles present. Sternopleural bristles 1. 0. 2. Fourth vein arcuate at bend, apical cell narrowly open. *Morellia micans* (det. Coquillett) and *hortorum* have nearly these characters, and it is likely that the present North Carolina and California specimens belong to *Morellia.*

Auchmeromyia spp.—This genus evidently belongs here. It probably has either hypopleural or pteropleural hairs or bristles.

Ochromyia jejuna J. C. Fabricius (N. W. India) et sp. (Amboyna).—Hypopleural bristles present. No pteropleural bristles, but yellowish pile present. Sternopleural bristles 1. 0. 1. Venation typical.

It will be at once seen from the above notes that the characters of the presence of one or other or absence of both the hypopleural and pteropleural bristles or hairs are the final determining test in the separation of the two superfamilies.

Metamesembrina, Graphomyia, and *Synthesiomyia* do not have the fourth vein continuous in any part of its extent with the hind margin of wing, but all show a more or less distinct posterior inclination of fourth vein where it joins the wing margin, this being less distinct in *Synthesiomyia.* The genera with this venation might be considered by some students to form an aberrant group of the Anthomyioidea, exhibiting a transition toward the Muscoidean type of venation; but, considered from all points of view, their relationships are mainly with the Muscoidea.

Synthesiomyia has strong hypopleural hairs, which can hardly be considered true bristles, yet they serve as a character of equal value. It has also a bare arista. It lacks the pteropleural hairs and bristles.

Musca, Glossina, Pseudopyrellia, Pyrellia, Morellia, and *Dasyphora* (?) have the Muscoidean type of venation strongly marked (except *Pyrellia*), but possess no hypopleural bristles. *Glossina* and *Musca,* however, possess distinct pteropleural bristles like the other Muscoidea, while *Pseudopyrellia, Pyrellia, Morellia,* and *Dasyphora* (?) possess a tuft of more or less bristly hairs in their place, directly beneath the wing bases. *Morellia hortorum* has pteropleural bristles approaching those of *Glossina* and *Musca* in strength, and is doubtless not a true *Morellia,* which has only a tuft of pteropleural hairs. All these genera are more or less intermediate, but they can be distinguished by the above characters.

Some doubt may arise with *Myiospila,* etc., which belong in the Anthomyioidea. They have neither hypopleural nor pteropleural hairs, which will always distinguish them, and it may be seen that the fourth vein is continuous with wing margin behind the middle point of the rather widened apex of wing.

In connection with the characters given for the Muscoidea in the table, it is to be noted that the fourth vein is incomplete in certain genera, as *Roeselia, Phytomyptera, Thrixion, Gastrophilus, Syllegoptera, Eurygeromyia, Dichætoneura,* etc.

Finally it may be pointed out that certain species of the old genus *Cyrtoneura,* referred to *Pararicia* by Brauer and von Bergenstamm, and belonging to the Anthomyioidea, show the gentle removal of the fourth vein from the wing margin which is characteristic of the forms whose position has been heretofore misunderstood. These forms were considered by some authors as belonging to the old Muscidæ s. str., and by others as belonging to the Anthomyiidæ, but the characters pointed out by Girschner serve to reveal their true position. They are distinctly to be considered as a genealogical group descended from forms with a wholly straight (as far as wing margin) fourth vein. The extensive removal of the fourth vein from the wing margin in *Pyrellia, Mesembrina, et al.* must be considered as a further step in the development of the venation toward the Muscoidean type. The Muscoidea are without question more specialized than the Anthomyioidea; and since the form normal in the latter exhibits the type of venation universal in the Holometopa (excepting the Conopidæ), the last named subsection is less specialized than the Schizometopa. The Conopidæ stand evidently to one side as a large group rather closely related to both the Schizometopa and the Holometopa, but with a preponderance of affinities for the

latter. They doubtless represent a branch which sprung from the proto-Myodarian stem during its period of multiform development. They should be considered as one of the primary divisions of the Holometopa, probably equal in taxonomic rank to all of the other Holometopa taken together. They stand in practically the same relation to the Holometopa as do the Œstridæ to the Schizometopa, the Œstridæ also being a group apart from the other Schizometopa and of older origin. Moreover, the Œstridæ is a polyphyletic group showing affinities with various subfamilies and tribes of Muscoidea, but owing to its present preponderance of characters due to mode of life it is best treated as a family. For similar reasons the Conopidæ are also best treated as of family rank.

While on the subject of the relationships and extreme specialization of the Schizophora in general and the Muscoidea in particular, it becomes highly significant to note that the Muscoidean stock has originated three separate and distinct types of parasitism on mammals, all having the same end in view—that of nourishing their larvæ at the expense of Mammalia—but each of the three attaining this result in radically opposite ways.

Cuterebra and its allies attain this end by their well-known subcutaneous larval endoparasitism, in which the larva does all the feeding, the imago taking no nourishment whatever, this peculiarity being developed even to the extent of the adult mouthparts having become atrophied and nonfunctional.

Glossina secures the same result by a supracutaneous imaginal ectoparasitism, in which the adult does all the feeding, by actual mechanical blood-letting, and retains and nourishes the larva within the oviduct until it is fully grown, when it is extruded and becomes a pupa almost immediately and absolutely without feeding. This is the exact antithesis of the preceding.

But the Muscoidea must be credited with developing yet a third, and still more remarkable method, because wholly unique and unparalleled among dipterous larvæ of this description, of living at the expense of mammals. *Auchmeromyia* produces a bloodsucking larva, and thus furnishes a case of supracutaneous larval ectoparasitism, since the larva sucks blood externally by mechanical means. This is the so-called Congo floor-maggot, which has recently attracted some attention in the literature. It possesses an extended range on the West African coast and has also been reported from Uganda. The maggot-like larva pierces the skin of sleeping persons with its small but sharp jaws, and sucks their blood. It is an unique habit, because the larva is a footless maggot with extremely small jaws and no means of attaching itself to the skin of its host

other than by its mouthparts. It can not cling during the act of piercing by any structure except its mouth-hooklets. The acquirement of such a habit has been possible through the fact that the natives of the region inhabited by it have from time immemorial slept on mats spread upon the earthen floors of their dwellings. The larvæ probably originally fed on fermenting juices and liquids, as evidenced by the fact that they are especially common beneath the urine-stained mats which have been occupied by sleeping children. The flies are attracted by sour-smelling liquids, and doubtless oviposit beneath the sleeping-mats of young children.

The peculiar mode of reproduction of *Glossina* is carried even farther by the Hippoboscid genera of mammal ectoparasites (*Lipoptena, Melophagus, Hippobosca, Ortholfersia*). The larva in these forms is retained and nourished within the oviduct of the female until full grown, but upon being extruded is incapable of movement. The *Glossina* larva upon extrusion is capable of only sufficient movement to find a suitable place for pupation, whereupon its integument undergoes chitinization to form the pupal envelope. The Hippoboscid larva upon extrusion forthwith undergoes this process of external chitinization. The Hippoboscid female therefore extrudes the larva in a situation and position suitable for it to remain during its pupal period. It is thus evident that some relationship exists between *Glossina* and the Hippoboscidæ, doubtless to the extent of a not very remote common origin. The Hippoboscidæ are probably an offshoot from the old muscid stock on the one hand, and the Œstridæ are likely an earlier offshoot in a quite opposite direction from several stems of the same stock.

The Œstrid habit of parasitism seems the oldest, the *Glossina* and Hippoboscid habit next, while the *Auchmeromyia* mode is evidently very recent.

DESCRIPTIONS

But little need be said in preface to the following descriptions of genera and species. In addition to the treatment of new forms, there is given considerable supplementary descriptive matter on forms already described.

As a basis of operations in determining the North American Muscoidea, the recent Smithsonian Catalogue of North American Diptera, by Professor Aldrich, will be found quite indispensable. Its value lies in its references to descriptions. It will be necessary to use it with much caution so far as the synonymy is concerned. It should also be pointed out that the sequence of genera there employed is unnatural and misleading. This is not the fault of the cataloguer, but is due to the present unsatisfactory state of the literature of the North American forms.

The sequence of subfamilies and tribes here adopted is as nearly a natural one as is possible of attainment in the present state of our knowledge. No doubt further study will modify this arrangement in certain details.

It is to be noted that the tribes which appear in center heads are independent of the subfamilies preceding them, except those in italics under the families Muscidæ and Phasiidæ.

Family MACRONYCHIIDÆ

Tribe TRIXODINI

Genus Trixodes Coquillett

Trixodes Coquillett clearly exhibits in its weakly developed mouthparts, peculiar facial plate, and weak macrochætæ a close affinity with the Œstridæ. The type species is *obesa* Coquillett, described from a specimen collected by the writer in the Sierra Madre of Chihuahua. A second specimen was collected by the writer on the West Fork of the Gila, in New Mexico.

Subfamily MEGAPROSOPINÆ

Genus Microphthalma Egger.

Microphthalma trifasciata Say.—*Tachina disjuncta* Wiedemann may be a small specimen of this species.

The genus *Microphthalma* is distinct from *Dexiosoma,* from which it differs in its relatively small eyes, almost bare and much shortened

arista, more compressed third antennal joint, and almost bare parafacials. The antennæ are inserted on eye middle.

M. michiganensis Townsend is a large northern form, distinct from *trifasciata* or *disjuncta* in its red face and cheeks, third antennal joint hardly longer than second, facial profile more flattened, silvery pollen of abdominal segments general and not restricted into basal fasciæ.

Tribe NEOPHYTOINI

NEOPHYTO, gen. nov.

The genus is like *Megaprosopus* in the formation of the facial plate, epistoma, and facial ridges, but the vibrissæ are distinct from the peristomal bristles below them, and the parafacials have an oblique well-marked row of thinly set bristles (not thickly placed as in *Macronychia*). Frontal bristles not strong. Peristomalia quite closely approximated. Cheeks more than one-half as wide as eye height, sometimes appearing almost as wide in female. Front prominent, facial profile strongly receding and slightly convex. Antennæ inserted distinctly below middle of eyes. Apical cell closed in margin considerably before wing tip; fourth vein bent at angle, without stump but with slight wrinkle, hind crossvein in middle between small and apical crossveins. Male without, female with two middle fronto-orbital bristles. Type, *Phyto setosa* Coquillett.

Neophyto anomala, sp. nov.

Syn. *Phyto clesides* COQUILLETT (non Walker).

Length, 6 to 8 mm. Grayish cinereous. Facial plate narrow, oval, acute below, the vibrissal angles but little more approximated than the peristomalia below them, the facial profile strongly convex. Face, parafacials and parafrontals silvery; palpi, cheeks, frontalia and antennæ light reddish brown, third antennal joint brown. Antennæ very short, third joint no longer than second, second about three times as long as the very short first joint. Male front much narrower than eyes, female front wider than eyes. Male cheeks two-thirds eye height in width, female cheeks fully equal to eye height. Mesoscutum cinereous, with three dusky vittæ in male, almost obsolete in female. Abdomen dusky cinereous, with anterior portions of second and third segments and most of anal segment silvery-cinereous. In the female especially the dusky portion is more variable, appearing in some only on narrow hind margins of second and third segments. Discal macrochætæ on all the segments except the first. Male abdomen long-subconical, female abdomen

oval and flattened. Legs blackish. Wings clear, veins brown. A strong costal spine present, apical cell sometimes extremely short petiolate. Tegulæ white.

Missouri to Louisiana.

Type.—Cat. No. 11,646, U. S. N. M. (Missouri, Riley Coll.).

Family TACHINIDÆ

Tribe Miltogrammini

Genus Senotainia Macquart

Senotainia rubriventris Macquart.—The writer retains *Senotainia*, of which this species is the type, as distinct from *Miltogramma* in having a more evenly rounded facio-frontal profile, narrower cheeks, bare parafacials, distinct vibrissæ, and longer antennæ.

Miltogramma and *Senotainia*, with certain other forms yet to be described, constitute a tribe by themselves. The writer can not follow Brauer and von Bergenstamm in grouping *Metopia, Araba, Hilarella*, etc., with them. The latter genera have the vibrissal angles close to oral margin.

Tribe Myiophasiini

Genus Myiophasia Brauer and von Bergenstamm

Myiophasia of Brauer and von Bergenstamm has the eyes bare; cheeks in female more than one-third eye height in width, in male scarcely one-fourth eye height; both sexes with short but strong claws, the front claws of male being the only ones that are somewhat longer than last tarsal joint; no macrochætæ on first and second abdominal segments; arista thickened only at extreme base, second joint short.

It is hardly possible that the Uruguayan and United States forms that have been referred to this species are identical. Several other well-marked forms have been confused here. *M. ænea* has the apical cell distinctly though narrowly open

Myiophasia setigera, sp. nov.

Differs from *M. ænea* in having a median marginal pair of macrochætæ on second abdominal segment in both sexes. Male with rows of hairs on parafacials, female with same rows somewhat less developed.

Texas, New Mexico, Nevada, Oregon.

Type.—Cat. No. 11,647, U. S. N. M. (Male, Beulah, New Mexico, 8,000 feet, August, Cockerell.)

A female specimen received from the Cotton Boll Weevil Laboratory (Hunter) was collected on an acorn of *Quercus alba* at Ruston, Louisiana, October 31, and was apparently ovipositing on a weevil larva within.

A female specimen from New Mexico (Santa Fé, Cockerell) has a pair of small macrochætæ on anterior border of second and third abdominal segments, and a submarginal posterior pair on third segment. It may be a distinct form.

These forms are placed in *Myiophasia* tentatively, and may need to be removed on further study.

Genus Phasioclista Townsend

The genus *Phasioclista* Townsend also has the eyes bare, but the cheeks are almost or quite one-half eye height in width in both sexes; male claws long, all being distinctly longer than last tarsal joint; female claws very short; arista bulbous at base, indistinctly jointed; first and second abdominal segments without macrochætæ, apical cell closed or sometimes very narrowly open, hind crossvein nearly straight.

Myiophasia differs from *Phasioclista* in having a loosely set, oblique, fringe-like row of bristly hairs on parafacials, in addition to the shorter irregularly arranged hairs above them; the cheeks are not so wide, as above pointed out, a double costal spine is present, and the antennæ reach almost to insertion of vibrissæ.

Whether the specimens with apical cell open and closed represent different forms of *Phasioclista* is still a question, but the fact is recorded in *Psyche* (June, 1893, p. 467) that specimens bred from different hosts differed in this character. A specimen bred from *Leucania unipuncta* had the apical cell open, and another bred from *Sphenophorus parvulus* had same closed. The radical difference between a parasitic habit involving a lepidopterous larval host with soft skin, and one affecting an adult coleopterous host, would easily imply the distinctness of these forms.

Phasioclista metallica Townsend.—Both sexes have perfectly bare eyes. Female with more or less suggestion of pollen on mesoscutum in front. No macrochætæ on first two abdominal segments. Male with rows of hairs on parafacials, female practically without.

Florida, Georgia.

Genus Ennyomma Townsend

Ennyomma, at least in the male, has the eyes thickly pubescent; arista distinctly three-jointed, not so bulbous at base as in *Phasioclista;* second abdominal segment with marginal macrochætæ;

apical cell open, sometimes narrowly so; hind crossvein strongly sinuate. The genus may be at once distinguished from both *Myiophasia* and *Phasioclista* by its thickly hairy eyes. *M. robusta* Coquillett belongs to *Ennyomma*.

Ennyomma robusta Coquillett.—Eyes thickly pubescent (at least in male). Last two abdominal segments and anterior border of second segment thickly pollinose. Large species.

California, Mexico.

Ennyomma globosa Townsend.—Eyes thickly pubescent in male, bare in female. Male with purplish shining mesoscutum, showing no pollen. Female showing pollen at least anteriorly and on humeri. Small species. The species was described in the male only, and referred to *Loewia*. Numerous male specimens agree perfectly with the description. The female is without macrochætæ on first two abdominal segments, the male having them as in the description.

White Mountains, New Hampshire; Maryland, Georgia, Florida, Louisiana, Missouri, Sierra Madre of Chihuahua, Mexico City, Nicaragua.

Two specimens, male and female, bred from *Anthonomus grandis*, Alexandria, Louisiana (Hunter, No. 1326, W. 6).

Tribe EUMEGAPARIINI

EUMEGAPARIA, gen. nov.

This genus may be considered intermediate between *Megaparia* and *Dexia*, but must be classed with the Tachinidæ in the neighborhood of the Dexiinæ. The oral margin is only slightly prominent and the facio-peristomal profile approaches that of the Megaprosopinæ, but the oral margin is nevertheless sufficiently prominent to destroy the evenly convex outline characteristic of the Megaprosopine profile. The antennæ are short and the mouthparts much reduced, the proboscis being very short. The mesofacial plate, however, is of good width and length; the vibrissal angles are widely separated and only feebly convergent, about as high above oral margin as length of second antennal joint. Ptilinal suture terminating well above vibrissal angles. Claws of male very long. Type, *Megaparia flaveola* Coquillett (No. 6236, U. S. N. M.), Colorado.

Subfamily DEXIINÆ

Genus Ptilodexia Brauer and von Bergenstamm

Clinoneura and *Ptilodexia*.—*Ptilodexia* has parafacials hairy, more than one pair of discal macrochætæ on middle abdominal seg-

ments, and male claws very long. *Clinoneura* has parafacials bare, only one pair of discal macrochætæ on middle abdominal segments. The species described by Robineau-Desvoidy as *Estheria tibialis* is neither a *Ptilodexia* nor a *Clinoneura,* since it has the apical cell petiolate.

Ptilodexia has cheeks (male) about, or slightly over, one-half eye height; antennæ inserted low, so as to give a long frontal profile; vibrissæ inserted high above oral margin; no strong or other reclinate vertical bristles; second antennal joint elongate and third shortened.

DOLICHOCODIA, gen. nov.

Near *Myiocera,* from which it differs as follows: Head conspicuously elongated anteriorly, apical cell open. Antennæ inserted on or above middle of eyes; proboscis slender and horny, with long filiform palpi which are but slightly thickened apically and bear very long bristles; parafacials wider; long axis of head at antennal insertion fully equal to that at epistoma; head longer than high. Type, *Myiocera bivittata* Coquillett, described from specimens collected by the writer on the Rio Ruidoso, in the White Mountains of New Mexico.

EUCHÆTOGYNE, gen. nov.

Like *Chætogyne,* but proboscis rather stout and only a little longer than head height; hind tibiæ completely ciliate on outer edge, with no bristles among the cilia. It agrees with *Chætogyne* in having the carina wide, flattened on its edge and conspicuously furrowed on median line. Type, *Hystrichodexia roederi* Williston (Kansas Univ. Quarterly, II, pp. 77-78), described from Arizona (1 male). For purposes of comparison, the following characters are given for certain allied genera:

Hystrichodexia has proboscis shorter than head height.

Paraprosena has carina narrow and thin.

Chætogyne has proboscis very long and slender, hind tibiæ with long macrochætæ among the cilia.

Phorostoma has only a weak rudimentary facial carina.

Euchætogyne roederi Williston.—Three males in U. S. N. M.; two collected by the writer in Meadow Valley, Sierra Madre of western Chihuahua, head of Rio Piedras Verdes, about 7,300 feet, August 30 and September 2; and one labeled "Mexico, 400, *Phorostoma.*"

Williston says in his description: "Third, fourth, and fifth segments opaque golden yellow." The so-called *fifth* segment shows

very narrowly, being the base of the hypopygium. It is in reality the sixth segment, since there is a very abbreviated basal segment present. What appears to be the fifth segment is only the portion of the fourth behind the transverse row of submarginal macrochætæ. The scutellum shows practically no yellowish on apex. The third segment (called second heretofore) has, in addition to the six approximated macrochætæ on hind border in middle, three or four (usually four) approximated lateral ones on each side. The second segment (so-called first) has one lateral macrochæta on each side. The apical decussate pair of scutellar macrochætæ is quite as strong and long as any of the others of scutellum. The narrow linear yellow of hind margin of third segment is continued in a slight anterior prolongation on the median line in the two Sierra Madre specimens. In addition to the two large silvery spots of third segment of venter, there are two smaller ones on the second and fourth ventral segments in the above specimens.

Genus Myxodexia Brauer and von Bergenstamm

Syn. *Tropidomyia* Brauer & von Bergenstamm (preocc.).
Neotropidomyia Townsend, nom. nov. (Dec., 1891), Trans. Am. Ent. Soc., xviii, p. 382.

The type of this genus is *M. macronychia* Brauer and von Bergenstamm, of Syria.

Subfamily Trixinæ

EUCLYTIA, gen. nov.

This genus is herewith proposed for the species *Clytia flava* Townsend (Tr. Am. Ent. Soc., xviii, pp. 372-373). It may be known by the two rows of weak frontal bristles on each side of frontalia, the outer row weaker and somewhat irregular. The epistoma is but slightly prominent. Specimens in U. S. N. M. have been referred by Brauer and von Bergenstamm to *Redtenbacheria*, but the species certainly can not be included in that genus.

It is distinct from the old genus *Clytia*, now to be known as *Clytiomyia*, of which the European *C. helvola* is to be taken as the type. *Clistomorpha* also is a very different genus. Both *Clistomorpha* and *Clytiomyia* belong in the Phasiidæ.

Tribe Phasiopterygini

Genus Phasiopteryx Brauer and von Bergenstamm

Phasiopteryx bilimeki Brauer and von Bergenstamm.—The remarks on this species in Ann. and Mag. Nat. Hist., xix, pp. 33-34,

indicate differences between *Phasiopteryx* and *Neoptera,* the significance of which did not appeal to the writer at the time. It seems quite certain that several forms are confused here. The specimens that the writer has seen of related forms in the Œstrophasiinæ incline him to the belief that large series of material will demonstrate the distinctness of *Neoptera* and *Phasiopteryx.* It must be remembered that only a fraction of the neotropical fauna is yet known.

Besides the differences, pointed out below, between *Œstrophasia* and *Phasiopteryx,* the following may also be noted: *Œstrophasia* and *Cenosoma* have the facial plate flat or subcarinate; antennæ inserted distinctly below middle of extreme head height, almost as low as lower margin of eyes; arista very short and bare, and third antennal joint only about as long as second. *Phasiopteryx* has the facial plate more strongly, often quite strongly, carinate; antennæ inserted but little below middle of eyes, distinctly above middle of extreme head height; arista very long, very distinctly but finely and thinly hairy (looks bare in some specimens, apparently from the fine hairs being lost or rubbed off), and the third antennal joint always twice as long as second.

Subfamily Œstrophasiinæ

Genus Œstrophasia Brauer and von Bergenstamm

Œstrophasia clausa Brauer and von Bergenstamm.—This is a northern species. The specimens from Cuautla, Mexico, referred here by Giglio-Tos, doubtless represent another form. Cuautla is thoroughly tropical, and *clausa* is a transition and boreal form.

The ultimate section of fourth vein in *Cenosoma signifera* and *calva* is normally rather deeply bowed in, but not so in *Œ. setosa* and *clausa,* both of which have the apical cell very short petiolate, while *setosa* has third vein bristly nearly to small crossvein.

The antennæ of *Œstrophasia* and *Cenosoma* are widely separated by a characteristic median enlargement of the lunula in both sexes of all the species. This is absent in *Phasiopteryx,* which has the antennæ closely approximated.

