

ON THE DIPTEROUS GENERA *PASSEROMYIA* AND *ORNITHOMUSCA*, WITH NOTES AND BIBLIOGRAPHY ON THE NON-PUPIPAROUS MYIODARIA PARASITIC ON BIRDS.

BY PROFESSOR M. BEZZI, Turin, Italy.

CONTENTS.

	PAGE
I. <i>Passeromyia</i> and <i>Ornithomusca</i>	29
II. <i>Protocalliphora</i>	32
III. <i>Philornis</i>	36
IV. <i>Carnus</i>	39
V. <i>Chortophila</i> and <i>Neottiophilum</i>	40
VI. Conclusions	41
VII. Bibliography	41

1. *PASSEROMYIA* AND *ORNITHOMUSCA*.

IN 1851 Macquart described two new species of the Dipterous genus *Cyrtoneura* from Tasmania, under the names of *Cyrt. longicornis* and *Cyrt. analis*, both species being very different from all others of the same genus in having hairy eyes and the first species also owing to its very long third antennal joint.

They were never recorded by subsequent writers until 1916 when Tyler Townsend describing his new Australian genus *Ornithomusca* expressed doubts as to the relationship of the above mentioned Macquart's species to his own genus (p. 145). In 1919 the late Prof. Stein in his *Catalogue of the Anthomyidae of the World* (p. 111) recorded these two species, showing however that they do not belong to the genus *Muscina* (which now comprises several species of the old genus *Cyrtoneura*) and that they cannot be placed in any known genus of Anthomyidae.

I have recently received from Mr E. W. Ferguson two specimens of a fly, one bred at Sydney, N.S.W., from a larva found in a nestling of the New Holland Honeyeater, the other caught in the open. Both these specimens I have recognised as belonging to the species *Cyrtoneura longicornis* Macquart. On the other hand, the type specimen of *Ornithomusca victoria* Tyler Townsend has been also found in nests of *Pardalotus* sp. and according to the description differ from *longicornis* only in the colour of the dust of the head, palpi, calypters, the base of the wings and the hairs of the body so that it is

very probable that the names *Cyrt. longicornis* and *Orn. victoria* are synonymous¹.

The habit of the above-named Australian fly *Cyrt. longicornis* living upon the bird nestlings recalls that of the African species belonging to the recently established genus *Passeromyia*, and the comparative study of the specimens of the Australian and African forms shows that they are very closely allied. The wide distribution of the African species indicates moreover the importance of a careful study of specimens of this species from the Oriental region. In fact, to this group belongs the species *Muscina longicornis* from Java, previously described by Stein (1909, p. 221). He noticed in this species the elongated third antennal joint, but has overlooked the hairiness of the eyes. In 1915 Dr Villeneuve described under the name *Muscina heterochaeta* a new African fly showing aberrant characters. The larvae of this fly have been previously described by Rodhain (1914, p. 214). The same year (1915) Rodhain and Villeneuve established for this African species the new genus *Passeromyia* and in 1916 appeared a very important paper by Rodhain and Bequaert on the structure and life-history of this fly (*Passeromyia heterochaeta*).

Professor Stein in a recent letter (1920) informed me that the specimens of *Passeromyia heterochaeta* sent to him by Dr Villeneuve, are identical with his paratypes of *Muscina longicornis*. I was able myself to compare the paratype of *longicornis* of my collection with Australian specimens and found that they were strictly congeneric; it is even a matter of some difficulty to distinguish the Australian species from the African. It can be concluded now that the genus *Ornithomusca* Tyler Townsend 1916 is synonymous with the genus *Passeromyia* Rodhain and Villeneuve 1915, and that the type species *heterochaeta* Villeneuve 1915 is synonymous with *longicornis* Stein 1909. As the last name is already preoccupied by Macquart's species, Villeneuve's name *heterochaeta* must be retained.

The two species of the genus *Passeromyia* can be distinguished as follows:

1 (2). The dust of the entire body, chiefly that of the abdomen of the male, is of a distinct bluish tint; third antennal joint about nine to ten times longer than the second joint, and extending almost to the mouth border; bristles of all femora less numerous, shorter and thinner; hind tibiae shortly ciliated; fourth longitudinal vein with the two portions on either side of the bend, of nearly the same length; average size 7 mm. *longicornis* Macquart.

2 (1). Dust of the body grey or slightly bluish on sides of the abdomen of the male; third antennal joint seven or eight times longer than the second

¹ Another question arises in connection with the species *Cyrtoneura analis* Macquart. This species was described from a type specimen with the second and third joint of antennae missing, and it is therefore not certain that this species belongs to the genus *Ornithomusca*. The description of the abdomen recalls the fly *Synthesiomyia nudiseta* which was originally described as *Cyrtoneura* and which is present even in Australia. The hairy eyes and the black first antennal joint of *analis* do not agree with *nudiseta*. Bigot in 1877 (p. 250) placed the species *analis* in the genus *Graphomyia* but removed it in 1887 (p. 584) to the genus *Dasyphora*.

and not reaching the border of the mouth; bristles of the underside of the femora longer, stronger and more numerous than in previous species; hind tibiae with longer ciliation; the portion of the fourth vein in front of the bend is longer than the hinder portion; average size 8–9 mm.

heterochaeta Villeneuve.