Genus Eucestrophasia Townsend

Eucestrophasia aperta Brauer and von Bergenstamm.—This South American form seems generically distinct from the species of *Œstrophasia* in its open first posterior cell, as pointed out in Trans. Am. Ent. Soc., XIX (1892), p. 133.

Genus Cenosoma van der Wulp

Cenosoma signifera van der Wulp.—It is likely that this tropical species will prove generically distinct from both *Œstrophasia* and *Euœstrophasia,* when sufficient material is studied. Two species are probably confused in the catalogue under the name of *signifera.* The Canadian and New England specimens are probably a northern form distinct from the tropical one. *Œ. calva* may be considered congeneric with *signifera.*

Subfamily PARAMACRONYCHIINÆ

Genus Pachyophthalmus Brauer and von Bergenstamm

Pachyophthalmus aurifrons Townsend.—This species is quite distinct from the European *signatus* Meigen, which probably does not occur in America. It differs from *signatus* in the golden pollinose sides of front and face, third antennal joint about the length of second, hind crossvein very slightly bowed, front quite strongly produced, etc. *P. signatus* has pollen of front and face silvery white with blackish reflections but without golden, third antennal joint about twice as long as second, hind crossvein strongly bowed, front scarcely protruded, etc. Both *aurifrons* Townsend and *floridensis* Townsend are best assigned to this genus.

Genus Sarcomacronychia Townsend

Sarcomacronychia unica Townsend.—This species, *S. sarcophagoides,* and *S. trypoxylonis* are to be considered as three valid forms. The genus *Pachyophthalmus* differs from *Sarcomacronychia* in having the ptilinal area wider in comparison with parafacials, being three-fifths to almost three-fourths width of face; cheeks as wide as one-sixth to one-eighth eye height, or less; eyes descending but little lower than vibrissæ, as seen in profile. *Sarcomacronychia* has facial plate very small and restricted, being two-fifths to one-third width of face, parafacials proportionately wider, often nearly as wide as facial plate itself, but sometimes appearing narrow in profile; width of cheeks from little less than one-fourth to about one-fifth eye height; eyes descending far below vibrissæ, and even below epistoma, nearly as low as lateral oral margins, as seen in profile. *Pachyophthalmus* has the vibrissæ inserted but little above epistoma, and the antennæ are inserted below middle of eyes. *Sarcomacronychia* has vibrissæ inserted much farther above epistoma, and the antennæ are inserted on eye middle.

Tribe Melanophryonini

Genus Atropharista Townsend

The affinities of *Melanophrys* and *Atropharista* are uncertain. One can hardly agree with Brauer and von Bergenstamm's reference of them to the Paramacronychiinæ. They seem rather to belong in the Tachinidæ.

Atropharista jurinoides Townsend.—The writer has previously considered this genus synonymous with *Melanophrys,* but it appears after all to be distinct. *Melanophrys* has the second antennal joint short, the third joint being three to five times as long as second, according to sex. *Atropharista* has second antennal joint elongate, the third joint same length or a little longer, probably never twice as long even in the male.

The species *jurinoides* is distinct from Walker's *Tachina insolita,* if any reliance is to be placed on the description of the latter. *T. insolita* is described as having the third antennal joint fully twice as long as second, third aristal joint very stout, and a white oblique stripe on each side of head, presumably (from the connection) opposite the antennæ. The last character agrees with *Mel. flavipennis,* but the other characters only partially agree. None of them seems to agree with *Atropharista,* as the second antennal joint does not appear to be elongate in *insolita.*

A. jurinoides differs from both in having a broad, elongate silvery crescent bordering the orbit on each side of the head, partly on the parafrontals and partly on the parafacials. It is quite certain that the elongate second antennal joint will prove *Atropharista* to be a valid genus, as genera will ultimately go in this superfamily.

Subfamily Phytoinæ

EUPHYTO, gen. nov.

Differs from *Phyto* (Robineau-Desvoidy) Brauer and von Bergenstamm in having parafacials absolutely naked, tegulæ small and rounded, cheeks not widened posteriorly, apical cell quite long petiolate, hind crossvein in middle between small crossvein and bend of fourth vein, and no discal macrochætæ on abdomen.

Differs from *Stevenia* Robineau-Desvoidy in parafacials being wide, same width above and below, their width being equal to that of cheeks, which are over one-third eye height. Cheeks bare, same as parafacials.

Type, *Leucostoma subopaca* Coquillett.

Tribe METOPIINI

Genus Hilarella Róndani

The cheeks in this genus are about one-fourth eye height, parafacials with a row of bristles to lower eye margin, arista pubescent or hairy, front sharply produced in profile. *Opsidia* is much closer to *Hilarella* than is *Eumacronychia*.

Tribe EUMACRONYCHIINI

Genus Eumacronychia Townsend

Eumacronychia decens Townsend.—This species is the type of the genus, which has cheeks about one-half eye height in width, parafacials bare of bristles, frontal bristles stopping at base of antennæ.

Genus Gymnoprosopa Townsend

Gymnoprosopa polita, *argentifrons*, and *clarifrons* are perfectly distinct, in spite of the note in the catalogue. They may be recognized by the descriptions.

SPHENOMETOPA, gen. nov.

This genus is proposed for *Araba nebulosa* Coquillett. The specimens from which this species was described were collected in the vicinity of Meadow Valley, six or eight miles south of Colonia Garcia, in the Sierra Madre of western Chihuahua, on the head of the Rio Piedras Verdes, in the pine zone, about 7,000 to 7,500 feet (Townsend). The form is not referable to *Araba*.

The genus may be known by the front being conspicuously narrowed anteriorly, the parafacials very narrow and bare, the vibrissæ quite distinct, and the front not produced conically like *Metopia* and *Araba*. It comes near to *Metopodia* in the latter character. The wings are slightly clouded on the veins.

Subfamily PSEUDODEXIINÆ

EUCALODEXIA, gen. nov.

This genus is proposed for *Homodexia flavipes* Bigot. It may be recognized from the characters pointed out by Brauer (Sitzungsber. Kais. Akad. Wiss., CVII, I, p. 515), who failed to give it a name.

Genus Atrophopoda Townsend and allies

The following new genera are here proposed:

DIAPHOROPEZA, gen. nov.

Type, *Atrophopoda braueri* Williston.

ŒDEMAPEZA, gen. nov.

Type, *Atroph. townsendi* Williston.

CATEMOPHRYS, gen. nov.

Type, *Vanderwulpia sequens* Townsend.

BRAUERIMYIA, nom. gen. nov.

Type, *Wulpia* Brauer and von Bergenstamm (1892), preocc. by Bigot in Dipt. (1886). The genus is a valid one. The new name is proposed as a tribute to the memory of Friedrich Brauer, the one student who has most advanced our knowledge of the Muscoidean flies.

Below is a table of these and certain allied genera. All of them except *Vanderwulpia, Brauerimyia,* and *Catemophrys* have the parafacial bristles continuous with frontal row. This character, however, does not seem to indicate close relationship in all cases, as it is probable that *Ceratomyiella, Metachæta, Dichocera,* and *Atrophopalpus,* all here included, belong in other subfamilies from the rest. *Hypertrophocera* and certain other genera not included in the table possess this character.

Frontal bristles stopping short at insertion of antennæ, apical cell ending well before wing-tip, stump of vein at bend of fourth, hind crossvein nearer bend of fourth, cheeks about one-third eye height, eyes bare, arista pubescent basally, abdomen slender and rather conical, macrochætæ only marginal 2

Frontal bristles descending to middle of second antennal joint, apical cell ending well before wing-tip closed or extremely short petiolate, a black wrinkle but no stump at bend of fourth, hind crossvein nearer to bend, cheeks about one-half eye height, eyes bare, arista pubescent basally, abdomen elongate, macrochætæ only marginal.

Type, *Vander. sequens* ..... *Catemophrys*, gen. nov.

Frontal bristles descending on parafacials to lower border of eyes 3

2. No costal spine, apical cell long petiolate, parafacials bare.

Type, *atrophopodoides* ..... *Vanderwulpia*

A costal spine present, apical cell narrowly open or closed in margin, parafacials distinctly very short pilose.

Type, *Wulpia aperta* ..... *Brauerimyia*

3. Palpi atrophied, minute, apical cell closed in border at wing-tip, hind crossvein nearer bend, eyes almost bare.

Type, *angusticornis* ..... *Atrophopalpus*

Palpi normal 4

4. Eyes bare, a costal spine, cheeks not over one-fourth eye height; apical cell ending well before wing-tip, long petiolate; claws of both sexes atrophied and tarsal joints compressed and swollen, arista pubescent

in female, hind crossvein is middle between small crossvein and bend of fourth vein, macrochætæ only marginal.

Type, *townsendi*.....*Œdemapeza*, gen. nov.

Eyes bare, a costal spine, cheeks one-half eye height 5

Eyes hairy 6

5. Apical cell long petiolate, ending well before wing-tip; hind crossvein in middle between small crossvein and bend of fourth vein.

Type, *atra* .....*Metachæta*

Apical cell very short petiolate, ending but slightly before wing-tip; hind crossvein a little nearer to bend of fourth vein.

Type, *conica* .....*Ceratomyiella*

6. Apical cell open and ending well before wing-tip, bend of fourth vein with long stump, male antennæ with third joint lyriform cleft.

Type, *lyrata* .....*Dichocera*

Apical cell ending well before wing-tip, a costal spine, hind crossvein much nearer to bend of fourth vein, macrochætæ only marginal (except on anal segment)..... 7

Apical cell ending at or but slightly before wing-tip, eyes thinly hairy.. 8

7. Apical cell closed in border (or narrowly open, or very short petiolate), eyes thinly hairy, cheeks fully one-half eye height.

Type, *mexicana* .....*Microchira*

Apical cell moderately long petiolate, eyes thickly hairy, cheeks nearly one-half eye height.

Type, *magnicornis* .....*Lachmomma*

8. Apical cell narrowly open, a costal spine, hind crossvein nearer to bend of fourth vein, cheeks not over one-fourth eye height, eyes very sparsely hairy, all the male claws and pulvilli much elongated, female claws atrophied and tarsal joints compressed and swollen, macrochætæ only marginal.

Type, *braueri*.....*Diaphoropeza*, gen. nov.

Apical cell closed in border (or very narrowly open or very short petiolate), double costal spine, hind crossvein much nearer to bend of fourth vein, cheeks fully one-half eye height, macrochætæ discal on last segment only, claws and pulvilli of both sexes atrophied (?) and tarsal joints swollen.

Type, *singularis* .....*Atrophopoda*

Apical cell open, cheeks nearly one-half eye height, hind crossvein near middle, no discal macrochætæ (acc. v. d. Wulp) or present on last segment only (acc. B. & v. B.), male claws and pulvilli of anterior tarsi elongated.

Type, *validinervis* .....*Paradidyma*

NOTE TO TABLE.—The group of *Pseudomintho, Olivieria,* etc., has the front tarsi of female plump and swollen, with very small claws. The group of *Mintho, Actinochæta,* and *Euantha* has the last tarsal joint of all the feet in both sexes swollen, and claws very short. But the frontal bristles do not descend half way to vibrissæ in any of these forms, and they are thus easily to be distinguished from the above genera in the table, having somewhat similar feet.

Cholomyia inæquipes Bigot.—One specimen bred at the Cotton Boll Weevil Laboratory, Dallas Texas, from *Conotrachelus elegans,* issued May 29 (Hunter).

NEAPORIA, nom. gen. nov.

This name is proposed for *Aporia* (Macquart) Brauer and von Bergenstamm, which is preoccupied. The type of the genus is *quadrimaculata* Macquart, of South America. The species *limacodis* Townsend seems to belong here also. The latter is distinct from *Dexia pristis* Walker in its practically bare arista. *D. pristis*, so far as can be judged from the description, is not a *Macquartia* s. str. Mr. E. E. Austen has referred it to *Aporia* (Ann. Mag. N. H., ser. 7, vol. XIX, p. 344).

RONDANIMYIA, nom. gen. nov.

This name is proposed in honor of Camillo Róndani for his genus *Gymnopsis* (Dipt. Ital. Pr., III, 1859, pp. 90-91), which is preoccupied by Rafael in Pisces (1815). The type is *Macq. chalconata* (Wiedemann, Meigen, Zetterstedt) Róndani, of Europe. Brauer and von Bergenstamm retain the species in *Macquartia*, but it seems preferable to maintain it separately on the characters pointed out by Róndani.

METHYPOSTENA, gen. nov.

This genus is proposed for the type of *Hypostena barbata* Coquillett, which can be referred to neither *Hypostena*, *Tachinophyto*. nor *Pseudomyothyria*. There are no bristles on the third longitudinal vein, the small crossvein is almost opposite to the end of the first vein, hind crossvein is in middle between small crossvein and bend of fourth vein, apical cell ends in exact wing-tip. The wings are narrow, their width being much less than one-half their length. The parafacials are narrowed below to a mere line next the lower border of eyes, the facial profile is very oblique and receding, the lower margin of head short, the arista strongly curved.

Subfamily PYRRHOSÜNÆ

Genus Leskia Robineau-Desvoidy

Syn. *Pyrrhosia* pt. (Róndani) Brauer and von Bergenstamm.

Type, *aurea* Fallen.

Genus Pyrrhosia Róndani (restricted)

Syn. *Myobia* (Schiner) Brauer and von Bergenstamm.

Type, *inanis* Fallen.

Genus Anthoica Róndani

Syn. *Myobia* Robineau-Desvoidy (preocc.—non Schiner, Brauer and von Bergenstamm).

Type, *atra* Róndani.

It is clear that the name *Leskia* Robineau-Desvoidy can not be properly substituted for *Myobia* Robineau-Desvoidy (preocc.), inasmuch as the species referred to *Leskia* by that author are not typical *Myobia* in his sense.

Róndani proposed the name *Anthoica* for this very purpose, and it must therefore be employed. *Leskia* should be recognized as distinct.

Genus Aphria Robineau-Desvoidy

Aphria ocypterata Townsend.—One female, Massachusetts (No. 142, Riley Coll.). Length, 7 mm. Agrees with original description. The stump of fifth longitudinal vein does not quite reach margin of wing. The hind crossvein is nearly in middle between the small crossvein and bend of fourth vein, the bend being quite rounded. The third antennal joint is distinctly and evenly rounded on both apical corners.

Aphria occidentale, sp. nov.

One female, Colorado (No. 120, Riley Coll.); one female, Beulah, N. Mex., August (Cockerell); one male, Roswell, N. Mex., August (Cockerell).

Length of female, 7½ to 8 mm.; of male, 9 mm. Differs from *ocypterata* in being more robust, larger, the abdomen more broadly red on sides, the red extending length of first segment and half or more length of third segment; third antennal joint in both sexes distinctly angular on front apical corner, rounded on posterior apical corner, widened in male; stump of fifth vein extending to margin of wing; hind crossvein more noticeably approximated to bend of fourth vein, which bend is abrupt.

The greater size, the character of third antennal joint, and the more widely red abdomen will at once distinguish the species.

Type.—Cat. No. 10,900, U. S. N. M. (Colorado, Coll. Riley).

Aphria georgiana, sp. nov.

Two females, Georgia (Riley Coll.), (= ? *Ocyptera triquetra* Olivier et ? *Ervia triquetra* Robineau-Desvoidy).

Length, 10 mm. This is a distinct species from both of the preceding. It is not so typical of *Aphria* as are the other species, being much larger and wider-bodied. Frontal bristles descend but slightly below insertion of antennæ, hardly more than to base of second antennal joint. The third vein is spined only one-half or three-fourths way to small crossvein, hind crossvein is nearly in middle

between small crossvein and bend of fourth vein, stump of fifth vein extends to wing border; first and second antennal joints and base of third reddish yellow, arista and rest of third antennal joint black or brownish; third antennal joint rounded on posterior apical corner, subangular on anterior apical corner. Palpi brownish yellow, or with a reddish tinge. Front fully one-half width of head, frontalia brownish yellow; face and front silvery white, parafrontals slightly cinereous. Thorax, scutellum, and pleuræ quite thickly silvery pruinose over the black ground color. Abdomen obscure light brownish red, obscurely blackish on median line, broadening on hind portions of second and third segments and nearly covering fourth segment; anterior borders of second to fourth segments broadly silvery pruinose, but more faintly so than thorax; legs blackish; wings clear, slightly tawny at base. Tegulæ white, very slightly tinged with yellowish.

Type.—Cat. No. 10,901, U. S. N. M.

PHOSOCEPHALA, gen. nov.[1]

Form rather *Lucilia*-like, narrow, abdomen round-oval, head yellow, wings slightly smoky, palpi absent, thorax and abdomen metallic.

Head and thorax about same width, abdomen slightly wider. Front (female) not prominent in profile, distinctly more than one-half width of head, flattened anteriorly, steeply sloping on anterior two-thirds, ocelli marking summit, vertex lower; parafrontals wide, not swollen, clothed with some fine black hairs; vertex not narrowed; frontal bristles descending in a single row about to middle of second antennal joint, the four front pairs decussate and widely divergent below; two strong reclinate frontal bristles next behind these and between them a pair of weak bristles also directed backward, the outer one outward; two reclinate vertical bristles of equal strength on each side, the outer one directed also outward, these

[1] This genus and several others were purposely described in detail in order to furnish a forcible illustration of the length of a full generic description in these flies, mentioning all the characters, such as would be necessary to enable the student to absolutely place the form in its proper tribe or subfamily without reference to the specimen. Such a description is far too long for practical use, and demonstrates the inadvisability of attempting systematic work in this superfamily without a great amount of previous study and access to a large central collection where all types are to be permanently preserved. Especial attention is here called to the fact that all these characters require to be studied and compared in order to determine the final location of a genus of these flies.

being strongest of all; postvertical bristles small, of same size as the black border row of occiput; ocellar bristles strong, proclinate, divergent; postocellar bristles represented only by weak hairs; two strong proclinate orbital bristles; lunula normal; frontalia differentiated only by being bare of hairs; facial plate elongate, ovate, widened below, about as high as parafacials, greatest width just above vibrissal angles and taking up three-fifths the facial width at that point, quite flat, slightly advancing below, reaching quite to lower margin of head; facial carina absent, antennal grooves hardly developed at all; facialia divergent inferiorly to point just above vibrissæ, then feebly convergent; facial bristles about two above vibrissæ; vibrissæ quite widely separated, inserted just a little above the oral margin; vibrissal angles only moderately pronounced, rather rounded, situated moderately close to oral margin; parafacials not quite twice as wide at base of antennæ as on lower orbits, flattened anteriorly, with some fine black hairs next lower eye-margins; epistoma moderately prominent, narrowed, showing a cut-off flattened edge below vibrissæ; mouthparts normal, proboscis when extended about as long as head height, moderately fleshy, only once bent, labella moderately developed; palpi entirely absent, showing no trace; oral cavity moderately narrow and elongate; peristomalia with a row of seven or eight black bristles, which are continued around edges of occiput; longitudinal axis of head at oral margin practically same as that at insertion of antennæ, the facial profile being slightly concave, and profile of parafacials straight but obliquely receding; antennæ inserted about on a line drawn through middle of eyes and about on upper three-fifths of head height, closely approximated; second antennal joint slightly elongate, fully twice as long as first joint; arista bare, moderately long and slender, a little thickened on basal one-third, basal joints short and indistinct; third antennal joint about twice the length of second, moderately wide and of equal width, rounded on both apical corners; eyes bare, not large, set rather high, not extending as low as vibrissæ, about twice as long as wide; cheeks about as wide as one-half of eye height, clothed with very fine light hairs, cheek grooves absent; lower margin of head nearly straight, but rounded behind; occiput slightly swollen on lower two-thirds.

Sternopleural bristles 3, the middle one inserted lower than the others and about equally distant from them; hypopleural bristles moderately strong, about 5 in number; 2 pteropleural bristles, the posterior one very strong, curved, reclinate; mesopleural bristles in a posterior fringe of 7; propleural bristles 3, curved upward and forward; notopleural bristles 2, strong, curved, reclinate; postsutural

bristles 4, the posterior one on each side reaching beyond hind border of scutellum, the others much less strong; 3 dorsocentral bristles; 4 short acrostichal bristles before suture, one strong one next scutellum (if more behind suture, the pin has destroyed them); 6 humeral bristles, moderately short; 3 intrahumeral bristles; 1 presutural bristle nearly in line with last; 3 intra-alar bristles, one in front of suture; 3 strong reclinate supra-alar bristles; 1 strong postalar bristle reaching middle of second abdominal segment, 2 weak ones below it; scutellar bristles consisting of 3 strong and 2 weak pairs, an apical decussate weak pair, a weak, more separated subdiscal pair in front of last, a strong subapical pair reaching almost to base of third abdominal segment, a shorter pair outside these, and the strongest macrochætæ of entire body being a lateral pair inserted on border in front of last, and which reach nearly to base of third segment; some other bristly hairs on scutellum appearing more or less like weak macrochætæ.

Wings not large, rather narrow, extending about length of anal segment beyond end of abdomen, normal; costal spine distinct but short; third longitudinal vein with about five bristles at base; other veins not spined; fourth vein ending in wing-tip, straight to bend, which is sudden (but hardly angular) and very obtuse, last section straight, the whole vein so gently bent as to distinctly narrow the apical cell, bend without stump or wrinkle and slightly more removed from hind margin than any part of the vein beyond it; fifth vein running half way from hind crossvein to wing border, rest being wrinkle; apical cell closed in margin, hind crossvein distinctly trisinuate, a little nearer to bend of fourth vein than to small crossvein, but not greatly removed from middle, the axis of its anterior half at almost a right angle to fourth vein; small crossvein slightly before middle of discal cell.

Abdomen of 4 segments, broad-oval, almost round, strongly convex above, subflattened below, first segment shortened; macrochætæ weak, only marginal except on last segment, first segment without any, second segment with a weak median pair and a weak lateral one, third segment with a marginal row of 8, anal segment with some marginal ones and a row of 6 subdiscal; ovipositor withdrawn inside the subcircular anal orifice on ventral side of last segment.

Legs short (only the hind pair present), femora with short black bristles; hind tibiæ not ciliate, with sharp bristles on posterior side and some shorter ones on front side; tarsi not stout, moderately slender, short, about same length as tibiæ, metatarsi fully as long as the other joints taken together; claws and pulvilli short, a little shorter than last tarsal joint. Type, the following species:

Phosocephala metallica, sp. nov.

One female, Tucurrique, Costa Rica, collected by Messrs. Schild and Burgdorf.

Length of body, 8 mm.; of wing, 6 mm. Head entirely pale yellowish, face and cheeks with a faint silvery bloom; parafrontals, frontalia, and two basal antennal joints unicolorous with a faint brownish tinge; third antennal joint, arista and proboscis pale yellowish brown; eyes dark purplish brown. Thorax, scutellum, and abdomen shining metallic dark purplish, the abdomen hardly more of a purplish black, humeri yellowish; presutural part of mesonotum deep golden pruinose, through which run only two linear vittæ, the pruinose covering thickest on sides and in front, extending backward behind suture very faintly on sides of mesonotum; scutellum faintly silvery pruinose; metanotum faintly silvery, pleuræ silvery gray; abdomen very faintly silvery, not obscuring the metallic sheen, most noticeable on bases of segments, particularly second segment, least so on anal segment. Wings distinctly smoky throughout, a little more so on costal border, extreme base of costa narrowly yellowish. Tegulæ appearing almost white in some lights, but with a smoky yellowish tinge, much whiter than the wings, halteres pale yellowish. Legs brownish yellow, tarsi hardly darker, but appearing blackish from the many short black bristles, coxæ lighter yellowish.

Type.—Cat. No. 10,902, U. S. N. M.

Paranaphora diademoides, gen. nov. et sp. nov.

This new genus and species are proposed for *Ervia triquetra* of Mr. Coquillett's Revision of the Tachinidæ (1897), page 66. The species is not to be identified with Olivier's *Ocyptera triquetra*, which is probably an *Aphria*. It does not fit Robineau-Desvoidy's *Ervia triquetra*, nor does it belong to his genus *Ervia*. The species looks some like *Stomatodexia diadema*, from which it may be at once known by the bare arista, the very elongate second antennal joint, and the atrophied palpi.

PARANAPHORA, gen. nov.

The salient characters of the genus are the elongate second antennal joint and the atrophied palpi, as just mentioned. Front at vertex one-third width of head in female, one-fourth in male. Palpi extremely small, cylindrical, like a minute grass seed, with a long, delicate apical hair. Apical cell narrowly open a little before wing-tip, sometimes almost closed in margin. Bend of fourth vein angu-

lar, with slight wrinkle, sometimes with slight stump. Hind crossvein much nearer to bend of fourth vein than to small crossvein, the latter on middle of discal cell. First vein ending well beyond small crossvein. A long costal spine present. Macrochætæ only marginal, except some submarginal on last segment.

Second antennal joint about four times as long as first, about equal to third. Frontal bristles descending only two below base of antennæ. Arista and eyes bare. Front prominent; parafacials moderately wide, about one-half width of facial plate. Face receding, epistoma slightly prominent; facialia bare, except two or three short bristles above vibrissæ in male, but practically absent in female. Vibrissæ strong and inserted a little above oral margin. Cheeks about one-half eye height. Antennæ inserted above line drawn through middle of eyes. Occiput swollen inferiorly. Male without, female with two orbital bristles.

Scutellum with a very short apical decussate pair of bristles, and two strong lateral pairs with a weaker bristle between them. Abdomen composed of five segments, first short, second shorter than those following. Male abdomen elongate-conical, last segment laterally compressed; female abdomen ovate with apex conical. Legs rather long, tarsi of male very elongate; male claws very long. Type, the following species:

Paranaphora diademoides, sp. nov.

Five females, four males, Mississippi, Louisiana, Texas.

Length, 7 to 12 mm. Head, thorax, and scutellum of male golden pollinose, most thickly so on thorax and scutellum. Same parts of female brassy gray, extending over abdomen. Antennæ of male reddish yellow, those of female brownish yellow. Frontalia reddish brown. Palpi minute, pale yellowish. Mesoscutum with a median pair of linear vittæ interrupted at suture and obliterated shortly behind same; a lateral triangular blackish marking just in front of suture outside these, and a longer, narrower, posteriorly pointed one corresponding to it behind suture. Abdomen of male reddish yellow with base, median line and broad hind borders of last three segments brown, a golden bloom over the lighter portions. Female with narrow hind borders of last three segments brown, with brassy gray bloom, the second segment faintly yellowish. First segment without macrochætæ; second with anterior and posterior lateral, and a median marginal pair; third with two lateral pairs and a median pair; fourth with 8; anal segment of male with about 8 marginal and 6 or more submarginal, those of female less in

number and more nearly apical. Legs reddish yellow, tarsi brownish, hind tibiæ brownish, and sometimes the femora less so. Tibiæ of female all reddish or yellowish. Wings distinctly yellow along narrow front border, the submarginal cell clear. Tegulæ slightly tinged with yellowish, mostly on borders.

Type.—Cat. No. 10,903, U. S. N. M. (Mississippi, H. E. Weed).

It is possible that further study will show the distinctness of some of the above specimens.

PARAFISCHERIA, gen. nov.

This genus is proposed for the type of *Demoticus venatoris* Coquillett, which is not a *Demoticus*. (Latter genus has the epistoma not at all produced, and furthermore has a short and fleshy proboscis.) The present genus approaches both *Demoticus*, *Rhinotachina*, and *Fischeria*, but agrees with neither, though it is clearly more closely related to the latter, as shown by its produced epistoma.

There are orbital bristles in the male, all the claws of the male are short, and the epistoma is strongly produced noselike (as in *Fischeria*); second aristal joint is short but distinct, and arista is short-pubescent; macrochætæ discal and marginal, though only weak discal ones (if any) are present on third abdominal segment. The proboscis is elongate and horny (also as in *Fischeria*), the portion below geniculation equal to head height (also equal to lower margin of head). Cheeks wide, fully one-half of eye height, hind crossvein nearer to bend of fourth vein than to small crossvein. Washington State (O. B. Johnson).

NEOFISCHERIA, gen. nov.

This genus is founded on the specimen from Philadelphia, Pa., mentioned on page 120 of Mr. Coquillett's "Revision" as *Demoticus venatoris*. It is related to *Parafischeria*, from which it differs as follows:

Male: Discal macrochætæ well developed on last three abdominal segments, consisting of a transverse discal row on last segment and a single discal pair on intermediate segments; basal segment with a lateral marginal, but no median marginal; next segment with both; last two segments with a marginal row. Hind crossvein nearly in middle between small crossvein and bend of fourth vein; no orbital (middle fronto-orbital) bristles in male, and male claws elongate. Cheeks about one-third eye height, proboscis elongate. Front tarsi (male) much longer than front tibiæ. Type, the following species:

Neofischeria flava, sp. nov.

One male, Philadelphia, Pa. Coll. Coquillett.

Length, 11 mm. General color yellowish. Antennæ reddish yellow; arista and third antennal joint, except base, blackish. Head, thorax, and scutellum dark in ground color, thickly light golden pollinose, the face more silvery. Palpi light reddish yellow. Abdomen and legs light reddish yellow, the tarsi quite blackish; abdomen thickly light golden pollinose, under which shows faintly a broad median stripe that widens on next to last segment into a triangular marking spreading along hind border, anal segment tinged with blackish only on the broad median line. Venter tinged with darker apically. Wings clear, very slightly yellowish at base; tegulæ tinged with yellowish; halteres yellowish, including stalks. Pulvilli rather smoky; claws brownish, with black tips.

Type.—Cat. No. 10,904, U. S. N. M.

EUDEMOTICUS, nom. gen. nov.

This name is proposed for *Plagiopsis* Brauer and von Bergenstamm (1889), which is preoccupied in Hemiptera by Bergroth (1883). Type, *Demoticus soror* Egger, of Europe.

APACHEMYIA, gen. nov.

This genus is proposed for *Demoticus pallidus* Coquillett.

Only marginal macrochætæ, front tarsi much longer than front tibiæ; proboscis only moderately elongate, horny, with large labella, cheeks fully one-half eye height, male without orbital bristles. Claws of male elongate. Hind crossvein nearer to bend of fourth vein than to small crossvein, apical cell narrowly open before wing-tip, bend of fourth vein without wrinkle. Frontal bristles descending to middle of second antennal joint, latter being more than twice the length of the somewhat elongate first joint, second aristal joint short, some fine hairs on parafrontals outside the frontal bristles, facialia bare, epistoma strongly produced. Palpi well developed, elongate, a little thickened apically, slightly curved.

Represented in U. S. N. M. by two male specimens collected on the Rio Ruidoso, White Mountains, New Mexico (Townsend), on flowers of *Rhus glabra*, 6,500 to 6,700 feet, July 25 and 29, and by type of *D. pallidus*, male, Denver, Colo. The species is large and robust.

All three specimens may be considered as *A. pallida* Coq

EUPHASIA, nom. gen. nov.

This name is proposed for the Australian *Neophasia* Brauer and von Bergenstamm, which is preoccupied in Lepidoptera.

Genus Drepanoglossa Townsend

The genus *Drepanoglossa* (type, *lucens* Townsend) has the cheeks one-third or more of eye height. *Epigrimyia* is distinct in having extremely narrow cheeks and parafacials; the eyes long and extending low, fully to insertion of vibrissæ; proboscis shorter, parafacials hardly widened above, front not prominent, epistoma strongly produced below, face perpendicular, and tarsal joints short.

Drepanoglossa amydriæ, sp. nov.

Three specimens, bred from masses of pupæ of a tortricid, *Amydria* sp., sent by Prof. A. L. Herrera, Cuernavaca, Mexico.

Length, 6 to 7 mm. Differs from *lucens* in whole coloration being darker; wings slightly infuscate, with a faint yellow tinge in the marginal cell; the mesoscutum cinereous pollinose with a faint tinge of brassy; abdominal segments, except anal, with a narrow hind margin of brown. Proboscis black on apical half.

Type.—Cat. No. 10,905, U. S. N. M.

Drepanoglossa lucens Townsend.—This species has the wings perfectly clear, the mesoscutum pale flesh tint with silvery-white pollen, the abdomen pale clear yellowish except median line and more or less of anal segment, no dark hind margin on first segment and only faint ones on middle segments.

Tribe Epigrimyiini

Tribe Epigrimyiini is close to Phaniinæ, but best retained as a separate tribe not actually coming within that subfamily. It includes *Epigrimyia* only. The genus *Drepanoglossa* clearly falls within the subfamily Pyrrhosiinæ.

Tribe Leucostomini

Genus Leucostoma Meigen

Leucostoma nigricornis Townsend.—The species *nigricornis* and *senilis* are distinct, and may be recognized by the characters given in the descriptions. *L. nigricornis* is essentially a southwestern and western species, and *senilis* an eastern and northeastern species. The former has the antennæ more uniformly blackish, the second

and third joints equal in length; the latter has them more rufous, the third joint being distinctly longer than the second as a rule. *L. nigricornis* has the sides of abdomen somewhat reddish at base, and the femora and tibiæ more or less so as well. Both species belong in *Leucostoma*. The genus *Phyto* has the cheeks and parafacials much widened, the cheeks about one-half eye height.

The species *atra* Townsend and *neomexicana* Townsend are likewise distinct forms, and do not belong to *Phyto*. It is doubtful if they can be properly referred to *Leucostoma*.

Leucostoma analis Meigen.—This species should not be recorded from America, as van der Wulp was presumably in error in his determination of it in Mexican material.

Subfamily PHANIINÆ

Genus Hemyda Robineau-Desvoidy

Hemyda aurata Robineau-Desvoidy.—The males of this species have the yellow of third segment wider than the females, but only slightly so, and nowhere nearly approaching in that respect the form described below from New Mexico. There are eight specimens of this form in the U. S. N. M., from Missouri, Kansas, Illinois, and Wisconsin, one of them being labeled "attracted to light, July, 1876" (Riley Coll.).

It is interesting to note that one of the above specimens, from Milwaukee, Wis., has the small crossvein of both wings practically absent; frontal bristles long, numerous, and thickly placed, and vibrissæ distinct, as in several others of the specimens.

Hemyda sp.—One male, Rio Ruidoso, White Mountains, New Mexico (Townsend), about 6,500 feet, August 1, on flowers of *Monarda stricta*. Length, 12 mm. Differs from all the above specimens by having the yellow of third segment taking up anterior two-thirds of length of segment except a median triangular prolongation anteriorly of the black of hind portion, which stops well before anterior edge of segment. The femora have only a faint trace of the black of *aurata* in a tinge of brown before apex. The yellow of second abdominal segment is more extended forward also. The specimen shows only microscopic vibrissæ, invisible save with a high-power lens.

This specimen probably represents a distinct form, but it is not deemed wise to name it as such without first securing a considerable series of specimens to substantiate its claim to distinctness.

Hemyda (*Ancylogaster*) *armata* Bigot.—It is highly probable that this is a good species. It may even be a good genus. Bigot states that the second antennal joint is longer than the third. If it develops that the second joint in Bigot's type is strongly elongate, more so than is *aurata,* that is to say more elongate as compared with the first joint (not the third), then it is likely that *Ancylogaster* should be retained.

Genus Penthosia van der Wulp

Penthosia satanica Bigot.—In this species the fourth longitudinal vein is slightly rounded at bend, and often bears a very short stump which can not be considered as the prolongation of the fourth vein beyond the apical crossvein, since no wrinkle is present in its absence. It always points straight away from the bend, like the stem from the arms of a Y, and is to be regarded perhaps as indicating an original sharp bend of the vein back upon itself for a short distance, the two approximated parts having later coalesced, finally disappearing more or less completely. The writer knows of no other tachinid which exhibits this peculiarity in the same degree.

Genus Cercomyia Brauer and von Bergenstamm

Synonyms are *Uromyia* Meigen (preocc.) and *Neouromyia* Townsend, nom. gen. nov. (Trans. Am. Ent. Soc., December, 1891, p. 382).

Subfamily Gymnosomatinæ

Genus Gymnosoma Meigen

The following description of the external anatomy of the male abdomen will be of interest as throwing light on the taxonomic position of the genus.

The male of *Gym. fuliginosa* Robineau-Desvoidy has six abdominal segments besides the genitalia. The first segment is very short, and its width is equal to about one-half the greatest width of abdomen. It consists below of a small, much shortened, subquadrate, basal ventral plate, wide in front and somewhat incurvate on front edge where it joins metathorax, rapidly narrowed posteriorly, its hind margin much shorter than its front margin. The second ventral plate is a smaller replica of the first, its front edge being the same length as the posterior edge of first, its sides converging posteriorly on same lines, its posterior edge being correspondingly shortened. The first and second ventral plates together thus appear much like a right-angled triangle in outline, with the hypothenuse

representing the front margin and the right angle cut off truncate to represent the hind margin.

The first segment consists above and on sides of a strip-like dorsal plate evenly depressed between its lateral edges, which are tucked-up rounded folds of the plate, the latter ending ventrally on each side in a short, pointed strip that does not meet the ventral plate, the ventral membrane intervening between them. A small spiracle, smaller than any of the others of abdomen, is present in the extreme point of the first dorsal plate on each side where it joins the ventral membrane, and each one of the other five dorsal plates has a similar but larger spiracle on its inner edge, these being in each case quite well removed from the lateral margin where it joins ventral membrane.

The third ventral plate is nearly rectangular, a little broader than long, about as wide as mean width of second plate. The fourth ventral plate is considerably broader than the third and much shorter, thus looking like a narrow transverse strip set in the ventral membrane. The fifth ventral plate is much wider than fourth, about same length, and its median portion (about middle one-third) appears to be crowded under the fourth plate by the walls of the sheath-like genital opening, partially retracted within which lies the hypopygium. Thus only the lateral one-third of the fifth plate is visible on each side, and these two portions form the narrow visible strips of the curved plate, bordering the edge of the genital opening on each side, and each pointed at its outer extremity.

The sixth abdominal segment is not apparent from a dorsal view. It is a shortened anal segment that has been pushed over and crowded beneath the extremity of the abdomen. It lies just under the posterior edge of the abdomen, is rather crescent-shaped, subsemicircular on posterior (appearing anterior owing to inverted position) edge where it encloses the basal segment of the hypopygium, slightly squared on anterior lateral corners. It little more than half surrounds the orifice of the genital cavity, and bears a spiracle on each side at some distance before the pointed end of its tapering lateral portion. The basal sclerite or plate of the hypopygium bears another spiracle, which is one of the largest in the abdomen, on its basal edge, near the spiracle of the sixth segment and appearing as if it belonged to that segment. This basal plate of the hypopygium represents another abdominal segment, and it should be considered as forming a seventh segment of the abdomen rather than the base of the hypopygium.

The ventral membrane is widely apparent and extensive, the ventral plates all lying free within it so far as contact with the dorsal plates is concerned. The area in which the ventral membrane, with

the enclosed plates, is visible occupies more than one-third the width of the ventral aspect of abdomen.

The plates, both ventral and dorsal, are at once distinguished throughout their extent from the membrane by being clothed with bristly hairs.

The above description was drawn from a specimen collected by F. C. Pratt, at Poolesville, Maryland, July 9. The abdomen was detached and put under the microscope.

ŒDEMASOMA, gen. nov.

This form (male) agrees with the description of *Wahlbergia brevipennis* H. Loew, except that the fourth vein is bent at a rounded angle, and hind crossvein is not strongly oblique. The hind crossvein is straight, almost at right angles to the fourth vein, hardly nearer to bend of latter than to small crossvein, and at right angles to fifth vein. The petiole of apical cell is slightly longer than small crossvein, but not twice as long—about one and one-fourth times as long. The abdomen is swollen and strongly convex above, wider than the thorax, exactly oval in outline from above, the wider end forward, absolutely without macrochætæ. Palpi are extremely small, almost atrophied, very slender and quite short. Antennæ as long as face, second joint almost as long as third. No orbital bristles. Wings very short and narrow. The claws are about as long as last tarsal joint. Type, the following species:

Œdemasoma nuda, sp. nov.

One male, Ormsby County, Nevada, July 6, C. F. Baker, Coll.

Length, 6 mm.; of wing, 4 mm. Face, parafacials and parafrontals from above silvery white pruinose, blackish from in front, the silvery extending on cheeks. Frontalia silvery white pruinose, with a faint brassy tinge or a golden reflection. Abdomen densely covered with moderately short and fine brown or black hairs, and entirely without bristles, wholly yellowish red or brownish red. The mesoscutum is silvery pollinose in front of suture, but it does not show well in some lights. Tegulæ white. Palpi pale reddish brownish in color. All the rest of insect is black, except the clear wings, which are yellowish at base. Otherwise agrees with Loew's description of *Wahlbergia brevipennis*.

This form apparently belongs in the neighborhood of *Gymnosoma*, indicated by the absence of macrochætæ and the possession of a swollen abdomen. *Wahlb. brevipennis* H. Loew is this genus, but a different species. Loew's specimen is a female from Nebraska,

length 4⅔ mm., of wing 3 mm. The writer has examined the type in Cambridge. The hind crossvein does not form a right angle with fifth vein, the petiole of apical cell is fully twice as long as small crossvein, the head is black and shining except face, and the mesoscutum does not show silvery before suture.

Type.—Cat. No. 10,898, U. S. N. M.

Subfamily Ocypterinæ

Genus Ocyptera Latreille

Ocyptera euchenor Walker.—While it seems probable that this form and *cpytus* Walker are the same, there can be no certainty in the matter until the types are compared. Probably *O. carolinæ* Robineau-Desvoidy is distinct. Some of Bigot's species may also prove distinct. It seems probable that *carolinæ* is a southern form, and that *euchenor* is the more northern large form, having the cheeks and parafacials narrow, and the eyes elongate, descending low. Further study may also show the distinctness of *dosiades*.

Genus Beskia Brauer and von Bergenstamm

Beskia cornuta Brauer and von Bergenstamm and allies.—*B. cornuta* is the South American form. The type is from Brazil. The figure of the head given by the authors (fig. 276, Musc. Schiz., 1) is not typical of Southern States specimens in U. S. N. M. There is a marked difference in the third antennal joint. Williston's figure of his St. Vincent specimen shows the third antennal joint same as the Brazilian. *Beskia* and *Ocypterosipho* may be separated on this character.

Genus Ocypterosipho Townsend

Our species may be known as *Ocypterosipho œlops* Walker. Although Walker says "palpi black," and does not mention the slender and elongate proboscis, Mr. E. E. Austen's statement that *œlops* belongs here (Ann. Mag. N. H., Ser. 7, vol. 19, p. 345) must be accepted. This is the Georgia and Southern States form, and has the third longitudinal vein bristly to small crossvein (Georgia, Louisiana, and Texas specimens in U. S. N. M.). Santo Domingo specimens agree with those from the Southern States in having the third antennal joint strongly convex on under border and concave on upper, presenting a curved outline like that of a pruning-knife blade with cutting edge upward, the anterior distal corner of the joint being produced in profile into a sharply pointed prolongation.

Van der Wulp's figure (in the Biol. C. A. Dipt., II, pl. 13, fig. 12) of Mexican specimens gives somewhat the same impression. Two specimens from Mexico (one Tehuantepec, Sumichrast) show this character markedly, the third antennal joint not being truncate at tip as in the figures given by Brauer and von Bergenstamm and by Williston. It therefore seems evident that not only is *willistoni* a good species, but the genus *Ocypterosipho* may be retained, *O. willistoni* being the West Indian and Central American form, while *O. œlops* is the more northern form occurring in our Southern States. It is to be noted that St. Vincent belongs to the South American fauna, while Santo Domingo belongs to the Central American, which includes parts of Mexico and the Southern United States.

ICHNEUMONOPS, gen. nov.

Bearing much superficial resemblance to *Ocyptera,* but differing radically in the structure of the basal portion of the abdomen, and in head characters as well. Elongate and narrowed in form. Head, thorax, and abdomen of almost equal width, but the head distinctly wider than the thorax, the abdomen constricted basally into a pedicel formed principally by the base of second segment, which shows more constriction than any other part.

No vibrissæ that can be differentiated from the bristles of peristomalia. Second antennal joint rather elongate, about three times as long as first; third joint elongate, narrowed, about two and one-half times as long as second. Arista not distinctly jointed. Front at vertex narrower than eye width, but about equal to latter at base of antennæ. One row of weak frontal bristles extending only to base of antennæ. One pair of weak ocellar bristles, slightly proclinate. One pair of vertical bristles longer than frontal bristles, directed well backward. No orbital bristles (male). Cheeks about two-fifths of eye height. Face receding, facial profile straight, epistoma prominent. Facialia bare, not divergent below, ptilinal area about as wide as eye width, parafacials about half as wide above, but narrower below. Facial plate elongate, not narrowed below, produced on lower edge. Antennæ inserted above eye middle, rather above three-fourths of head height. Eyes bare, descending about three-fourths way to lower margin of head, which is long. Seen from in front, the space between lower angles of eyes is more than twice that between upper angles, the frontofacial area evenly widening from middle of front to cheeks. Proboscis below geniculation hardly as long as antennæ, labella well developed. Palpi extremely small and short, atrophied. Occiput convex, swollen on lower three-fourths.

Three postsutural bristles, no acrostichal bristles either before or behind suture. Only one sternopleural bristle (possibly one has been lost anteriorly on both sides).

Scutellum with a weak apical pair of bristles that are strongly decussate. Also a much longer marginal subapical pair, and a weak marginal pair behind last.

Abdomen strikingly *Ichneumon*-like in outline, consisting of five segments visible from above. Basal segment narrow, but little wider than base of scutellum, narrowed behind. Postbasal or second segment still narrower on basal portion, the greatest constriction being at about anterior three-fourths of the segment where the abdomen is narrower than scutellum. The second segment gradually widens posteriorly from the point of its greatest constriction, until on hind border it is twice its anterior width. The third segment widens posteriorly at not quite same angle, the fourth or preanal segment narrowing posteriorly about as rapidly as the third segment narrows anteriorly. Anal segment still narrowing posteriorly and evenly rounded on apex. The basal and anal segments are about same length, the second segment nearly twice as long. The third and fourth segments are equal and each is a little over twice as long as anal.

Second, third, and fourth segments with a median marginal pair of macrochætæ quite removed from posterior border of segment, also a lateral marginal one on each side. Anal segment with only an outer pair on each side near hind margin. Second segment with a lateral one in middle on each side.

Ventral plates not visible, except that the basal plate shows plainly with adjacent ventral membrane rather widely surrounding it.

Wings elongate and narrow, reaching about to end of abdomen. No costal spine. Small crossvein nearly opposite end of first vein, distinctly beyond middle of discal cell. Hind crossvein in middle between apical crossvein and small crossvein, strongly bisinuate. Apical crossvein still more strongly bisinuate, quite S-shaped. Fourth vein produced beyond apical crossvein in a short stump. Petiole of apical cell half as long as apical crossvein, reaching anterior wing border well before wing-tip. No veins spined, not even third vein at base.

Tegulæ of moderate size, inner portion subsemicircular in outline, so transparent (except narrow borders) that the halteres beneath are almost as clearly seen through them as through glass.

Legs moderately long, but quite normal. Claws and pulvilli elongate, but not longer than the last tarsal joint, which is itself elongate. Type, the following species:

Ichneumonops mirabilis, sp. nov.

One male, Beulah, N. Mex., August 17. Prof. T. D. A. Cockerell, Coll.

Length, 10 mm.; of wing, about 7 mm. Wholly dull black, abdomen very slightly shining. Antennæ light yellowish brownish on second joint and base of third. Face and parafrontals slightly silvery, extending on occipital orbits. Thorax and scutellum thinly silvery pollinose. Abdomen still more thinly silvery pollinose, the narrow hind margins of first three segments pale brownish with a yellowish tinge, that of first segment twice as broad as those of the others. Legs largely brownish reddish on femora, and especially on tibiæ. Wings on costal half deeply smoky, tinged with yellowish, including basal cells. Tegulæ and portion of wing behind fifth and sixth veins clear hyaline; discal and apical cells faintly clouded, the latter more so.

Type.—Cat. No. 10,899, U. S. N. M.

Tribe CORONIMYIINI

Genus Coronimyia Townsend

Coronimyia and *Epigrimyia* are distinct genera, belonging to and representing distinct tribes. *Coronimyia* has the arista short and geniculate, with very long second joint. *Epigrimyia* has the arista elongate, with basal joints short.

EUCORONIMYIA, nom. gen. nov.

This name is proposed for the genus *Isoglossa* Coquillett (Can. Ent., 1895, pp. 125-126), which is preoccupied by Casey in Coleoptera (Annals New York Acad. Sci., 1893, p. 304). The characters are sufficient to retain the genus.

Genus Olenochæta Townsend

Olenochæta kansensis Townsend.—This form, *Pseudogermaria georgiæ* Brauer and von Bergenstamm, and *Distichona varia* van der Wulp are all generically distinct.

Genus Chætoglossa Townsend

Chætoglossa nigripalpis Townsend.—This species differs from *violæ* Townsend in having black palpi and discal macrochætæ on third abdominal segment. It is also twice the size of *violæ*. By

some error the words "palpi black" were omitted from the description (Tr. Am. Ent. Soc., XIX, p. 126). *C. violæ* has palpi light orange, and third abdominal segment is without discal macrochætæ.

Subfamily THRYPTOCERATINÆ

Genus Ceratomyiella Townsend

Ceratomyiella conica Townsend.—This genus may be known by the apical cell ending but slightly before wing-tip, usually if not always short petiolate; bend of fourth vein not sharply angular, third vein bristly not quite to small crossvein, fifth vein not at all bristly, and costal spine very small. The face is so elongate and retreating in profile below eyes as to bring the insertion of vibrissæ nearly or quite into the transverse plane of the hind margins of eyes; the cheeks are one-third to one-half eye height in width (nearly one-half in *C. conica*).

Chætoplagia has the apical cell narrowly open or closed in border.

Metachæta greatly resembles *Ceratomyiella* in facial characters. The facial profile is very receding and elongate below, so as to bring the insertion of vibrissæ close to or nearly into the transverse plane of hind border of eyes (as viewed in full profile).

ACRONARISTA, gen. nov.

Allied to *Schizotachina* Walker, from which it is at once distinguished by the remarkable characters of the third antennal joint. This is biramose in the female, being split into an anterior and a posterior ramus, the two rami almost meeting apically and showing in profile like an imperfect zero. The inner or under ramus is a little widened apically; otherwise the profile width of both is practically the same throughout, even including the base of the joint where the rami join. The arista is inserted in the anterior edge of the upper ramus well before its apex, but much nearer the apex than the base, being at a distance from the apex equal to one-third the length of the joint. The second aristal joint is only about twice as long as wide, the first about as long as wide, and the third about three times as long as second. Front equilateral, about one and one-half times as wide as one eye, two middle fronto-orbital bristles in female, facial plate very wide, parafacials reduced to a mere line, facialia practically bare. Apical cell closed in margin near wing-tip, last section of fourth vein bent in; hind crossvein distinctly nearer to small crossvein than to bend of fourth vein, but not nearly so approximated to small crossvein as in *Schizotachina*. Third vein

with a few bristles at base only, costal spine present. Type, the following species:

Acronarista mirabilis, sp. nov.

One female, Palm Beach, Florida. Dr. H. G. Dyar, collector.

Length, 4 mm. Blackish, with gray pollen. Antennæ reddish brown, becoming more or less reddish yellow at base. Face, front, thorax, and scutellum silvery gray pollinose. Abdomen blackish, narrow anterior margin of second and third segments and all of fourth segment silvery gray pollinose. Legs quite blackish. Tegulæ whitish. Wings faintly tawny at base.

Type.—Cat. No. 11,685, U. S. N. M.

It is strongly probable that the male of *Acronarista* has the third antennal joint much more elaborate in structure than that above described for the female, and it will be very interesting to look for the male in South Florida material.

In *Talarocera* female the location of the arista approaches in a measure that of *Acronarista* female, but is not nearly so apical. *Acronarista* female seems to be a farther development of *Talarocera* female in this regard, in that the ramus of third antennal joint bearing the arista has become elongated and enlarged into almost the counterpart of the other ramus, the elongation taking place at the base of the ramus, and thus making the arista subapical thereto. It is probable that in the male of *Acronarista* the arista will be found to be apical to one of many rami, as in the male of *Talarocera*. However, this would indicate no near relationship, since *Talarocera* is a large form belonging to the Hystriciinæ.

LIXOPHAGA, gen. nov.

Differs from *Gymnostylia* by having macrochætæ of abdomen only marginal; parafacials and parafrontals bare except for the frontal and orbital bristles. Male cheeks hardly one-fourth eye height; no orbital bristles in male, but a row of six or seven minute bristles between frontalia and eye margin on the parafrontals. Apical cell closed in margin just before wing-tip. Hind crossvein in middle between small crossvein and bend of fourth vein, the latter rounded and bent at an obtuse angle. Front about one-third head width, widening on anterior portion. Face fully one-half head width. Type, the following species.

Lixophaga parva, sp. nov.

One male bred from *Lixus scrobicollis*, Hunter No. 219, Dallas, Texas, issued August 15, 1907.

Length, 3.5 mm. Face, cheeks, parafacials, and parafrontals silvery, the parafrontals tinged with cinereous. Frontalia, antennæ, and legs blackish. Third antennal joint about three and one-half times as long as second. Thorax silvery pollinose with tinge of cinereous above; four narrow linear black vittæ, the outer ones interrupted at suture, the inner ones abbreviated just behind suture. Scutellum silvery pollinose. Abdomen blackish, the second to fourth segments thickly silvery-cinereous pollinose leaving a median vitta and the hind margins blackish or brown, the vitta not so marked on anal segment. The pollen of abdomen is flecked with numerous small dots marking insertion of bristly hairs. Macrochætæ in a median marginal pair and a lateral one on first two segments, weaker than the marginal rows on third and anal segments.

Type.—Cat. No. 11,648, U. S. N. M.

Subfamily BAUMHAUERIINÆ

Genus Euthyprosopa Townsend

Euthyprosopa petiolata Townsend.—There are two pairs of ocellar bristles in this genus, the posterior pair being about same length as frontal bristles. The anterior pair is strongly proclinate, almost appressed; the posterior pair is slightly reclinate, suberect, and inserted between the two posterior ocelli.

Subfamily PLAGIINÆ

Genus Plagia Meigen

Plagia aurifrons Townsend.—This species is from the northeastern United States, and is not conspecific with the Mexican *americana* van der Wulp.

Genus Plagiprospherysa Townsend

Plagiprospherysa valida Townsend.—It is possible that the Presidio specimens referred by van der Wulp to his species *parvipalpis* may be conspecific with this species, but the others are likely to prove distinct.

Genus Heteropterina Macquart

Heteropterina nasoni Coquillett.—This form seems, from an examination of the type, to be quite typical of the genus *Heteropterina*. The cheeks are very narrow, not over one-tenth eye height, and the few fine hairs of the normal row on parafacials are almost imperceptible with an ordinary low-power lens, but they are present.

Subfamily PHOROCERATINÆ

Genus Achætoneura Brauer and von Bergenstamm

Achætoneura.—This genus is characterized by having the second antennal joint but little longer than the first, and thus is easily distinguished from *Tachina* s. str., to which it otherwise bears a strong resemblance. Type is *hesperus* Brauer and von Bergenstamm, of North America. *T. alctiæ* Riley belongs to this genus.

HEMIARGYRA, gen. nov.

Form *Pollenia*-like, eyes pilose, facialia and hind tibiæ ciliate. Ptilinal suture bent at a rounded angle in middle superiorly, its ends divergent inferiorly, making the ptilinal area almost triangular in shape and about one-third head width below. Facial plate elongate, not narrowed below, depressed, but not produced anteriorly on lower portion, fossæ running full length of plate; foveæ shallow, but marking length of third antennal joint; a low, sharp, narrow carina fading out before reaching inferior end of foveæ. Facialia sharp-edged, narrow in front outline from being set on edge, with a row of strong bristles running fully half way up and marking the edge, which is nearly straight in outline save for a slight curve inward at lower end, and is closely approximated to suture until it begins to curve. Vibrissal angles quite distinctly removed from oral margin, very faintly pronounced, but slightly more approximated than the rows of bristles above them, the vibrissæ strong and decussate. Peristomalia subparallel in epistomal region, divergent posteriorly, with a row of black bristles extending to beard. Epistoma not prominent, not showing in profile. Proboscis very short and fleshy, part below geniculation hardly as long as eye width, but about as long as the palpi; labella large, with long hairs; palpi rather elongate, moderately slender, but thickened on apical half. Axis of head at insertion of vibrissæ distinctly less than that at insertion of antennæ, facial profile very gently receding, but nearly straight. Antennæ inserted about on eye middle, at about three-fifths of head height; second joint rather short, but about twice as long as first; third joint elongate, not wider than second, sides nearly parallel, subtruncate at apex. Arista thickened on hardly more than basal one-third, finely short-hairy, basal joints distinct but short. Eyes thickly pilose, extending not quite to vibrissal angles, inner outline appearing slightly bulged on middle by reason of a faint incurvature below. Front (female) not prominent in profile, at vertex (seen from in front) about one-fourth of head width, gradually widening

anteriorly to distinctly more than one-third head width at base of antennæ. No ocellar bristles, but some long fine hairs on and in front of ocellar area. Frontal bristles in a single row on each side close to frontalia, but widely divergent at an angle anteriorly, the foremost two being out of line with main row and the only ones inserted below first antennal joint. Vertical bristles consisting of a moderately strong inner and a very weak outer one, the latter but slightly longer than the row forming occipital fringe. Two strong, lightly reclinate upper fronto-orbital bristles inserted close to frontalia, in profile showing same strength and curvature as inner vertical, all three being same distance apart in profile. Two strong middle fronto-orbital bristles, strongly curved and proclinate, outside line of preceding, the posterior one being inserted midway in profile between the two upper fronto-orbital bristles, the anterior one about half way between foremost frontal bristle and vertex. Parafacials wide, only gently narrowed below, fully two-thirds as wide on lower portion as opposite base of antennæ, bare. Width of cheeks equal to about one-fourth eye height, cheek grooves well marked. Lower margin of head arcuate, evenly bulged and rounded. Occiput considerably swollen below, behind eyes.

Two sternopleural bristles, strong, formula 1:0:1; hypopleural bristles in a curved row, long but slender; one moderately strong pteropleural bristle with some fine hairs; three postsutural bristles, supra-alar bristles stronger. Scutellar bristles in three strong marginal pairs and a weak apical decussate pair; subapical pair longest, reaching nearly to base of preanal segment; a widely separated discal pair about as strong as the apical.

Wings decidedly longer than abdomen, rather broad, with very small but distinct costal spine. No veins spined, except a few bristles at base of third vein. Fourth vein bent roundly at an obtuse angle, ultimate section slightly and evenly crooked, no wrinkle or stump at bend. Hind crossvein bisinuate, slightly more than one-half as far from bend as from small crossvein, which is on middle of discal cell and about half way between ends of auxiliary and first veins. Apical cell well open, ending on front border well before wing-tip. Tegulæ very large, antitegulæ one-third as long.

Abdomen broadly oval, rounded anally, only four segments visible from above, with almost equally short marginal and discal macrochætæ. Ventral plates not visible. Anal segment with a ventral median cleft, within which is the retracted ovipositor.

Legs not elongate, normal, the hind tibiæ quite thickly ciliate with a slightly stronger bristle near middle. Claws and pulvilli (female) short, not as long as last tarsal joint. Type, the following species:

Hemiargyra nigra, sp. nov.

One female, San Carlos, Costa Rica, collected by Schild and Burgdorf.

Length, 8.5 mm.; of wing, 8 mm. Blackish, or brownish black. Palpi reddish yellow, quite thickly black-hairy, blackish at base. Space from anterior fronto-orbital bristle to cheek grooves conspicuously silvery white pruinose as seen from above, covering whole area of parafacials and anterior half of parafrontals, but appearing dead black when seen from below. Facial plate silvery from above, blackish from below. Epistoma yellowish. Third antennal joint three and one-half times as long as second. Cheeks brownish, clothed with black hairs; cheek grooves and edge of parafacials bordering suture slightly golden in some lights, brownish or reddish in others, the golden continued on occipital orbits. Frontalia, thorax, scutellum, and basal abdominal segment soft black with slight brownish tinge, apex of scutellum silvery. Two middle segments of abdomen heavily golden silvery pollinose seen from in front, behind, or above, but nearly lost when seen from side; the coating showing broadly on venter, anteriorly on each segment at least. Sides of middle segments slightly reddish under the pollen. Anal segment black, with some golden pollen on sides and base. Macrochætæ as follows: A median and lateral marginal pair on basal and postbasal segments, a median discal pair on postbasal and preanal segments, the latter with a marginal row, anal segment with only bristly and fine hairs. Wings slightly infuscate along the veins, chiefly on costal half, rest subhyaline. Tegulæ smoky, with smoky yellowish borders widening in oblique lights. Pulvilli whitish, with a slight smoky yellowish tinge. Halteres rufous, knobs fuscous.

Type.—Cat. No. 10,907, U. S. N. M.

POLIOPHRYS, gen. nov.

Ptilinal suture rounded subangular in middle, its ends divergent below, giving ptilinal area an oval outline that is quite narrowed above and fully one-third head width below. Facial plate elongate, not narrowed below, depressed, produced anteriorly on lower portion; fossæ running full length of plate, foveæ deep and marking length of third antennal joint; a distinct narrow carina between the foveæ, with a linear median furrow on its edge. Facialia wide, but with rather sharp edge, latter gently curved in outline, well inside suture and furnished with bristles extending more than half way up. Vibrissal angles quite distinctly removed from oral margin, not

sharp, conspicuously more approximated than the rows of facial bristles above them, the vibrissæ strong and decussate. Peristomalia almost straight, nearly parallel, with bristles extending to beard. Epistoma prominent, but not showing greatly in profile owing to strong depression of facial plate. Proboscis short, fleshy, part below geniculation about as long as eye width (in front view), labella well developed; palpi elongate, rather slender, more attenuate on basal one-third. Axis of head at insertion of vibrissæ very noticeably less than that at insertion of antennæ, facial profile gently receding, but quite straight. Antennæ inserted above eye middle, at about three-fourths of head height; second joint about twice as long as first, with a pair of bristles on lower front edge; third joint elongate, wider than second, sides nearly parallel. Arista bare, thickened on more than basal one-half, conspicuously jointed; first joint slightly elongate; second joint elongate, two or three times as long as first, and one-fourth to one-fifth as long as third joint. Eyes thickly pilose, not extending as low as vibrissal angles, inner outline S-shaped in front view in male, straight in female. Front not strongly prominent in profile, but flattened and sloping straight to base of antennæ; at vertex (seen from in front) one-third head width in both sexes, in male suddenly swelling in lateral outline anteriorly, in female gradually widening anteriorly, almost one-half head width at base of antennæ. A strong pair of proclinate, divergent ocellar bristles. Frontal bristles in two rows, the inner rows strongly curved and widely divergent below, the outer rows nearly straight; the lowermost bristle on each side sometimes in line with both rows so as to appear (male) as belonging to either, but belonging (as shown in female) to inner row, which descends strongly to point somewhat below insertion of arista. Short fine hairs on parafrontals, long hairs on and in front of ocellar area. The usual strong inner and weaker outer vertical bristles, both reclinate, latter also divergent; two lightly reclinate upper fronto-orbital bristles, the frontal bristles extending only about half way back from base of antennæ to vertex. No middle fronto-orbital bristles in male, two strong, decidedly proclinate ones in female nearly in line with the posterior one of the upper fronto-orbital bristles. Parafacials wide, narrower below than opposite antennal insertion, least width about equal to length of second antennal joint, greatest width bordering parafrontals and not twice as much. Facio-orbital bristles in a median row of about five or six, not so strong as frontal or facial bristles, some fine hairs outside them. Width of cheeks equal to one-third eye height, cheek grooves faint. Lower margin of head

nearly straight, about two-thirds as long as axis of head at antennal insertion. Occiput swollen below, behind eyes.

Four sternopleural bristles, formula 2:1:1; hypopleural bristles in a curved row, strong: pteropleural bristles several, one strong; four postsutural bristles. Scutellar bristles strongly developed; apical pair decussate, suberect, weaker than the other marginal ones, a weak discal pair in front of them; three strong marginal pairs, the subapical longest and reaching nearly to middle of preanal segment (male), or only to base of same (female).

Wings a little longer than abdomen, moderately broad, with very small but distinct costal spine. No veins spined, except third vein with two or three bristles at base. Fourth vein bent at nearly a right angle, with very slight (almost imperceptible) wrinkle at bend, latter not sharp, apical crossvein well bowed in near origin, hind crossvein slightly bisinuate and approximated to bend of fourth vein, small crossvein half way between end of auxiliary and end of first vein. Apical cell widely open, ending far before wing-tip. Tegulæ large, antitegulæ overlapping them for one-third of their length.

Abdomen rather broadly oval, quite pointed at apex, only four segments visible above, with strong marginal and short, weak discal macrochætæ. Ventral plates not visible. Anal segment in both sexes with a median ventral slit for protrusion of genitalia, which are retracted.

Legs not elongate, middle tibiæ with three strong bristles in middle, hind tibiæ weakly ciliate with a long bristle in middle of ciliated edge; tarsi normal; male claws and pulvilli elongate, longer than last tarsal joint; female claws about as long as last tarsal joint. Type, *Poliophrys sierricola* sp. nov.

This genus is proposed for what Mr. Coquillett has identified as *Gædiopsis mexicana,* represented by four male specimens from Organ Mountains, New Mexico, about 5,300 feet, September 4–5 (Townsend), on flowers of *Lippia wrightii;* and two specimens, male and female, from Sierra Madre of western Chihuahua, head of Rio Piedras Verdes, about 7,000 feet, July 19 (Townsend), on flowers of *Rhus glabra.* The Sierra Madre specimens are distinct from the Organ Mountains species, and probably represent two species. The male from the Sierra Madre, *P. sierricola,* is made the type, and the Organ Mountains species is called *P. organensis.*

The genus differs from *Phrissopolia* chiefly in having the eyes pilose. The genus *Gædiopsis* differs from *Chætogædia* chiefly in having the eyes hairy. *G. setosa* Coquillett belongs close to if not in the genus *Poliophrys.*

Poliophrys sierricola, sp. nov.

One male, Sierra Madre, Chihuahua, collected by Townsend.

Length, 9 mm.; of wing, 7½ mm. Blackish, clothed with silvery cinereous. Parafrontals with a golden tinge (male), which extends very faintly on parafacials and cheeks. Facial plate silvery. Frontalia seen from in front silvery, seen from behind brownish. Antennæ brownish, third joint blackish and three times as long as second, arista blackish. Palpi yellowish. Thorax silvery pollinose, with four moderately wide vittæ, which are blackish seen from behind, but salmon colored seen from in front. Scutellum light brownish reddish, blackish at base, silvery. Abdomen silvery, slightly marmorate above, with a faint golden tinge which is strong on anal segment, where it is about the same as on parafrontals. Sides of abdomen faintly reddish under the pollen. Wings clear, tegulæ whitish. Legs blackish, femora silvery; tibiæ reddish or brownish yellow, except at ends; pulvilli slightly smoky.

Type.—Cat. No. 10,908, U. S. N. M.

A female from same locality differs only in second antennal joint being clear reddish yellow, the third joint little more than two and one-half times as long as second, and the sexual characters given above under the genus. It may prove to be a distinct species, but more material is needed to make sure of this.

Poliophrys organensis, sp. nov.

Four males, Organ Mountains, New Mexico, Townsend, Coll.

Length, 8 to 10 mm.; of wing, 6 to 7.5 mm. Front fully one-third head width at vertex, cheeks more than one-third eye height in width. Differs further from *P. sierricola* in having hardly a tinge of golden to the pollinose covering of head, which is silvery white throughout face and with only a slight tinge of golden on parafrontals not extending on facial plate at all. Antennæ black, third joint nearly four times as long as second (male). Abdomen more noticeably reddish on sides; anal segment less distinctly golden, about the same as other segments.

Type.—Cat. No. 10,909, U. S. N. M.

PHRISSOPOLIA, gen. nov.

This genus is proposed for *Prospherysa crebra* van der Wulp, which was included in *Chætogædia* by Brauer and von Bergenstamm. It is characterized by a double row of frontal bristles, the outer row nearly or quite as strong as the other, and especially by a row of strong bristles on parafacials close to orbit, the facio-orbital

bristles, of same strength as frontal bristles, and, except for their downward curve, appearing like a continuation of latter to lower eye border. The second aristal joint is long, the third much shorter than in *Chætogædia*, and the whole arista is widened and flattened, usually geniculate or subgeniculate. Eyes bare.

Phrissopolia desertorum, sp. nov.

Las Cruces, New Mexico, Cockerell, No. 4,952. Specimens from Beulah, New Mexico (Cockerell), and Santa Clara County, California, may also be referred to this species.

Length, 9 to 10 mm. The species differs from van der Wulp's description of *crebra* as follows: All the tibiæ rufous (male) or yellowish (female). Face, including parafacials, silvery roseate white in male without yellowish tinge, which is confined to front; in female with a faint yellowish white tinge spreading over face. Third antennal joint of male four times as long as second, of female three times as long. Arista thickened nearly to end in both sexes, only the apical one-third or one-fourth appearing slender from certain viewpoints due to flattening; second joint very distinct, elongate, fully one-fourth as long as last joint, the articulation geniculate in some cases. Hind tibiæ rather weakly ciliate, with a long bristle in middle. Wings faintly yellowish tinged at base.

Type.—Cat. No. 10,910, U. S. N. M. (Las Cruces, N. Mex.).

Genus Chætogædia Brauer and von Bergenstamm

Chætogædia acroglossoides Townsend.—This is a good species. It is neither a *Frontina* nor a *Baumhaueria*, but is apparently to be referred to *Chætogædia*. *Frontina* has the parafacials bare, and the second aristal joint is not elongate. *Baumhaueria* has the front greatly produced, the parafacials hairy and of exaggerated width, much wider than the eyes, and the cheeks as wide as eye height.

The identification of this species with *Baumh. analis* van der Wulp is quite out of the question, if the description agrees with the type. The second antennal joint is elongate, the third is not over four times as long in male and less than three times as long in female as second joint. The description was of the female.

Chætogædia vilis van der Wulp, the type of the genus, has the frontal bristles in two rows, the outer row usually weaker, and the parafacials are clothed only with fine bristly hairs.

Genus Gædiopsis Brauer and von Bergenstamm

Gædiopsis cockerelli Coquillett.—This species appears to be correctly referred to the genus *Gædiopsis*. The material from which it

was described was all collected by the writer in the White Mountain region of New Mexico (not New Hampshire, as given in the Catalogue), at about 8,000 feet, on the head of Eagle Creek, a stream which takes its rise on the upper slopes of the peak known as Sierra Blanca (altitude, 10,050 feet).

TREPOPHRYS, gen. nov.

Head in profile almost half round. Antennæ inserted about at eye middle. Front flattened, rounded in profile, showing just the same width beyond eye margins as do parafacials. Eyes bare, reaching quite to vibrissæ. Cheeks very narrow, not over one-tenth of eye height. Front about one-third of head width, or slightly less, the inner outline of eyes but slightly divergent below base of antennæ. Parafrontals a little wider than frontalia, parafacials gradually narrowing from base of antennæ until they become almost linear at lower eye margin. Ptilinal suture inverted V-shaped, the median angle a little rounded. Ptilinal area elongate, about one-third head width below. Facial plate elongate, not narrowed below, depressed, with a distinct and sharp but low median carina full length, not produced at lower margin. Facialia edge-like, bristly more than half way up, vibrissal angles hardly perceptible. Vibrissæ inserted close to oral margin, well developed.

Frontal bristles in a single row close to frontalia and extending back to ocelli, all curved inward, more or less decussate, descending in front to insertion of arista. The usual strong inner and weak outer vertical bristles. Two upper reclinate fronto-orbital bristles set well forward, almost far enough forward to occupy the usual place of insertion of the middle or proclinate ones. These two fronto-orbital bristles are of exactly the same strength, length, curvature, and direction as the inner vertical bristle, and look like two replicas of it in profile. They are also quite in line with it, and the three in profile are seen to be an equal distance apart. Two proclinate middle fronto-orbital bristles in female, outside the upper ones; none in male.

Proboscis short and fleshy, palpi slender and normal. Second antennal joint about twice as long as first; arista indistinctly jointed and minutely pubescent, slightly thickened on basal one-third. Third antennal joint about two and one-half times as long as second. Occiput slightly swollen behind on lower one-fourth, the lower margin of head short, long axis of head at vibrissæ but little over one-half that at base of antennæ.

Three sternopleural bristles, 1. 1. 1, the middle one weakest, the posterior one strongest. Three postsutural bristles. Scutellar

bristles in five pairs, one decussate apical, three lateral, of which anterior and posterior are longer and stronger, and one separated discal pair.

Abdomen above of four visible segments, macrochætæ only marginal.

Wings reaching well beyond end of abdomen, apical cell narrowly open just before and almost in wing-tip, ultimate section of fourth vein bowed in about the middle so as to attenuate the terminal portion of apical cell. Hind crossvein slightly curved, not quite in middle between small crossvein and bend of fourth vein, distinctly nearer latter. None of the veins spined, the small crossvein slightly or distinctly before middle of discal cell.

Legs normal, hind tibiæ weakly ciliate, with a bristle or two among the cilia, claws and pulvilli very short. Type, *T. cinerea,* n. sp.

Comes near *Pseudochæta* Coquillett, with which it agrees in the arrangement of the upper and middle fronto-orbital bristles, and from which it differs as follows:

Pseudochæta	*Trepophrys*
Antennæ inserted distinctly above eye middle in both sexes, but especially so in the male.	Antennæ inserted practically on eye middle in both sexes.
Two sternopleural bristles.	Three sternopleural bristles.
Four postsutural bristles.	Three postsutural bristles.
Apical cell ending not far but very distinctly before wing-tip.	Apical cell ending slightly before, almost in, wing-tip.
[1] Hind crossvein almost in middle, male; nearer bend of fourth vein, female.	[1] Hind crossvein distinctly nearer bend of fourth vein, male; almost in middle, female.
[1] Small crossvein nearly in middle of discal cell, male; before middle, female.	[1] Small crossvein well before middle of discal cell, male; nearly in middle, female.
Wings very short and broad, hardly more than twice as long as wide.	Wings elongated beyond end of abdomen, at least two and one-half times as long as broad.
Head distinctly widened.	Head hardly wider than thorax.

Trepophrys cinerea, sp. nov.

Three specimens bred from masses of pupæ of a tortricid, *Amydria* sp., sent by Prof. A. L. Herrera, from Cuernavaca, Mexico.

Length, 4.5 to nearly 6 mm. Blackish, parafrontals and parafacials golden, extending on occipital orbits; frontalia, antennæ, and face blackish, latter with a slight silvery reflection. Cheeks slightly golden. Pleuræ very faintly silvery. Dorsum of thorax and abdo-

[1] These characters represent the average of the specimens.

men cinereous pollinose, with a distinct golden tinge most noticeable on scutellum. First abdominal segment, narrow hind margins of second and third, and apical half of anal blackish, the black surface of anal segment shining. Wings clear, tegulæ whitish with a tawny tinge. Legs black.

Type.—Cat. No. 10,911, U. S. N. M.

Subfamily MASICERATINÆ

Genus Exorista Meigen and allies

The genus *Exorista,* as restricted, has the cheeks wide, one-third to one-half eye height; second antennal joint somewhat elongate, and abdominal macrochætæ discal and marginal.

Parexorista differs from *Exorista* in cheeks being not over one-fourth eye height, second antennal joint not elongate, second aristal joint usually elongate; abdominal macrochætæ usually only marginal, but long discal bristles present, those on third segment approaching macrochætæ in character.

The genus *Carcelia* Robineau-Desvoidy may be known by having no long discal bristles on abdominal segments, all being short and of even length. Macrochætæ only marginal. Cheeks not over one-fourth eye height. Type, *gnava* Meigen.

Nemorilla has cheeks not over one-fourth eye height, second antennal joint elongate, second aristal joint short, macrochætæ discal and marginal, hind tibiæ weakly ciliate.

EUSISYROPA, gen. nov.

Proposed for *Exorista blanda* Osten-Sacken. Differs from *Parexorista* in possessing regularly arranged discal macrochætæ on abdominal segments, without the erect and usually long bristly hairs of that genus, and especially in the peculiar form of the abdomen in both sexes. The latter is high, somewhat arched, slightly wedge-shaped ventrally in female, and obliquely truncate downward and forward at apex in profile. The female has these abdominal characters more marked, but the male also possesses them in a hardly less degree. The female has the venter quite distinctly carinate.

Eusisyropa blanda Osten-Sacken.—This species has the legs and second antennal joint more or less deeply blackish or brownish, with usually only faint suggestions of yellowish or reddish. The palpi have a reddish tinge. Both sexes have the parafrontals with a slight golden tinge, and anal segment very distinctly golden. There are two sternopleural bristles only.

New Jersey, New York, Massachusetts, and south to District of Columbia.

This species has been bred from *Cymatophora pampinaria* Guenée, one specimen issuing from a larva collected on cranberry at Cotuit, Massachusetts, by J. B. Smith (Riley Notes, Bureau of Entomology); also from *Hyphantria textor,* at Washington, D. C. (No. 78[03] Riley Notes).

One female specimen was bred at the Gipsy Moth Parasite Laboratory, North Saugus, Massachusetts, issued July 29, 1907, which may have come from native *Euproctis chrysorrhœa.*

Eusisyropa boarmiæ Coquillett.—This is a Florida and Southern States form closely allied to *blanda.* It reaches Arkansas and Missouri. It has light reddish yellow legs and second antennal joint, these being quite concolorous with the reddish yellow palpi, and possesses a small third sternopleural bristle.

The type specimen was bred from a larva of *Aletia argillacea,* received from Oxford, Mississippi, issued November 14, 1882 (No. 468 L°, Riley Notes, Bureau of Entomology). The species has not been bred from *Cymatophora* (*Boarmia*), the *Boarmia*-bred specimen mentioned by Coquillett being *E. blanda.*

Genus Argyrophylax Brauer and von Bergenstamm and allies

The following is a table of *Argyrophylax* and the forms closely related to it:

1. Ocellar bristles wanting (type, *albincisa* Wd.) ..... *Argyrophylax* B. B.
   Ocellar bristles present 2
2. Apical pair of scutellar bristles much stronger than those next to them, hind tibial cilia dense (type, *pupiphaga* Rdi.) ..... *Sturmia* R. D.
   Apical pair of scutellar bristles much weaker than those next to them.. 3
3. Third abdominal segment of male with two shining or pilose black spots on ventral surface, a distinct longer bristle in cilia of hind tibiæ near middle (type, *bimaculata* Htg.) ..... *Zygobothria* Mik.
   Third abdominal segment of male without such spots, hind tibial cilia dense and without longer bristle (type, *scutellata* Rdi.) ... *Blepharipa* Rdi.

Argyrophylax piperi, nom. sp. nov.

This name is proposed for *Sturmia schizuræ* Coquillett, which is an *Argyrophylax.* The specific name is preoccupied by *Argyr. schizuræ* Townsend.

Pullman, Washington State (Piper). Bred from *Schizura ipomœa.*

Length, 10.5 mm. Much larger than type of *A. schizuræ* Townsend, with which it at first seemed identical. Agrees with descrip-

tion of *A. schizuræ* Townsend except as follows: The facial plate shows no appreciable tinge of golden, fourth vein is quite abruptly bent, first abdominal segment has one lateral marginal macrochæta, second segment has a lateral marginal pair of macrochætæ, pulvilli are smoky blackish, and size is larger.

Genus Zygobothria Mik.

Zygobothria nidicola, sp. nov.

Male.—Fifteen specimens. Thirteen bred at the Gipsy Moth Parasite Laboratory, North Saugus, Massachusetts, as follows: Four bred by E. S. G. Titus, in 1906, from *Euproctis chrysorrhœa* imported from Germany (Erfurt, Munich, and Fuhlsdorf, received from Marie Ruhl); nine bred by W. F. Fiske, in 1907, from hibernated larvæ of *Euproctis chrysorrhœa* from imported nests received from Vienna and other parts of Nieder-Oesterreich, and from summer importations of larvæ of same species from South Tirol and Carniola. Two bred at Simferopol, Russia, by S. Mokschetsky, from *Euproctis chrysorrhœa*, June 7, 1905, and July, 1907.

Length, 7 to 9 mm. Eyes very faintly hairy, appearing bare. Antennæ blackish, third joint more or less reddish or lighter colored at base, palpi light yellow. Face and front silvery, parafrontals darker in some lights, but not golden. No middle fronto-orbital bristles. Frontalia slightly, if any, wider than one parafrontal. Parafrontals with fine hairs outside the row of frontal bristles. Front anteriorly hardly as wide as one eye, half as wide as one eye at vertex. Facialia with some bristles extending about one-third way up. Arista thickened on less than proximal half, first two aristal joints short. Cheeks hardly one-third eye height. Thoracic dorsum thinly silvery pollinose. Scutellum testaceous except extreme base, apical pair of bristles weak, almost erect, decussate. Abdomen with more or less red on sides, first segment and narrow hind borders of second and third segments shining black, rest thickly cinereous pollinose leaving a more or less distinct median line. A median marginal pair of macrochætæ on first and second segments, also three lateral marginal ones on each side of same segments, third segment with a marginal row of twelve or fourteen. Anal segment with only bristly hairs. Legs wholly black, claws and pulvilli very elongate, hind tibiæ thickly ciliate, but with a longer bristle near middle. Tegulæ white. Four sternopleural and four postsutural bristles, a few specimens showing a fifth weaker sternopleural bristle.

A specimen of this series sent to Dr. K. Kertész, at Budapest, was returned by him as *Argyrophylax galii* Brauer and von Bergenstamm. As *galii* has the male vertex one and one-third times the eye width and female vertex twice the eye width, this can not be that species. Two specimens sent to Dr. A. Handlirsch, at Vienna, were returned as unknown to him, and indicated with a query as American.

Female.—Fourteen specimens. Twelve bred at the Gipsy Moth Parasite Laboratory, North Saugus, Massachusetts, as follows: Five bred by E. S. G. Titus, in 1906, from *Euproctis chrysorrhœa* imported from Germany (Baden and Dresden, received from Marie Ruhl and Schopfer, respectively); seven bred by W. F. Fiske, in 1907, from summer importations of *Euproctis chrysorrhœa* from Germany. Two bred at Simferopol, Russia, by S. Mokschetsky, from *Euproctis chrysorrhœa*, June 10, 1905, and July, 1907.

Length, 7 to 8 mm. Differs from the male as follows: Thickly yellowish-cinereous pollinose all over, including front and first abdominal segment. Face more silvery. Thoracic vittæ fine, outer ones broken at suture and somewhat widened. Scutellum yellowish on margin. Middle fronto-orbital bristles two in number. Front from more than one-third to about two-fifths width of head, hardly narrowed from facial width. Abdominal macrochætæ same as male, but the second segment rarely has four median marginal macrochætæ more or less well developed from the long marginal hairs on each side of the original pair. Hind tibiæ sparsely but distinctly ciliate, a long bristle near middle. Four sternopleural and four postsutural bristles.

A specimen of this series sent to Dr. K. Kertész was returned undetermined; another sent to Dr. A. Handlirsch was returned as unknown to him, and probably American. The two sexes were not suggested by either Kertész or Handlirsch as belonging together, but it seems highly probable that they are the same species. Both are positively European, as conclusively demonstrated not only by the breeding records of the Gipsy Moth Parasite Laboratory, but also by Mr. Mokschetsky's breeding of both at Simferopol, Russia.

Types.—Cat. No. 11,803, U. S. N. M. (2 types: male from Nieder-Oesterreich, issued July 29, 1907; female from Central Europe, issued July 10, 1907).

Mr. W. F. Fiske has bred this species (male specimens) from cages containing hibernated larvæ of *Euproctis chrysorrhœa* under circumstances indicating that the female tachinids oviposit in the *Euproctis* nests in the fall, the tachinid larvæ remaining through the winter in the nests and issuing from the host larvæ or pupæ in the

summer. This is a remarkable habit of oviposition among tachinids, and credit is due to Mr. Fiske for the discovery of it.

Genus Comatacta Coquillett

Comatacta nautlana, sp. nov.

The material upon which the genus *Comatacta* Coquillett was founded was collected at San Rafael, near Jicaltepec, Veracruz (Townsend). The specimens were erroneously identified with *Brachycoma pallidula* van der Wulp (Can. Ent., 1902, pp. 199-200), which is to be considered the type of the genus *Comatacta*.

The present species differs from van der Wulp's description of *pallidula* as follows: Facial plate silvery like parafacials; frontalia honey yellow, parafrontals silvery with a golden shade. Frontal bristles descending but one or two below base of antennæ. Beard very short, grayish. Antennæ reaching two-thirds to three-fourths way to oral margin. Arista rufous, concolorous with antennæ. Anal segment hardly at all rufous.

Type.—Cat. No. 10.906, U. S. N. M.

PARADEXODES, gen. nov.

Wings longer than *Dexodes* (type *spectabilis* Meigen), abdomen very bristly like *Dexodes*, with many discal macrochætæ and erect hairs, apical pair of scutellar bristles weak but long and markedly divaricate. Eyes bare; male front narrow, about or nearly equaling eye width anteriorly, vertex about or more than one-half eye width. Frontal bristles in male closely placed, descending three to four below base of antennæ. Ocellar bristles present. Vibrissæ close to oral margin, facialia with a number of bristles above vibrissæ. Parafacials quite narrowed below, widening above. Antennæ inserted on eye-middle. Second antennal joint nearly three times as long as first; third joint narrow, two or more times as long as second, equilateral in profile, subtruncate at tip. Second aristal joint short but distinct, arista thickened on proximal fourth. Legs rather long, male claws and pulvilli elongate. Wings long and narrowed in male, apical cell open well before wing-tip, hind crossvein approximated to bend of fourth vein, small crossvein on middle of discal cell. Abdomen elongate, conico-cylindrical in male. Type, the following species:

Paradexodes aurifrons, sp. nov.

One male, North Saugus, Massachusetts (Gipsy Moth Laboratory, bred in Cage E, 14 July, 1906. No. 698, E. S. G. Titus. Host unknown).

Length, 10 mm. Blackish, gray pollinose. Entire face and front, even including cheeks and orbit, deep golden pollinose. Frontalia quite black, nearly as wide as one parafrontal. Antennæ blackish. Palpi reddish yellow. Thorax and scutellum very thinly pollinose, humeri thickly so. Abdomen quite uniformly pollinose except first segment, thickly bristly and hairy. Legs entirely black, femora pollinose on under side. Claws long and black, pulvilli smoky. Tegulæ whitish, with narrow yellowish edge.

Type.—Cat. No. 11,686, U. S. N. M.

Paradexodes albifacies, sp. nov.

One male, White Mountains, New Hampshire, Morrison. This specimen is figured in Dr. Howard's Insect Book, pl. 22, fig. 7, as *Hypostena variabilis* Coquillett, but is not congeneric with the type of that species.

Length, 9.5 mm. Face and front, cheeks and orbits silvery white. Frontalia reddish brown, wider than one parafrontal. Antennæ reddish brown. Palpi yellow. Thorax, scutellum, and abdomen shining black, very thinly bluish silvery pollinose, most thickly so on humeri and bases of last three abdominal segments. Legs blackish brown, femora silvery beneath, pulvilli yellowish white, claws pale reddish brown. Tegulæ white, with narrow yellowish edge.

Type.—Cat. No. 11,687, U. S. N. M.

Genus Ceromasia Rondani

Ceromasia aurifrons, sp. nov.

Three females and one male, New Hampshire (2 females and the male from Canobie Lake, Dimmock).

Length, 7.5 to 10 mm. Differs from the European *C. florum* Meigen (determined by Brauer and von Bergenstamm) by having whole of parafrontals, parafacials, and orbits deep golden in both sexes, even the cheeks showing golden in fresh specimens; the pollen of thorax and abdomen whitish gray, without the brassy tinge of florum; anal segment in both sexes with a noticeable tinge of golden, and scutellum testaceous only on apical half.

Type.—Cat. No. 11,649, U. S. N. M. (female).

Two males of this species were bred at the Gipsy Moth Parasite Laboratory, North Saugus, Massachusetts, by E. S. G. Titus, from unidentified lepidopterous larvæ.

Ceromasia auricaudata, sp. nov.

Two females and one male, Harrison, Idaho (male and female), and Pullman, Washington (female, July 16).

Length, 7 to 9 mm. Differs from *C. aurifrons* Townsend by having the anal segment wholly deep golden, same shade as parafrontals, etc.; humeri with a faint, abdomen with a more distinct golden tinge, scutellum hardly more narrowly testaceous, and thorax more distinctly vittate.

Type.—Cat. No. 11,650, U. S. N. M. (female, Harrison, Idaho).

EUDEXODES, gen. nov.

This genus is proposed for *Dexodes eggeri* Brauer and von Bergenstamm, of Europe. The characters of the facial plate throw the species into a different tribe (if not subfamily) from *Dexodes*, of which the type is *spectabilis* Meigen.

Subfamily WILLISTONIINÆ

Genus Belvosia Robineau-Desvoidy and allies

Dr. Williston published a plate of *Belvosia* and allies in Insect Life, vol. v (1893), facing p. 238, exhibiting the difficulties to be encountered in separating the forms. By studying this plate, it will be seen that there is a correlation between length of second antennal joint and bristles on the facialia, also between former and distance of vibrissæ from oral margin.

The more elongate the second antennal joint is, the less bristles there are on the facialia. Conversely, the shorter the second joint, the more strongly are the facialia ciliate. In all cases, the distance of the vibrissæ above the oral margin is about equal to the length of the second antennal joint.

The forms having facialia not ciliate have the second antennal joint long, vibrissæ inserted far above oral margin, and fourth vein angular at bend. Those having facialia ciliate have the second joint much shorter and vibrissæ inserted only a little above oral margin; they fall into two categories by the character of the bend of fourth vein. We thus have the following table:

1. Facialia not ciliate, fourth vein angular at bend; second antennal joint strongly elongate, nearly as long as third joint; vibrissæ inserted high above oral margin, male claws normally very elongate, female claws less elongate. (Sto. Domingo, Brazil, California, New Mexico, Mexico, Jamaica.) ..... *Belvosia bicincta* Robineau-Desvoidy
   Facialia ciliate 2
2. Fourth vein bent at a sharp angle, with or without stump, but often V-shaped and with stump; claws of male normally elongate, of female not; second antennal joint not strongly elongate, vibrissæ inserted normally above oral margin. (Brazil.) ... *Willistonia esuriens* J. C. Fabricius

Fourth vein rounded at bend, second antennal joint short or only appreciably elongate; vibrissæ inserted close on or only appreciably above oral margin, about as far above as length of second antennal joint; male claws usually not elongate, but longer than the short female claws.....*Latreillimyia,* nom. nov. (*Latreillia* preocc.) 3

3. Vibrissæ inserted close on the oral margin..... 4
Vibrissæ inserted appreciably above the oral margin, male claws strongly elongate. (Brazil, Pennsylvania.).....*L.* (aberrant form)

4. Second antennal joint appreciably elongate, female claws rather short. (Minnesota.).....*L.* (intermediate form)
Second antennal joint short, not at all elongate. (Brazil, Mexico, New York.).....*Latreillimyia* (typical forms)
bifasciata J. C. Fabricius, *leucopyga* (van der Wulp) Williston.

The character of the ciliate facialia is more important than the venational character and the same holds good of the vibrissal character and the elongation of second antennal joint. As already pointed out in a previous section of this paper, the relative length of the second and third antennal joints will not hold for generic separation, since the length and size of the third joint in these flies is largely a sexual character. But the actual length of second joint taken independently furnishes a good character. Only a few genera have the second joint elongate. It may be compared in length with the first joint. The first two joints do not vary sexually.

Brauer and von Bergenstamm state that the claws of male are elongate in *Willistonia* and short in *Latreillimyia.* It is doubtful how far these characters can be relied upon, since they are also sexual. The same authors also give as a character of *Willistonia* a stump at the angular bend of fourth vein and the angle more approximated to hind margin of wing. These may hold good, especially the latter, but are not necessary for the separation of the forms at present known to us. Further material will probably call for their use.

The writer pointed out in 1892 (Trans. Am. Ent. Soc., XIX, p. 89) that *bifasciata* has the facialia strongly ciliate and *bicincta* has not; that five specimens of *bicincta* from New Mexico had the third antennal joint scarcely longer than the second, which means that the second joint was strongly elongate; that three specimens from New York were easily referable to *bifasciata,* and one from Jamaica to *bicincta;* and that, while the parafacials are bare in both species, the whole anterior aspect of head is altogether more bristly in *bifasciata,* which possesses also greater hairiness of cheeks.

The elimination of *Belvosia,* argued for by Brauer and von Bergenstamm, is not permissible under the rules of the International Code. Its maintenance fortunately does not conflict with the genus *Willistonia,* since *bicincta* differs generically from *esuriens.*

Belvosia and *Latreillimyia* show no ventral plates or ventral membrane.

LATREILLIMYIA, nom. gen. nov.

This name is proposed for *Latreillia* Robineau-Desvoidy (1830), which is preoccupied by Roux in Crustacea (1827).

GONIOMIMA, gen. nov.

This genus is proposed for *Belvosia luteola* Coquillett. Bears a striking resemblance to *Gonia*. Second antennal joint short, third joint very long and narrow; arista long and flattened whole length, in front view appearing as a mere line, but in lateral view showing itself to be uniformly widened nearly to apex; frontal bristles in one main inner row bordering frontalia, with a row of weaker bristles outside, and orbital bristles (female) outside these; second aristal joint very short, front not widened and swollen, facialia ciliate almost to base of antennæ. Abdomen appearing conical from above, but laterally appressed on apical portion, fully as thick dorso-ventrally for its whole length as its greatest width, which is at base. The body and wing characters agree perfectly with *Gonia*, but the head characters are totally different, and it is the latter which place the genus in the Willistoniinæ.

The genus appears to come near *Thelymorpha* Brauer and von Bergenstamm, but is at once distinguished by having no discal macrochætæ on abdomen. The head is almost the same, and the abdomen is described as very similar.

TRIACHORA, gen. nov.

This genus is proposed for *Latreillia unifasciata* Robineau-Desvoidy, of which *Exorista flavicauda* Riley is a synonym. Differs from *Latreillimyia* in having three rows of frontal bristles on each side of frontalia, besides the fronto-orbital bristles of female. The arista is flattened, and the antennal characters are similar to those of *Goniomima*. The main or strongest row of frontal bristles, of the three rows on each side, is in the middle, the inner row being decidedly weaker, and the outer row but little weaker than the main or middle row.

Genus Rileymyia Townsend

(Ent. News, 1893, p. 277)

This name was proposed by the writer in 1893 for *Rileya* Brauer and von Bergenstamm, which is preoccupied in Hymenoptera. The type of the genus is *Blepharipeza fulvipes* Bigot, according to Brauer

(Sitzungsber. Math.-Naturwiss. Cl. k. Akad. Wiss., CVI, I, p. 348), who says that *R. americana* Brauer and von Bergenstamm is a synonym of Bigot's species. *B. adusta* H. Loew is also typical of the genus, which may be distinguished from *Blepharipeza* by the absence of apical scutellar bristles and thornlike macrochætæ.

Rileymyia albifacies Bigot.—Brauer (l. c.) says this is a synonym of *fulvipes* Bigot, but in view of the widely removed type localities it would seem that the point needs verification. *R. albifacies* was founded on a specimen from Brazil, while *fulvipes* is from Washington State. *R. americana* is from California.

Subfamily MEIGENIINÆ

Genus Viviania Róndani

It must be noted that this genus is characterized quite fully by Róndani on p. 53, vol. IV, of Dipt. Ital. Prod., where the imperfectly erected *Biomyia* (l. c., vol. I, p. 72) is given as a partial synonym. *Biomyia* does not cover the same forms, so far as any one knows, and its one-line characterization entitles it to no notice in the face of its author's subsequent rejection of it. It is therefore quite out of the question to attempt to use it, especially since we have no definition of it.

Viviania mutabilis Coquillett, etc.—*Biomyia mutabilis* is a *Viviania*. So also is *B. aurigera* Coquillett. *B. genalis* Coquillett does not belong anywhere near this genus.

Viviania lachnosternæ, sp. nov.

One female, Urbana, Ill. (No. 36,817, Forbes). "Supposed to have bred in *Lachnosterna* adults."

Length, 10 mm.; of wing, 8 mm. Gray-cinereous, more or less silvery. All three antennal joints and arista wholly reddish yellow, the frontalia same color posteriorly, but darker in front. Parafrontals blackish, thinly silvery. Parafacials more distinctly silvery. Ptilinal area blackish, the lower portion of facial plate broadly yellowish on oral margin. Palpi light reddish yellow. Mesoscutum with five vittæ, the middle one narrow behind and obsolete in front of suture, the outer ones more or less triangularly widened, shorter and more triangular in front of than behind suture. Wings wholly hyaline, tegulæ white. Legs wholly blackish, femora silvery below, pulvilli smoky. Abdomen black, thickly cinereous pollinose.

Type.—Cat. No. 10,913, U. S. N. M.

Genus Tachinomyia Townsend

Tachinomyia robusta Townsend.—The genus differs from *Tachina* in the vibrissæ being inserted higher above oral margin, cheeks one-half eye height in width, and abdomen very elongate.

Genus Emphanopteryx Townsend

Emphanopteryx cumyothyroides Townsend.—This genus differs from *Cryptomeigenia* by having the abdomen large; claws and pulvilli of female elongate, those of male very long and strong; arista finely pubescent, strong subdiscal and discal macrochætæ (at least on second segment), fourth vein rather angular at bend and usually represented beyond apical crossvein by a short stump.

Subfamily Tachininæ

Genus Tachina Meigen

Tachina clisiocampæ Townsend.—*Achætoneura fernaldi* Williston is very probably a synonym. The strongly marked wrinkle at angular bend of fourth vein, the elongate second antennal joint which is about three times as long as first, the frontal bristles descending low on parafacials, and the strongly ciliate facial ridges, whose bristles ascend at least to opposite the lowest frontal bristles, make the species typical of *Tachina* s. str. The third antennal joint is about twice as long as second. *Achætoneura* has the second antennal joint hardly longer than the first, the third joint thus being easily five or six times as long as the second.

This species can not be identified with *T. mella* Walker, if the description of latter is to be depended on, since it states that the second antennal joint is ferruginous apically, third joint three times as long as second, arista much longer than third antennal joint, second aristal joint moderately long, large ferruginous spot on each side of second segment. The venational characters also do not agree. In *clisiocampæ* there is at most in either sex only a very faint tinge of reddish, hardly perceptible in fact, on sides of second abdominal segment. The antennæ are wholly blackish, the third joint, even in male, hardly more than twice as long as second, arista but little longer than third antennal joint, apical crossvein well bowed in, hind crossvein quite strongly sinuate.

Tachina orgyiarum, nom. sp. nov.

This name is proposed for *T. orgyiæ* Townsend, which is preoccupied by *T. orgyiæ* Le Baron. Both species belong in the genus *Tachina,* as here restricted.

Tachina utilis, sp. nov.

Length, 6 to 8 mm. Differs from *T. larvarum* in its much smaller size, vertex of male not wider than one eye, thoracic dorsum not so thickly pollinose, abdomen more shining, with pollinose bands not so distinct, and anal segment not thickly hairy. The male in some specimens shows signs of reddish on sides of abdomen.

The anal stigmata of puparium also show important differences, the median slit being much abbreviated.

Germany, Bavaria, and Carniola. Bred at the Gipsy Moth Parasite Laboratory, North Saugus, Massachusetts, by E. S. G. Titus, in 1906, and W. F. Fiske, in 1907, from both *Euproctis chrysorrhœa* and *Porthetria dispar* larvæ received as summer importations from above localities; and also bred by W. F. Fiske, in 1907, from native larvæ of both species collected in field colonies near Boston (Oak Island and Woburn), Massachusetts, where European specimens of this tachinid had been previously liberated, showing that this species has gained a foothold.

Type.—Cat. No. 11,804, U. S. N. M. (male, length 6 mm.; Dresden, Germany, from *Euproctis* larvæ collected and shipped by Schopfer).

This type specimen was submitted to Dr. K. Kertész, and by him determined as *Tachina glossatorum* Róndani. It can not be that species, which is described by Róndani as having the second aristal joint four times as long as wide, and belongs to the genus *Microtachina* established on that character. *Tachina*, including the present species *utilis*, has the second aristal joint no longer than wide.

Genus Euphorocera Townsend

Euphorocera slossonæ, sp. nov.

One female, Franconia, N. H. (Mrs. A. T. Slosson). Syn. *E. cinerea* Coquillett (non van der Wulp), Rev. Tach., p. 102.

Differs from van der Wulp's description of *Phorocera cinerea* (Biol. C. A., Dipt., II, pp. 81-82) as follows: Frontalia as broad or broader than the parafrontals. Lowest frontal bristles not close to the eyes. Face very distinctly yellowish. Second antennal joint two and one-half times as long as first, the third joint a little more than twice as long as second. Arista thickened on basal third only. Palpi somewhat swollen, evenly clothed with black hairs. No trace of dorsal stripe on second and third abdominal segments. Two discal macrochætæ on second segment as well as on third. Anal segment only moderately beset with bristles. Small crossvein

slightly before the middle of discal cell. Fourth vein bent at an obtuse angle. Posterior crossvein gently bisinuate.

Type.—Cat. No. 10,912, U. S. N. M.

Subfamily ECHINOMYIINÆ

Genus Varichæta Speiser

The name *Varichæta* has been proposed by Speiser for *Erigone* Robineau-Desvoidy (1830), which is preoccupied by Savigny in Arachnida (1827). The type species is *V. radicum* Fallen.

Varichæta aldrichi Townsend.—This species, described under *Hystricia*, belongs in the genus *Erigone* (Robineau-Desvoidy) Brauer and von Bergenstamm, and must thus be known as *Varichæta aldrichi*. It is quite distinct from *V. radicum*. The latter has only three postsutural macrochætæ, while *aldrichi* has four or five. There are also differences in the abdominal macrochætæ.

Genus Elachipalpus Róndani

This genus is characterized by Róndani as possessing palpi, though small; and having apical cell appendiculate by reason of the continuation of fourth vein beyond apical crossvein. The type cited for it by Róndani is *Micropalpus longirostris* Macquart, from the Cape of Good Hope. The species is figured by Macquart as having a proboscis like *Spanipalpus*, but with distinct filiform palpi, and venation like *Spanipalpus* and *Deopalpus*, except that, instead of a wrinkle, there is a distinct stump representing fourth vein beyond apical crossvein. Brauer and von Bergenstamm indicate *E. longirostris* Róndani as type of *Elachipalpus*, but throw doubt on Róndani's *longirostris* being the same as *Micropalpus longirostris* Macquart. However this may be, it is certain that the American species *ruficauda* van der Wulp and *macrocera* Wiedemann do not belong to *Elachipalpus*, since they have absolutely no palpi, the proboscis is much shorter, and the venation markedly different. The new genus *Copecrypta* is therefore proposed for *Schineria ruficauda* (van der Wulp) Williston. The species was referred to *Cuphocera* by Williston.

COPECRYPTA, gen. nov.

Distinguished by a characteristic narrowing of the apical cell at the end, the ultimate section of fourth vein being crookedly bowed in and for the last one-third or one-fourth of its extent parallel with the third vein and very closely approximated to it, thus forming a narrow handle-like tip to the apical cell. The proboscis beyond

geniculation is shorter than head height. Palpi absent. Two orbital bristles in female, none in male. Some extra bristles outside the frontal row, but these do not form a definite second row except anteriorly in some males. No ocellar bristles. Claws of female short, those of male as long as last tarsal joint.

The genus differs from *Trichophora* by having the abdomen elongate, subconical or subcylindrical, reaching nearly to end of wings. *Trichophora* has abdomen much shorter than wings and rounded.

SPANIPALPUS, gen. nov.

This genus is proposed for *Trichophora miscelli* Coquillett. It differs from *Copecrypta* in possessing a strong pair of ocellar bristles; proboscis long and slender, much longer than head height; abdomen considerably widened (female). Male not known. Female with two strong orbital bristles; only one row of frontal bristles; inner pair of vertical bristles very long and strongly curved, decussate, reclinate. Apical crossvein normal, not crooked, evenly bowed in near origin; apical cell widely attenuate on terminal portion, widely open. A distinct wrinkle at origin of apical crossvein.

DEOPALPUS, gen. nov.

Differs from *Spanipalpus* only as follows: No ocellar bristles. Two very definite rows of frontal bristles on each side of frontalia. No orbital bristles (male), claws of male not elongate. Parafacials, parafrontals, and cheeks evenly and thinly pilose with rather long fine black hairs. Parafrontals not metallic or blackish, silvery white. Venation and proboscis like *Spanipalpus*. Abdomen about like *Copecrypta*. The head bristles, like those of all the rest of the body, are strong. The inner frontal rows are decussate, extending only half way back between base of antennæ and vertex. The outer row on each side is composed of lightly reclinate bristles of nearly equal strength, nearly as strong as the vertical bristles. Both rows descend well below base of antennæ, the outer row slightly lower than the inner and to base of third antennal joint. Two facioorbital bristles as strong as the frontal bristles. Facial plate strongly produced below. Second antennal joint elongate, about as long as third. Second aristal joint strongly elongate, slightly geniculate. Cheeks nearly equal to eye height. Type, the following species:

Deopalpus hirsutus, sp. nov.

One male, Meadow Valley, head of Rio Piedras Verdes, about 7,300 feet, Sierra Madre of western Chihuahua, July 29 (Townsend).

Length, 9.5 mm. Bears considerable superficial resemblance to *Copecrypta ruficauda,* but may be distinguished therefrom by the generic characters above given. Head entirely silvery white, frontalia showing very faintly pale brownish, first two antennal joints light brownish yellow, third joint hardly darker, but with anterior terminal border and arista blackish. Proboscis black, shining. Thorax cinereous pollinose, with two interrupted heavy outer dark vittæ, and two narrow inner vittæ stopping a little behind suture. Scutellum tawny yellowish, darker at base, silvery, with two very strong pairs of lateral macrochætæ reaching beyond base of third abdominal segment, a moderately strong but shorter apical decussate pair, and two lateral weak pairs besides discal bristles. Abdomen faintly blackish on dorsum, pale reddish or brownish yellow on sides, anal segment wholly reddish. All of abdomen more or less thickly silvery pollinose, showing most on basal half or more of last three segments. Macrochætæ as follows: One lateral marginal on first segment; one lateral marginal, and one median marginal pair on second segment; eight strong marginal in a row on third segment; anal segment with about twenty in marginal, submarginal, and discal rows. Legs black, tibiæ reddish, especially hind ones, pulvilli only faintly smoky. Wings clear, tegulæ white, third vein bristly to small crossvein.

Type.—Cat. No. 10,914, U. S. N. M.

EUPELETERIA, gen. nov.

Erected for *Echinomyia fera* Linné, *magnicornis* Zetterstedt, *præceps* Meigen, etc. Differs from *Peleteria* Robineau-Desvoidy in lacking the two or three facio-orbital bristles (macrochætæ on parafacials next orbit and separated from descending frontal bristles). Differs from *Echinomyia* Duméril, as restricted, by having abdominal macrochætæ not closely set and thorn-like. Body *Peleteria*-like, not *Jurinia*-like.

EUFABRICIA, gen. nov.

Second antennal joint strongly elongate, fully four times as long as first, much longer than third; third joint strongly convex on front border in profile. Second aristal joint elongate, fully four times as long as wide. Palpi widened and flattened on distal one-third or so, somewhat spatulate. No ocellar bristles. Parafacials wide, front not specially prominent in profile. Cheeks about two-thirds eye height in width. Anterior tarsi of female not more widened than those of other legs.

Differs from *Fabricia*, to which it is most nearly related, in the absence of ocellar bristles, and form of palpi and third antennal joint.

Type, the following species (to be figured in the forthcoming new edition of Dr. S. W. Williston's Manual of Diptera, fig. 157).

Eufabricia flavicans, sp. nov.

One female, Brazil, H. H. Smith, Coll. Received from Dr. S. W. Williston.

Length, 14 mm. General yellowish or rufous yellowish in ground color. Head silvery whitish, frontalia and first two antennal joints reddish yellow, third joint and arista light brown. Palpi yellow. Parafrontals with a faint tinge of brassy yellow. Thorax and scutellum brassy yellow pollinose. Abdomen rufous yellow, first segment brown on depressed median portion, other segments more tinged with rufous on median line, third segment wholly so tinged. Narrow anterior margin of second and third and all of anal segment yellowish silvery pollinose. A median marginal pair of macrochætæ on second segment, a marginal one on each side of first and second segments, a median marginal pair and three lateral marginal ones on third segment (eight marginal in all), anal segment with a discal and marginal row. Legs blackish or brown, the tibiæ more or less rufous, hind tibiæ especially so. Claws reddish or yellowish brown, tips darker, pulvilli yellowish. Wing bases broadly yellow, tegulæ whitish.

Type.—Cat. No. 11,805, U. S. N. M.

Subfamily HYSTRICHINÆ

Genus Dejeania Robineau-Desvoidy and allies

Dejeania vexatrix Osten-Sacken and *Paradejeania rutilioides* Jaennicke.—Speaking of *Dejeania vexatrix*, Osten-Sacken said: "It is very remarkable that *Dejeania*, a South American and Mexican genus, should occur so commonly at high altitudes in the Rocky Mountains among alpine forms, and it would be worth the while to investigate on what insect (probably Lepidopterous) it preys as a parasite" (Western Diptera, p. 343). At the close of his paper (l. c., p. 354), he again referred to the same matter, and included a reference to *P. rutilioides*, not, however, mentioning it by name.

These instances of a tropical group of tachinids developing boreal forms is paralleled in birds by the parrot genus *Rhynchopsitta*, peculiar to the pine region of the Sierra Madre of western Chihuahua. The tropical bird group of parrots has here developed a sub-boreal

genus peculiar to the pine region, and which both passes the winter and nests there. Likewise a species of trogon occurs, belonging to the monotypic genus *Euptilotis,* also peculiar to the same region and breeding there.

Paradejeania may be considered as more or less of a boreal offshoot from *Dejeania,* and *D. vexatrix* Osten-Sacken is a boreal and distinct form from the tropical *corpulenta* Wiedemann. Osten-Sacken was mistaken in taking Wiedemann's type to be the same as *vexatrix.*

PTEROTOPEZA, nom. gen. nov.

This name is proposed for *Chætoprocta* Brauer and von Bergenstamm (1891), which is preoccupied by Nicéville in Lepidoptera (1890). Type is *Blepharipeza tarsalis* Schiner, of South America.

Genus Gymnochæta Robineau-Desvoidy

Gymnochæta alcedo H. Loew.—This species is not typical of the genus *Gymnochæta.* The type of the genus is *viridis* Fallen, which has second antennal joint elongate, second aristal joint elongate, antennæ inserted a little below middle of eyes, and cheeks one-half eye height.

EUJURINIA, gen. nov.

This genus is proposed for *Hystricia pollinosa* van der Wulp. Antennæ, frontal bristles, arista, and palpi like *Jurinia,* but resembling *Hystricia* in having the eyes hairy and the cheeks not so wide. It differs from *Jurinella* in the narrower cheeks and wider parafacials, and from *Pseudohystricia* in the first of these characters and the less produced front.

The cheeks of *Jurinia* are nearly equal to eye height, and the eyes are bare. *Hystricia* has the third antennal joint truncate at tip, second joint not so elongate, but attenuated at origin; frontal bristles weaker, straighter, descending lower, and all directed forward; no macrochætæ on lower border of cheeks, second aristal joint not strongly elongate.

A female specimen in U. S. N. M., collected by the writer July 3, at San Rafael, near Jicaltepec, Veracruz, is apparently to be identified as *Eujurinia pollinosa,* although van der Wulp says "arista indistinctly jointed," which, it seems, must be an error, and not intended by the author. The first two aristal joints in above specimen are elongate and distinct. Also there are some fine strong bristles on under side of middle femora. Length, 16 mm.

RHACHOËPALPUS, gen. nov.

This genus is proposed for *Saundersia testacea* van der Wulp. Mr. van der Wulp has remarked on the striking resemblance which this species bears to *Paradejeania rutilioides*.

Rhachoëpalpus olivaceus, sp. nov.

Two specimens, male and female, collected on the head of Rio Piedras Verdes, about 7,000 feet, Sierra Madre of western Chihuahua (Townsend), one on flowers of *Rhus glabra,* July 15, the other August 16.

Length of male, 18.5 mm.; of female, 19 mm. Thorax with an olive green tinge. Frontalia with much the same tinge, but darker. Second antennal joint with a strong bristle on front border near distal end, sometimes a pair of them. Third joint only a little longer than second, hardly one and one-half times as long, same size in both sexes. Arista thickened on rather more than basal half, distinctly jointed, second joint elongate. Scutellum with at least four rows of spines. The male shows a median dorsal stripe on abdomen, widened in front on second segment, where it is marked by an area of spines, narrower on third segment, and narrowest, but still distinct, on anal segment. This stripe shows only on anal segment in female, but the area of spines is present on second segment. The anal segment in both sexes is gently emarginate in middle on hind border, presenting a double curve like a pair of buttocks. Wings evenly infuscated. Color of scutellum is same in both sexes—quite yellowish. Abdomen of male is of a distinctly more reddish shade, female abdomen being of nearly same shade as scutellum, if anything, slightly lighter. Claws of female are yellow, with black tips. Front of female is wider, with three proclinate fronto-orbital bristles on one side and only two on the other. Front tarsi of female not dilated.

Type.—Cat. No. 10,915, U. S. N. M.

Rh. olivaceus bears the same striking resemblance to *Paradejeania* that *Rh. testaceus* does; perhaps even more so, since in the latter there seems to be no posterior emargination of anal segment on the median line. Mr. van der Wulp's figure shows none, and his text mentions none.

Rhachoëpalpus shows broad ventral plates in both sexes, but ventral membrane in female is not visible. There are five abdominal segments, the first very short and barely discernible from the side. The female shows ventral plates, bearing thick bunches of spines, corresponding to second to fifth dorsal plates, the lateral edges of

latter overlapping sides of former, and a sixth ventral plate, or sclerite appearing as such, at base of ovipositor. The latter bears only hairs. The male with second and third ventral plates bearing thick bunches of spines as in female, but fourth with only hairs and free, the ventral membrane showing widely on sides of fourth only; fifth ventral plate much narrower, longer than wide, bare, not free; what seems a sixth ventral plate in female represented in male by a paired process articulating with the hypopygium.

EUËPALPUS, gen. nov.

Differs from *Epalpus* in having third antennal joint elongate and convex in profile on anterior edge, front and epistoma much less prominent, face less deeply concave in profile. Eyes absolutely bare. Parafacials very wide, black-hairy. Cheeks about equal to eye height. Second aristal joint hardly twice as long as wide.

Differs from *Xanthozona* (type, *melanopyga* Wiedemann) in having no discal macrochætæ on abdomen.

Type, the following species (to be figured in the forthcoming new edition of Dr. S. W. Williston's Manual of Diptera, fig. 156).

Euëpalpus flavicauda, sp. nov.

One female, Brazil, April, H. H. Smith, Coll. Received from Dr. S. W. Williston.

Length, 15 mm. Black; face, cheeks, and beard silvery white. Frontalia and parafrontals blackish, quite concolorous. Antennæ and arista brown. Thoracic scutum metallic black with greenish tinge, thinly silvery pollinose, more thickly so on anterior edge, humeri, and pleuræ. Scutellum and abdomen metallic brown with a hardly purplish tinge, the anal segment with a conspicuous subtriangular (from above) yellow area defined by the discal row of macrochætæ and extending under so as to narrowly surround the genital opening. A comb of median marginal thorn-like macrochætæ on ventral segments, and discal row on ventral side of anal segment. A single lateral marginal macrochæta on first and second segments, two median marginal pairs on second, a marginal row of ten on third, the discal row on anal; and only a row of weak bristles on posterior edge of anal, appearing like bristly hairs compared with the other macrochætæ. Legs brown or blackish; claws and pulvilli rufous yellow, tips black. Wings entirely and evenly infuscate, tegulæ decidedly smoky.

Type.—Cat. No. 11,806, U. S. N. M.

XANTHOZONA, gen. nov.

This genus is proposed for *Tachina melanopyga* Wiedemann. Two female specimens in U. S. N. M., Campinas, Brazil (A. Hempel), and Sao Paulo, Brazil (Ad. Lutz), labeled "parasitic on *Brassolis astyra.*"

The ventral plates (female) only narrowly showing, overlapped by edges of corresponding dorsal plates, exposed portion being wider behind and narrowed anteriorly owing to the posteriorly rounded-off shape of edges of dorsal plates overlapping them, the posterior ones showing more widely than anterior ones, all widening successively from anterior to anal segments.

Family MUSCIDÆ

Subfamily CALLIPHORINÆ

Genus Calliphora Robineau-Desvoidy

Girschner and Hough have paved the way for a clearer understanding of *Calliphora* and its allies, and the genera as established by them are accepted in this paper, with the addition of two new ones.

Calliphora texensis, sp. nov.

Two males, three females, Paris, Texas. A. A. Girault, Coll.

Length, 9 to 11 mm. Differs from *C. coloradensis* Hough in the third posterior intra-alar bristle being absent and without a trace. The male front at vertex is about one-fifth of head width, and narrows very noticeably in front of vertex in an even curve, widening at same curve on anterior portion. The male parafrontals and parafacials are conspicuously pale brassy. The female parafrontals are obscure brownish, the parafacials light russet and unicolorous with facialia and facial plate, which are also this color in male. In one female the anterior reddish portion of buccæ (hairy part of cheeks) looks almost black in some lights, but the reddish tinge can be distinctly seen, and the specimen should be included with this species. The color of abdomen varies from metallic green to purplish blue.

Type.—Cat. No. 10,883, U. S. N. M.

Calliphora rubrifrons, sp. nov.

Two females, one male, Stickeen River, British Columbia, H. F. Wickham, Coll.; two females, one male, Kaslo, British Columbia, H. G. Dyar, Coll.

Length of female, 9.5 to 12.5 mm.; of male, 8.5 to 9.5 mm. Buccæ black, beard black. The two Stickeen River females and one of those from Kaslo, being the three largest specimens, show the buccæ with a good reddish tinge on anterior half, the two males and the other Kaslo female not. Third posterior intra-alar bristle absent. Frontalia bright orange red on anterior portion, in the Stickeen River male more of a yellowish red, in the Kaslo male a brownish yellow. Parafacials, facialia, epistoma, palpi, and apex of second antennal joint with base of third joint nearly the same color as the frontalia anteriorly, but sometimes a lighter shade of same color. Female front over one-third of head width, male front about one-twentieth of head width. Thorax faintly silvery white dusted, most thickly so on front border. Abdomen metallic green to blue, distinctly silvery pollinose in certain lights. Wings clear, with more or less distinct flecks of black on humeral, small, and basal cross-veins, origin of third vein, and apex of auxiliary. Alulæ well tinged with smoky, appearing quite black if resting against thorax or base of wing, tegulæ blackish with narrow white margins.

Type.—Cat. No. 10,884, U. S. N. M. (Stickeen River, British Columbia).

Calliphora popoffana, sp. nov.

One female, Popoff Island, Alaska, July 16, 1899. Harriman Expedition. T. Kincaid, Coll.

Length, 10.5 mm. Buccæ black, beard black. Front and face black, with a faint silvery white pollen distinctly to be seen in certain lights, even on facial plate, and especially on the broad frontalia and on the parafacials. Palpi light reddish yellow, facialia and epistoma darker reddish yellow, second antennal joint reddish, rest of antennæ black. Front distinctly more than one-third head width. No trace of third posterior intra-alar bristle. Wings quite clear, even at base, tegulæ white. Abdomen metallic green. Legs black. The plumosity of the arista is much shorter than in the other species.

Type.—Cat. No. 10,885, U. S. N. M.

A male from Bear Lake, British Columbia, 7,000 feet, R. P. Currie, Coll., measures 7 mm., and may be this species. The front is about one-eighth head width. The parafacials and narrow parafrontals are strongly silvery white; also facial plate. The frontalia are brownish. Tegulæ blackish. Wings with two smoky streaks on costal half. Abdomen metallic blue, silvery white dusted. The antennæ are paler on basal half of third joint. Otherwise it agrees with the female just described. The plumosity of the arista is quite

normal, and this, taken with the blackish tegulæ and wing streaks, would point to it as a distinct form.

Calliphora irazuana, sp. nov.

One female, Irazu, Costa Rica, Schild and Burgdorf.

Length, 11.5 mm. Buccæ black, beard black. Third posterior intra-alar bristle wholly absent. Parafrontals black, with a soft brassy brown pollen on front half. Parafacials dark dragon's-blood red, facial plate blackish. Palpi reddish yellow, antennæ blackish, inner basal portions of third joint paler. Front equilateral, one-third head width. Thorax and scutellum black, faintly silvery on front and lateral edges. Tegulæ and wing bases blackish. Abdomen purplish blue. Legs wholly soft black, as are also the pleuræ, with hardly a trace of silvery.

Type.—Cat. No. 10,886, U. S. N. M.

EUCALLIPHORA, gen. nov.

Proposed for *Calliphora latifrons* Hough. Differs from *Calliphora* in possessing two strong pairs of ocellar bristles. This is a character of considerable importance in the Muscoidea, especially in the higher groups, and may well form a generic distinction here.

Eucalliphora latifrons Hough.—A large series of this interesting species, consisting of some sixty specimens, was brought from Kaslo, British Columbia, by Messrs. Dyar, Caudell, and Currie. The character of the second pair of ocellar bristles is constant in all.

There are also two females in the U. S. N. M., collected by H. S. Barber, Las Vegas Hot Springs, N. Mex., and Fieldbrook, Cal., which both belong to this genus and are apparently this species.

Genus Lucilia Robineau-Desvoidy

There are several species of this genus, notably *sericata* (Meigen) Hough and *sylvarum* (Meigen) Hough, which have a well-developed second pair of ocellar bristles. The latter are remarkably strongly developed in these two species, and were it not for the presence of certain intermediate forms, like *pilatei* Hough, and especially *oculata*, n. sp., they would constitute a well-marked new genus separable on this character. But in *pilatei* the second pair in the male is hardly to be differentiated in strength from some of the other pairs of divergent ocellar hairs, and in *oculata* the male shows no second pair, though the females of both possess the character quite distinctly. As genera are mere matters of convenience, and these forms do not otherwise differ in points of generic value, the charac-

ter in question can not be used here for the erection of a separate genus. This is only another illustration of the fact that a character of value for the separation of certain forms may be valueless for this purpose in certain other forms closely allied to the first. In all the species there are several widely divergent pairs of weak ocellar hairs behind the first or regular pair of ocellar bristles. In the forms which have a second pair of ocellar bristles well developed, this second pair is always inserted just behind the two posterior ocelli, and not inside the ocellar triangle. In other words, it is only the pair of hairs inserted just behind the two posterior ocelli that ever develop into a second strong pair of bristles. *L. cæsar* is typical of the forms in which this pair of hairs is not developed in either sex, but it is to be noted that some of the bristly hairs within the ocellar triangle in this species often seem strong enough to be considered additional pairs of ocellar bristles.

Fourteen species of *Lucilia* are here recognized, occurring in material in U. S. N. M. They may be separated as follows:

Table of Lucilia spp.

1. Only one postacrostichal bristle present.....*morrilli*, sp. nov.
   Two postacrostichal bristles present..... 7
   Three postacrostichal bristles present..... 2
2. Palpi more or less yellowish..... 4
   Palpi wholly black or blackish..... 3
3. Second pair of ocellar bristles developed.....*sylvarum*
   Second pair not developed.....*nigripalpis*, sp. nov.
4. Palpi wholly yellow..... 5
   Palpi infuscate at tip..... 6
5. Second pair ocellar bristles developed.....*sericata*
   Second pair not developed.....*angustifrons*, sp. nov.
6. Second pair developed.....*giraulti*, sp. nov.
   Second pair not developed.....*barberi*, sp. nov.
7. Abdomen unicolorous..... 8
   Basal segment of abdomen black or blackish..... 9
8. Second pair developed.....*unicolor*, sp. nov.
   Second pair not developed.....*cæsar*
9. Whole body purplish, except basal abdominal segment, second abdominal segment with a marginal row of bristles.....*purpurea*, sp. nov.
   Whole body not so..... 10
10. Second and third abdominal segments with a purplish or blackish margin..... 11
    Second and third segments unicolorous..... 12
11. Buccæ yellow wholly or partly.....*pilatei*
    Buccæ black, not at all yellow.....*australis*, sp. nov.
12. Eyes normal, face black.....*infuscata*, sp. nov.
    Eyes flattened anteriorly with large front aspect, face brownish yellow. *oculata*, sp. nov.

Lucilia morrilli, sp. nov.

Six males, nine females, Texas, New Mexico, Arizona, California, British Columbia, and Missouri.

Only one postacrostichal bristle. Male front one-seventh of head width, female front fully two-fifths of head width. Whole of abdomen, thorax, parafrontals, and cheeks, including occiput, strongly metallic green. Face and frontalia black, silvery. Palpi black. Tegulæ white. No macrochætæ on abdomen. No second pair of ocellar bristles.

Type.—Cat. No. 10,887, U. S. N. M. (Victoria, Texas—Morrill).

Lucilia sylvarum (Meigen) Hough.—One female, Prussia.

Three postacrostichal bristles. Male front very narrow, female front one-third head width. Palpi black. Two stout marginal macrochætæ on second abdominal segment. Second pair of ocellar bristles well developed.

Lucilia nigripalpis, sp. nov.

Two females, Cuyahoga County, Ohio. W. V. Warner.

Differs from *infuscata* only by having three postacrostichal bristles; palpi quite blackish, faintly paler basally; antennæ, face, buccæ, and front all more deeply black; tegulæ white. A trace of purplish on hind margins of second and third abdominal segments, especially on second. Second segment with a marginal row of weak macrochætæ. No second pair of ocellar bristles.

Type.—Cat. No. 10,888, U. S. N. M.

Lucilia sericata (Meigen) Hough.—Two males, six females, eastern United States, Alabama, Hidalgo (Mexico), Kadiak Island (Alaska).

Three postacrostichal bristles. Male front one-eighth to one-sixth head width, female front two-fifths head width. Palpi yellow. Abdomen unicolorous, tegulæ white. A strong second pair of ocellar bristles in both sexes.

Lucilia angustifrons, sp. nov.

One male, England (Brunetti).

Same as *cæsar*, but having three postacrostichal bristles. Front linear, eyes almost contiguous. Palpi yellow. A female, having front one-third head width, from Kaslo, British Columbia (Caudell), seems to be this form. No second pair of ocellar bristles.

Type.—Cat. No. 10,889, U. S. N. M.

Lucilia girault, sp. nov.

One male, Paris, Texas. A. A. Girault, Coll.

Three postacrostichal bristles. Male front one-eighth head width. Abdomen like *pilatci*, but no dark hind margins to second and third segments. Buccæ and whole face and front black, palpi yellowish but infuscate apically. Tegulæ nearly white. No strong macrochætæ except marginal row on third segment. Of the three postacrostichal bristles, the front one is well behind the front postsutural bristle, and the middle one is a little behind the middle postsutural. A second pair of ocellar bristles present.

Type.—Cat. No. 10,890, U. S. N. M.

Lucilia barberi, sp. nov.

Six males, Arizona (H. S. Barber), California (Coquillett), Guanajuato (Mexico), Alabama, West Virginia, and District of Columbia.

Three postacrostichal bristles. Differs from *girault* practically only in the second pair of ocellar bristles not being developed appreciably longer than the ocellar hairs, and the three postacrostichal bristles being even with the three postsutural bristles. Palpi yellowish, infuscate at tip. Buccæ, face, and front blackish, facialia reddish, epistoma yellowish. Tegulæ white. Basal abdominal segment black. An even row of ten marginal macrochætæ on third segment above, and three on each side below. No dark margins to second and third segments. Male front one-eighth head width.

Type.—Cat. No. 10,891, U. S. N. M. (Williams, Arizona).

Lucilia unicolor, sp. nov.

Five females, New Mexico, Mexico, and British Columbia.

This form corresponds to *cæsar*, differing therefrom in having the second pair of ocellar bristles distinctly developed. Two postacrostichal bristles. Female front a little less than one-third head width. Palpi yellow. Abdomen unicolorous. Tegulæ white.

Type.—Cat. No. 10,892, U. S. N. M. (Mesilla, N. Mex.—Cockerell).

Lucilia cæsar Linné.—Numerous specimens of both sexes, England, eastern United States, and British Columbia.

Two postacrostichal bristles. Male front linear, female front one-third head width. Abdomen unicolorous. Tegulæ white. Palpi yellow. Second pair of ocellar bristles not developed, or only very weakly so.

Lucilia purpurea, sp. nov.

One female, Fort Wrangel, Alaska, Wickham; one male, Kadiak, Alaska, Kincaid (Harriman Expedition).

Two postacrostichal bristles. Male front one-twelfth of head width, female front one-third head width. Palpi yellow. Basal abdominal segment blackish. Whole body purplish, strongly violet tinged, especially in the female. Tegulæ of female white, of male smoky. Buccæ, face, and front blackish, epistoma paler. Second abdominal segment with a marginal row of bristles or macrochætæ, but not as strong as those of marginal row of third segment. No second pair of ocellar bristles.

Type.—Cat. No. 10,893, U. S. N. M. (Fort Wrangel, Alaska).

Lucilia pilatei Hough.—Two males, two females, Florida, Porto Rico, Guatemala, and Peru. A neotropical species.

Two postacrostichal bristles. Male front one-eighth head width, female front one-fourth head width. Palpi yellow. Abdomen as in *australis,* only the purplish or black margins of segments often more marked. Buccæ of female yellow, of male gray with yellow anteriorly. A second pair of ocellar bristles in female more or less hair-like, but distinctly larger and thicker than the other hairs of ocellar area; in male very weak, not appreciably stronger than the other ocellar hairs.

The purplish black hind margins of second and third abdominal segments are characteristic of this and one or two other species, added to which is the blackish basal segment. The latter in some females shows a little metallic green on sides, but the general opaque black of its dorsum is the distinguishing character. Also the hind margins of second and third segments are only faintly purplish in some specimens, but distinct traces are present in all. The white tegulæ are characteristic of this species, and serve to separate the males of *pilatei* from the males of similar species having a black basal abdominal segment.

Lucilia australis, sp. nov.

Two females, Tennessee, Texas (Girault); one male, Popoff Island, Alaska (Kincaid, Harriman Expedition). The male is provisionally referred here.

Two postacrostichal bristles. Male front one-twelfth head width, female front one-fourth head width. Palpi infuscate yellow. Basal abdominal segment black above, conspicuously so, the purplish or darker hind margins of second and third segments also showing.

Distinguished from *pilatei* by the buccæ being black, silvery gray pollinose, not at all yellow. Second pair of ocellar bristles present in female, not developed in male.

Type.—Cat. No. 10,894, U. S. N. M. (Tennessee, Coll. Riley).

Lucilia infuscata, sp. nov.

Nine males, six females, Massachusetts, New Hampshire, Ohio, Missouri, New Mexico, Arizona, and British Columbia.

Two postacrostichal bristles. Male front very narrow, female front two-sevenths of head width. Basal abdominal segment black or purplish black in female, but no dark margins to second and third segments. Male tegulæ infuscate, female tegulæ more nearly white. Palpi yellowish. Buccæ, face, and front black. No second pair of ocellar bristles. The female can be told from female *cæsar* only by narrower front and darker basal segment.

Type.—Cat. No. 10,895, U. S. N. M. (Organ Mountains, New Mex., on flowers of *Lippia wrightii*—Townsend).

Lucilia oculata, sp. nov.

Six males, two females, District of Columbia, Kentucky, North Carolina, Mississippi, Kansas, and Cuba.

Two postacrostichal bristles. Male front linear, eyes nearly contiguous and approximated more anteriorly than in *infuscata,* with larger front aspect than in that species. Female front one-fourth of head width. Tegulæ nearly white, only very faintly tinged with yellowish. Antennæ and face brownish yellow instead of black. Basal abdominal segment quite black. Male shows no second pair of ocellar bristles, but female has them developed. Otherwise like *infuscata.*

Type.—Cat. No. 10,896, U. S. N. M. (Cumberland Gap, Ky.—G. Dimmock).

PROTOPHORMIA, gen. nov.

Hough characterizes *Phormia* as having the mesonotum "somewhat flattened caudad the transverse suture," as in *Protocalliphora.* This is a mistake. *P. regina,* which is the type of *Phormia,* does not show this flattening at all. The species *terræ-novæ* is not a *Phormia,* but differs in possessing the same conspicuous flattening seen in *Protocalliphora.* The new genus *Protophormia* is herewith proposed for its reception. The characters given by Hough for *Phormia* (Ent. News, x, p. 66) all apply to *P. regina* except the character of the flattened thorax. This flattening carries with it a more or less complete abortion of the postacrostichal bristles except the hindmost one of each row.

Subfamily Muscinæ

Tribe *Mesembrinini*

Two new genera are here proposed in this tribe, and the genus *Mesembrina* is restricted as follows:

Genus Mesembrina Meigen

Type of the genus, *M. mystacea* Linné. Densely pilose flies. Subalar pile present, representing the pteropleural bristles. Sternopleural bristles 1. 0. 1. Fourth longitudinal vein very deeply and roundly bent far before reaching margin of wing, which latter point is same distance behind that termination of third vein is before extreme wing-tip, the portion between bend and margin being fully three times that in margin. Apical cell much narrowed, its mouth width not over one-third its greatest width. Small crossvein distinctly before middle of discal cell.

METAMESEMBRINA, gen. nov.

Proposed for *Mes. meridiana* Linné. Hairy, not pilose, flies. Subalar bristly hairs present, representing pteropleural bristles. Sternopleural bristles 0. 0. 1. Fourth longitudinal vein reaching front margin of wing before tip, arcuate at bend.

EUMESEMBRINA, gen. nov.

Proposed for *Mes. latreillei* Robineau-Desvoidy. Hairy, not pilose, flies. Pteropleural hairs present. Sternopleural bristles 1. 0. 2. Fourth vein very slightly and roundly bent a little before reaching hind margin of wing, the portion between bend and margin about equal to the portion in margin. Apical cell very widely open, its mouth width equal to about three-fourths its greatest width. Small crossvein distinctly beyond middle of discal cell.

Eumesembrina latreillei Robineau-Desvoidy.—Two specimens, White Mountains, New Hampshire, Morrison; one, Colorado; two, Washington State; two, Kaslo Creek, British Columbia, June 18, R. P. Currie and A. N. Caudell. All show face and parafacials silvery white from above. Antennæ reddish yellow to brownish. Palpi reddish or brownish red.

Eumesembrina alascensis, sp. nov.

Four specimens.—Kukak Bay, July 4; Kadiak, July 20; Saldovia, July 21; Juneau, July 25. All Alaska. Collected by T. Kincaid (Harriman Expedition).

These specimens are more hairy, more bristly on thorax and scutellum, and on peristomalia. They also usually show less silvery on face and parafacials, and the antennæ are quite black. Palpi black. The Kukak Bay and Kadiak specimens show no silvery on the soft blackish facial plate, and the parafacials are tan-colored without a sign of silvery. The other two specimens show some silvery, not only on facial plate, but also on the more or less tan-colored parafacials.

Type.—Cat. No. 10,897, U. S. N. M. (Kukak Bay, Alaska).

The two Washington State and two British Columbia specimens mentioned under *latreillei* are certainly distinctly to be referred to that species, which is the eastern form, and which is thus seen to range from the Atlantic to the Pacific. *Eumes. alascensis* doubtless represents rather a boreal form.

Family PHASIIDÆ

Tribe ANUROGYNINI

Genus Hyalomyodes Townsend

Hyalomyodes weedii Townsend.—This species seems distinct from *Hyalomyia trianguliferа* H. Loew, but needs further study. The writer has examined the type of the latter in Cambridge.

Hyalomyodes trianguliferа H. Loew.—Ten specimens from the White Mountains of New Hampshire, one from Massachusetts, and one from Maryland agree perfectly with the description of *H. weedii* Townsend. They also agree with Loew's description, but an examination of the type in Cambridge seemed to indicate differences. The front, frontalia, and parafacials are wider in the male, and the claws are elongate. Humeri grayish.

Hyalomyodes robusta, sp. nov.

Two males, North Fork of Rio Ruidoso, White Mountains, New Mexico, about 8,200 feet, on flowers of *Solidago trinervata*, August 17, Townsend.

Differs from *trianguliferа* in being more robust, and first abdominal segment with pollinose fascia same as second and third. The thorax is also more conspicuously pollinose. Hind crossvein quite straight, in one specimen much nearer to small crossvein than to bend of fourth vein, in both distinctly nearer. The pollen of median portion of thorax and abdomen has a brassy tinge, that on sides being silvery-whitish. Macrochætæ not so well developed, considerably weaker. Parafacials wide in both specimens. Length, 5 mm.

Type.—Cat. No. 11,651, U. S. N. M.

Hyalomyodes californica, sp. nov.

Two specimens, male and female, Santa Clara county, California (C. F. Baker).

Almost like *triangulifera,* but distinguished by humeri being more golden, extending back in a lateral stripe.

Type.—Cat. No. 11,652, U. S. N. M. (female).

Tribe CLISTOMORPHINI

Genus Clistomorpha Townsend

A synonym of *Clistomorpha* is *Clytiomyia* Coquillett (non Róndani). This genus is very distinct from *Clytiomyia* Róndani (*Clytia* Robineau-Desvoidy). *C. hyalomoides* Townsend is distinct from *C. didyma* H. Loew (described as *Xysta*). The writer recognized the fact of the two being congeneric nearly fifteen years ago, from drawings of the type furnished by Mr. Samuel Henshaw, and has since examined the type of *didyma* in the Cambridge Museum.

Clistomorpha didyma H. Loew.—The apical cell is very short-petiolate, and the hind crossvein is curved and in middle between the small crossvein and bend of fourth vein.

Illinois.

Clistomorpha hyalomoides Townsend.—The apical cell is practically closed in the margin. The hind crossvein is in middle and straight.

New York.

Clistomorpha atrata Coquillett.—The apical cell is closed in margin, or almost narrowly open. The hind crossvein is sinuate and nearer to bend of fourth vein than to small crossvein.

Idaho, Washington State.

Genus Himantostoma H. Loew

Himantostoma sugens H. Loew.—This genus belongs in this tribe, as shown by an examination of the type in Cambridge.

Subfamily PHASIINÆ

Tribe *Alophorini*

The following table will serve to separate the genera of this tribe:

1. Front above antennæ thickly beset on both sides with small bristles..... 2
   Front above antennæ naked, only one row of frontal bristles on each side 3

2. First longitudinal vein elongate, small crossvein placed opposite end of auxiliary vein, fourth vein very obtusely bowed, apical cell sharp-angled at extremity and short petiolate.....*Alophora*
   First longitudinal vein not elongate, small crossvein placed opposite end of same, fourth vein roundly bowed, apical cell usually long petiolate. *Hyalomyia*
3. Second longitudinal vein ending opposite the junction of third and fourth veins, wings of male usually much widened.....*Phorantha*
   Second longitudinal vein elongated beyond junction of third and fourth veins, wings of male not widened, apical cell very long petiolate, fourth vein roundly bowed.....*Paralophora*

Genus Alophora Robineau-Desvoidy

Alophora sp.—A large species from Texas. The female shows ventral plates overlapped by dorsal plates. The male shows ventral plates free, at least those of second, third, and fourth segments, with membrane widely exposed on each side.

Genus Phorantha Rondani

The genus *Alophora* has the front prominent in profile above insertion of antennæ. *Phorantha* has front flattened, and with greater slope so as to present in profile an almost perfectly straight line from insertion of antennæ to vertex.

Probably all, or nearly all, of the various forms of the *Alophorini* that have been described are distinct and entitled to recognition. We know practically nothing of the early stages or the mating of the adults, and it is premature to attempt to outline the synonymy in the absence of such knowledge.

Tribe *Cistogasterini*

Genus Gymnoclytia Brauer and von Bergenstamm

The genus *Gymnoclytia* is distinct from *Cistogaster*. The peduncle of apical cell is continuous with fourth vein in *Gymnoclytia*, but with third vein in *Cistogaster*.

Gymnoclytia has ventral membrane (female) very widely visible and ventral plates free, much as in *Gymnosoma*.

Gymnoclytia occidua Walker.—Male.—Thorax brassy or golden pollinose, with two straight narrow median vittæ extending from front margin to behind suture, and two irregularly widened vittæ obsolete before and interrupted at suture. Abdomen more or less ferruginous, sometimes entirely so, but usually with a longitudinal fuscous stripe in connection with a median pollinose vitta, and more or less brown on third and fourth segments with grayish pollen.

Female.—Thorax silvery-whitish pollinose, with two heavy shining black vittæ, sides of front silvery-white pollinose becoming blackish posteriorly, abdomen black with silvery pollen in median vitta and two or three fasciæ.

New Hampshire, District of Columbia, North Carolina, Georgia, and Texas.

Gymnoclytia occidentale, sp. nov.

Male.—Thorax deep brassy to old-gold pollinose, with same vittæ as in *occidua*. Abdomen like *occidua* except that pollen is golden, the ground color bright ferruginous and markings varying from none to the usual ones strongly marked.

Female.—Colored almost like the male of *occidua*. Thorax brassy pollinose, with two broad heavy brown vittæ extending from anterior margin almost to scutellum, and two very narrow linear vittæ between them. Abdomen the same as in the male, pollen being golden, but no specimens occur with abdomen entirely ferruginous, the usual markings being pronounced in all.

Colorado and New Mexico to California.

Type.—Cat. No. 11,653, U. S. N. M. (female, Beulah, New Mexico, Cockerell, July, 1902).

Gymnoclytia immaculata Macquart.—Male.—Fuscous stripe of abdomen wanting, median pollinose vitta more or less distinct. Abdomen yellowish, the third and fourth segments with lateral pollinose reflections.

Female.—Thorax shining black, without pollinose markings except the humeri, sides of front shining black, abdomen without distinct pollinose vitta or crossbands, apical cell quite long petiolate (as in the males of the preceding species). Abdomen distinctly red on the sides, especially anteriorly.

This form and *Gym. occidua* Walker are distinct. See Robertson's and the writer's notes in T. A. E. S., XXII (1895), pp. 66-67, and Ann. and Mag. N. H., XX, pp. 283-284.

Gymnoclytia ferruginosa van der Wulp.—Male.—Thorax deep golden or old-gold pollinose, with the same stripes as *occidua* more or less apparent. Abdomen ferruginous, fuscous stripe hardly apparent, but pollinose stripe present, and third and fourth segments more or less pollinose, pollen being golden.

Female.—Sides of front faintly golden-silvery, thorax shining black, with three faintly golden pollinose vittæ. Abdomen shining black, with median pollinose vitta and third and fourth segments

more or less pollinose, pollen being grayish with a hardly brassy tinge.

Veracruz and Nicaragua.

Tribe *Xanthomelanodini*

Genus Xanthomelanodes Townsend

Syn. *Xanthomelana* VAN DER WULP preocc.

The name used by van der Wulp was applied by Bonaparte to a genus of birds in 1850.

Xanthomelanodes arcuata Say.—Only a single vibrissa on each side.

Male.—Front and face deeply golden, especially parafrontals. Abdomen usually with a well-defined black median vitta, last segment and last half of penultimate segment black.

Female.—Front and face silvery-white. Abdomen all black except yellow on sides of second and third segments, only covering anterior half of third segment, but some specimens show less black.

New Hampshire, Kansas, Veracruz.

Xanthomelanodes atripennis Say.—One vibrissa on each side.

Male.—Front golden. Abdomen golden, with only some brownish shading for the median vitta. Wings quite smoky on inner border.

Dixie Landing, Virginia (Townsend).

Xanthomelanodes californica, sp. nov.

Two vibrissæ on each side.

Male.—Front and face almost silvery, with only a faint suggestion of golden, in some specimens quite silvery-white. Abdomen ferruginous, more or less dusky, the brown markings not well defined as a rule, consisting of a broken median stripe and the usual dark markings of last two segments.

Female.—Face and parafrontals silvery-white. Abdomen nearly same as in *arcuata*.

Colorado, Nevada, California.

Type.—Cat. No. 11,654, U. S. N. M. (male, Los Angeles county, California, Coquillett).

Tribe *Trichopodini*

The following is a table of the genera of this tribe:

1. Hind tibiæ without flattened cilia, with only a row of short appressed bristles and one or two stronger bristles among them..... 2
   Hind tibiæ ciliate with the usual flattened cilia..... 3

2. Wings infuscate on less than costal half, gray or hyaline on other portion ..... *Acaulona*
   Wings almost wholly infuscate, but much more faintly so on inner half, the infuscation rather graduated into almost hyaline on inner border. *Euacaulona*
3. Wings wholly infuscate..... 4
   Wings more or less widely hyaline on inner border, the hyaline abruptly defined 6
4. Hind femora ciliate with closely appressed flattened bristles on one or opposite edges..... *Galactomyia* (males)
   Hind femora not ciliate at all..... 5
5. Apical cell open..... *Homogenia*
   Apical cell closed..... *Euomogenia*
6. Wings hyaline on more than inner half, abdomen subcylindrical in both sexes and largely translucent in both..... *Pennapoda*
   Wings with inner hyaline border almost as wide as the infuscate costal half, abdomen subcylindric in both sexes and wholly opaque in both ..... *Polistomyia*
   Wings with hyaline border about one-third width of wing... *Eutrichopoda*
   Wings with hyaline border very narrow, not over one-fifth of wing width 7
7. Wholly black form..... *Galactomyia lanipes* (female)
   Partly reddish forms..... 8
8. Hind femora ciliate distally on inner edge with closely placed bristles; abdomen cylindrical, reddish or orange with apical half or at least anal segment black..... *Galactomyia radiata* (female)
   Hind femora not at all ciliate, smaller forms with abdomen more or less flattened and almost wholly light reddish or yellowish in both sexes ..... *Trichopoda*

Genus Acaulona van der Wulp

Acaulona costata van der Wulp.—One female, Tehuantepec, Sumichrast; one male, Frontera, Tabasco, February 9, Townsend. The Tehuantepec specimen is of much lighter coloration than Veracruz and Tabasco specimens. Tegulæ are yellowish in this genus.

Acaulona tehuantepeca, sp. nov.

One female, Tehuantepec, Sumichrast. Labeled "17. *Homogenia* sp." Length, 7 mm.

Differs from *A. costata* in having the apical cell subfuscous, the abdomen with a median blackish vitta and more or less wholly blackish on apical half, and the hind tibiæ weakly subciliate in a row of short, closely approximated bristles. The form is intermediate between *Acaulona, Euacaulona,* and *Homogenia,* but nearest to *Acaulona.*

Type.—Cat. No. 10,878, U. S. N. M.

EUACAULONA, gen. nov.

Differs from *Acaulona* in having somewhat more than costal half of wings pronounced fuscous, the rest of wing not being clearly hyaline, but more or less so, the fuscous rather gradually fading out on inner border. There are also two distinct grayish or milky vittæ on wings (male), one between the first and second veins, one between the third and fourth veins, besides a short one in front of the auxiliary vein. Tegulæ brownish or fuscous, paler in middle.

The front at vertex is nearly as wide as either eye, and gradually widens anteriorly to almost width of both eyes as viewed from in front, the face in same view being fully three-fifths width of head. The frontalia are very wide, of equal width, as wide as front at vertex.

Apical cell closed in margin. Hind tibiæ not ciliate, bearing only a row of short appressed bristles with one or two stronger bristles among them. Claws of male elongate. Abdomen of male flattened. Type, the following species:

Euacaulona sumichrasti, sp. nov.

One male, Tehuantepec, Sumichrast. Length, 9.5 mm.

Blackish, the venter and basal half of femora, also base of hind tibiæ, yellow; the usual golden yellow markings on prothorax along and in front of suture, also extending posteriorly on the sides and along the scutellar suture. Frontalia black, the narrow parafrontals and all of face and cheeks golden yellow. Thorax, scutellum, and abdomen above brown or blackish.

Type.—Cat. No. 10,879, U. S. N. M.

Genus Homogenia van der Wulp

Syn. *Trichopododes* Townsend.

This genus has the wings wholly infuscate, those of male with considerable luteous and more or less of a milky bloom (*latipennis* and *nigroscutellata*); female not known. Hind femora not ciliate at all, hind tibiæ only weakly ciliate. Apical cell open. Tegulæ yellowish. Type, *H. latipennis* van der Wulp. The species *rufipes* van der Wulp evidently does not belong with the other two described under the genus, and will have to be separated generically.

H. latipennis van der Wulp.—One male, Tehuantepec, Sumichrast. Labeled "*Trichopoda luteipennis* Wd." This specimen agrees with van der Wulp's description except that there is no trace of a black

median abdominal vitta, and abdomen is only a little dusky on anal segment as seen through the golden silvery bloom.

H. nigroscutellata van der Wulp.—One male, Cacao, Trece Aguas, Alta Vera Paz, Guatemala, April 18. Barber and Schwarz, collectors. This specimen agrees well with van der Wulp's description except that abdomen is widely blackish on median portion, with only narrow lateral borders yellow. The scutellum has golden pollen on dorsum.

EUOMOGENIA, gen. nov.

Differs from *Euacaulona* in the wings (male) being wholly infuscate, uniformly so, the same milky vittæ being present; and in the hind tibiæ being ciliate with moderately developed cilia. Front like *Homogenia,* very broad. Apical cell closed in border. Tegulæ blackish. Type, the following species:

Euomogenia lacteata, sp. nov.

One male, Frontera, Tabasco, March 3, Townsend.

Length, 9.5 mm. Blackish, the usual silvery golden markings on mesoscutum, including the sides back to scutellar suture and along latter. Scutellum somewhat silvery golden on dorsum. Abdomen wholly fuscous, with a reddish tinge showing through the fuscous. The broad frontalia velvety blackish, narrow parafrontals and whole of face and cheeks golden. Antennæ brownish. Palpi yellow, dark on tips. Basal half of femora yellow, least extensive on front pair, most extensive on hind pair, base of hind tibiæ yellow, rest of legs black, claws and pulvilli yellow, tips of claws black. Wings blackish, with the milky or golden grayish vittæ described for *Euacaulona.*

Type.—Cat. No. 10,880, U. S. N. M.

Genus Pennapoda Townsend

This was described as a subgenus, in Ann. and Mag. N. H., xx, p. 282. It is here raised to generic rank. Type, *Trich. phasiana* Townsend, loc. cit., male and female. The species *Phania simillima* Wiedemann and *Trich. subalipes* Townsend may belong to this genus. There are no specimens in U. S. N. M. for examination.

POLISTOMYIA, gen. nov.

This genus is proposed for the *Trich. trifasciata* H. Loew group. The abdomen is subcylindrical in both sexes, slightly more widened on apical portion in male. Apical cell closed and quite long petiolate. Wings with but little more than costal half colored, the inner por-

tion clear. Abdomen in both sexes wholly opaque, brown or black in ground color, more or less golden pollinose, never with translucent portions. Scutellum always yellow. Both sexes have yellow on the wings. Hind femora not at all ciliate. Tegulæ white or yellowish. Parasitic in Acridiidæ (*Dissosteira*), so far as known.

The male has frontalia suddenly narrowed, presenting a curved outline on each side, closely followed by the frontal row of bristles, the width on posterior half being only one-half the width at base of antennæ. Claws strongly elongate in male, hypopygium exserted and tucked up under the end of abdomen.

The female has the frontalia but little narrowed behind, being evenly narrowed from anterior to posterior end, the sides and frontal row of bristles being quite straight. Claws somewhat elongate in female, even slightly longer than last tarsal joint, but very markedly less elongate than in male. Anal end of abdomen truncate, the ovipositor more or less withdrawn within anal segments, its apex usually showing.

Type, *T. trifasciata* H. Loew.

The other species belonging here are *histrio* Walker, *indivisa* Townsend, probably *umbra* Walker and *plumipes* J. C. Fabricius; also the following new species. The writer formerly suggested these (except *plumipes*) as varieties of one species, but now considers them valid forms differing in marked characters. They form a group apart by themselves, distinctly contrasted with the other members of the Trichopodini.

Polistomyia subdivisa, sp. nov.

One female, St. Helena, Napa County, Cal., bred by A. Koebele from a locust (*Dissosteira venusta* Stål); issued August 30, 1887.

Length, 6.33 mm. Segments three and four of abdomen golden pollinose, segment three with a median vitta and median hind margin brown, segment four wholly pollinose with a trace of vitta, segment two with a large yellow spot on each side, and segment one with a similar smaller spot on each side.

Type.—Cat. No. 10,881, U. S. N. M.

Two female specimens from Las Cruces, New Mexico, collected by the writer, August 25 and September 2, on flowers of *Solidago arizonica,* are larger, measuring 7 to 8 mm., show no median vitta on third and fourth segments, and only a faint vitta on second segment, which bears a fascia rather than separated spots. They very likely represent another form, but more material is needed from California and New Mexico before separating them as distinct. They occupy an intermediate position between *trifasciata* and *subdivisa.*

T. plumipes (J. C. Fabricius) Wiedemann is probably a *Polistomyia,* as indicated by the yellow scutellum, broad, clear inner margin of wings, and the cylindrical abdomen. The latter is described as black, which would indicate a form without fasciæ or pollinose markings, since it is hardly possible that such could have been so far lost as to leave no trace. We thus have the following forms of this genus, to be separated as below:

Polistomyia plumipes—No pollinose fasciæ on abdomen. Continuous black surface.
histrio—Two pollinose fasciæ, interrupted.
trifasciata—Three fasciæ, broadly interrupted.
subdivisa—Four fasciæ, two broadly interrupted and two faintly so.
umbra—Continuous pollinose surface, interrupted by median vitta.
indivisa—Continuous pollinose surface.

EUTRICHOPODA, gen. nov.

Differs from *Trichopoda* in the apical cell being moderately long petiolate, and the wings with inner border broadly hyaline, the latter being nearly or about one-third of wing breadth. Hind tibiæ ciliate, hind femora without cilia. Abdomen cylindrical in female, probably flattened in male. Tegulæ pale or whitish yellow. Type, the following species:

Eutrichopoda nigra, sp. nov.

Syn. *Trich. lanipes* VAN DER WULP (non J. C. Fabricius, Wiedemann), Biol. C. A. Dipt., II, pp. 434–5.

One female, Tehuantepec, Sumichrast.

Length, 9 mm.; of wing, 8 mm. Black. Parafrontals silvery white, with only a faint tinge of golden, which tinge is lost in view from above and behind. Face wholly silvery white, including parafacials. Transverse suture of mesoscutum marked by a golden yellow linear fascia, with two golden lines running to front border of thorax, humeri broadly golden. Scutellum is of the same dull black as the abdomen, with hardly a brownish tinge. Tegulæ saturated with a faint yellow tinge. Femora almost as black as rest of legs, with a faint brownish tinge. The mesoscutum behind suture is faintly purplish or bluish shining. The wings have no yellowish tinge in the black, and the inner hyaline border is hardly one-half as wide as the black portion.

Type.—Cat. No. 10,882, U. S. N. M.

This form comes nearer agreeing with Wiedemann's description of *plumipes* than anything that has turned up since Bosc's time. It differs therefrom only as above described, and principally in the black scutellum.

Mr. van der Wulp (l. c.) has described this species from what he records as one male and four females, but says nothing as to whether the apical cell is petiolate or closed in the margin, nor does he mention the shape of the abdomen in the sexes. It seems quite certain that his specimens are this species, and it is likely that all five of them have the apical cell moderately long petiolate.

Genus Trichopoda Latreille

This genus, as here restricted, has the wings with inner margin narrowly hyaline, hind femora not ciliate at all; only male with yellow in wings, no milky radiations, apical cell very short petiolate, and tegulæ yellowish. Type, *T. pennipes* J. C. Fabricius. Parasitic in Heteroptera (*Anasa, Leptoglossus*), so far as known.

GALACTOMYIA, gen. nov.

This genus is proposed for *Trich. radiata* H. Loew. *Trich. lanipes* J. C. Fabricius (description is of female; *T. formosa* Wiedemann is the male) also belongs in this genus.

The males have the abdomen flattened; the wings infuscate to inner margin, milky radiate on a yellow or fuscous background, the milky radiations conspicuous and the yellow less pronounced. Hind femora strongly ciliate on posterior half, with flattened bristles.

The females have the abdomen cylindrical; the wings wholly black except narrow inner border, without yellow coloring, the internal border abruptly limpid. Hind femora at least short-ciliate distally, though bristles may not be flattened. *G. radiata* female has the abdomen reddish, with at most the apical half black. *G. lanipes* female is to be distinguished by its wholly black coloration, aside from the usual yellow of head, thorax, claws, and pulvilli.

It is yet uncertain what species can be referred to this genus besides *radiata* and *lanipes* (syn. *formosa* Wiedemann). As to the distinctness of these two species, Loew pointed out in his description of *radiata* (male) that it has the palpi reddish yellow, abdomen purple black, and bases of femora yellow. *G. lanipes* (male) has palpi black, abdomen obscure rufous, and femora wholly black.

The males of *Galactomyia* have ventral membrane widely visible, and all the ventral plates free. There are six abdominal segments, the first extremely short and not visible above unless abdomen is

detached, but visible on sides below; the second to sixth segments visible above, and a seventh wedged between the sides of ventral aspect of sixth, rounded in outline and forming the base of the hypopygium. This seventh segment occupies the position of a ventral plate to sixth segment and belongs to dorsum, being a dorsal plate. Five ventral plates, corresponding to first to fifth segments; first plate rather crescent shaped, much shorter (antero-posteriorly) and wider than second to fourth; second plate long-oval, third and fourth long-elliptical; fifth subquadrate and widened behind, about as wide as first. Immediately behind the fifth plate is the hypopygium, and behind latter is the seventh segment, with the lateral ends of sixth dorsal plate enclosing it on the sides.

In the female of *G. lanipes* there are seven ventral plates visible, the first three free, with ventral membrane showing on each side, fourth plate showing ventral membrane only around anterior edge and corners, fourth and fifth plates overlapped on sides by lateral edges of corresponding dorsal plates, sixth and seventh plates overlapping the corresponding dorsal plates, but sixth overlapped basally by fifth, and seventh by sixth, as is to a less extent fifth by fourth. Seven segments visible on sides and below, the first shortened, the sixth and seventh retracted with only their narrow posterior edges showing, the sixth being retracted within fifth and seventh within sixth. The seventh segment does not show at all dorsally, though the sixth shows equally widely dorsally and ventrally, and sixth and seventh show equally widely ventrally.

Galactomyia lanipes J. C. Fabricius.—As the description of *lanipes* is earlier than that of *formosa,* the species must be known by the former name. Mr. C. W. Johnson, of the Boston Society of Natural History, has a pair of this species taken in copula by Mr. P. Laurent, at Miami, Florida, March 26, 1901. This pair is mentioned in *Ent. News,* November, 1901, page 294. The capture of these specimens in copula confirms Brauer and von Bergenstamm's statement as to the sexes of this species. Both specimens have the palpi black, and the femora wholly black. The male has the abdomen obscure rufous, the female wholly black. The hind femora are conspicuously flattened-ciliate distally in the male, but only short-bristly-ciliate in the female. Apical cell closed practically in margin, tegulæ blackish. The female is the form described by Fabricius and Wiedemann as *lanipes.* The male is the form described by Wiedemann as *formosa.*

Carolina, Florida, Texas.

A small female from Costa Rica (Schild and Burgdorf) differs only in its smaller size and in having the apical cell rather more than short-petiolate. More material is needed to demonstrate its distinctness.

Galactomyia tropicalis female.—This is a large robust form, with hind femora distinctly ciliate near tip. Body wholly black. Palpi lighter colored, bases of femora reddish. Apical cell closed in margin. Male not known. Closely allied to *lanipes*. (Mexico, Costa Rica.)

Galactomyia radiata H. Loew.—Mr. C. W. Johnson has males from New Jersey, Pennsylvania, and New York. He also has a female specimen collected by him at Delaware Water Gap, New Jersey, July 10, 1898, which is doubtless the female of this species. It has the palpi yellow and bases of femora yellow. The hind femora are short-bristly-ciliate distally. The abdomen is reddish yellow, except anal segment, which is wholly shining black including narrow posterior border of preanal segment. A female specimen in the U. S. N. M., and others that the writer has collected in the District of Columbia, agree with this specimen in Mr. Johnson's collection and are no doubt females of *radiata*.

The writer wishes to especially thank Mr. Johnson for kindly placing his private collection at his disposal, and for many other favors.

Subfamily AMENIINÆ

Genus Amenia Robineau-Desvoidy

Amenia lconina J. C. Fabricius (det. Coquillett).—Australia. Both sexes show broad ventral plates overlapped by sides of dorsal plates.

Subfamily AMPHIBOLIINÆ

Genus Amphibolia Macquart

Amphibolia fulvipes Guérin (det. Coquillett).—Australian genus. This species shows in both sexes posterior triangular views of ventral plates where the rounded-off posterior corners of dorsal plates fail to cover them from view. The male shows a very large paired plate-like hypopygial process similar to that of *Rutilia*.

Subfamily RUTILIINÆ

Genus Rutilia Robineau-Desvoidy

Rutilia spp.—The species are all Australian. An examination of specimens of both sexes of several species in U. S. N. M. reveals

the following characters: Neither sex shows any ventral plates, but the males show a paired plate-like process widened on apex, occupying the position of a ventral plate to the hypopygial segment, and the long fifth or anal segment is shortened to a mere margin on venter by reason of the hypopygial cavity being pushed strongly forward. There are five abdominal segments, the first being rudimentary and greatly shortened.