PASSEROMYIA.

Rodhain and Villeneuve, 1915, p. 592; Rodhain and Bequaert, 1916, p. 249.
Ornithomusca, Tyler Townsend, 1916, p. 45.

1. *Passeromyia longicornis* (Macquart).

Cyrtoneura longicornis, Macquart, 1851, p. 228 (255), pl. 23, fig. 8; Stein, 1919, p. 111.

Ornithomusca victoria, Tyler Townsend, 1916, p. 45.

Geographical distribution. Australia; Victoria (in nest of *Pardalotus* sp.); New South Wales, Sydney; Tasmania.

2. *Passeromyia heterochaeta* (Villeneuve).

Muscina longicornis, Stein, 1909, p. 221 (non Macquart, 1851); 1919, a, p. 111, and b, p. 68.

Larva (without a name), Rodhain, 1914, p. 214, fig. 1.

Muscina heterochaeta, Villeneuve, 1915, p. 225, fig. 1.

Passeromyia heterochaeta, Rodhain and Villeneuve, 1915, p. 593; Rodhain and Bequaert, 1916, p. 250, figs. 1–6, pl. XIX, fig. 2; Roubaud and Van Saceghem, 1916, p. 765; Roubaud, 1918, p. 428; Stein, 1919, p. 86; Patton, 1920, p. 30, pl.; Engel, 1920, p. 258.

Geographical distribution. Africa: Nyasaland, Port Herald; N.W. Rhodesia, Chilanga; Katanga, Elisabethville; British East Africa, Mombasa; Belgian Congo, Ouelle, Leopoldville, Boma, etc. I have in my collection specimens from Usambara, Nguelo.

Asia: India, Madras; Java, Batavia; China, Kamsi. I have received numerous specimens from S. China, Canton, by Prof. C. W. Howard.

Ethology. The species has been found in the nests of various species of birds of the genera *Passer*, *Hirundo*, *Cinnyris*, *Spermestes*, *Sitagra*, *Ploceus*, etc.

According to Rodhain and Bequaert the larvae of *Passeromyia* have the same habits of intermittent haematophagy as observed in the floor maggot and other African Calliphorines belonging to the genera *Auchmeromyia* and *Chaeromyia* which live upon the blood of bare-skinned mammals.

It is interesting to note that *Passeromyia*, as a bird-parasite, is widely spread over the whole tropical region of the Old World only. There are however true Calliphorine flies the larvae of which live upon birds and have the same habits of intermittent haematophagy as is the case in *Passeromyia*. These flies belong to the well-known genus *Protocalliphora* which we shall examine presently.

II. *PROTOCALLIPHORA*.

There is a marked tendency both in Europe and in N. America to place the three species of haematophagous Calliphorine flies (*caerulea* R. D., *azurea* Fall., and *metallica* Tyler Townsend) in the genus *Phormia*.

The genus *Phormia* was established by Robineau-Desvoidy in 1849 and accepted by Coquillett in 1910 (p. 589) for the species *Musca regina* Meigen 1826 which differs markedly from the above mentioned calliphorine species.

The calliphorine bird parasites cannot therefore be placed with the species *regina* Meigen in the same genus *Phormia*. As to the new generic name *Euphormia* proposed by Tyler Townsend in 1919 (p. 542) for the genotype *regina* it becomes quite superfluous, and was introduced only through misinterpretation of Villeneuve's statements (see 1911, p. 84).

The right generic name for the bird parasites is that of *Protocalliphora* Hough 1899, as it has already been used by me in the third volume of the *Katalog der palaearktischen Dipteren*, pp. 544-545. The true genus *Phormia* thus remains a monotype, with the species *regina*, while in the genus *Protophormia* Tyler Townsend 1908 must be placed the species *terraenovae* Robineau-Desvoidy 1830 (= *groenlandica* Zetterstedt 1838)¹ and *Boganidae* Erichson 1851.

There has been some discussion about the validity of the described species of *Protocalliphora*. Hendel in 1901 (p. 29) distinguished in this genus five different species, while Hough, Villeneuve and Bequaert accepted only two species which were subsequently united by Roubaud (1918) into a single species. However, Kramer (1911, p. 43) has already shown that the species can be distinguished by the structure of the male genitalia; and recently Engler (1920) clearly established the existence of the two distinct European species by the study of the structure of the larval, pupal and adult stages. In addition to the two European species Tyler Townsend (1919) has added a third North American species: *metallica*. Of the two European species *caerulea* is the commoner. It shows however in addition to sexual dichroism, some variation in the breadth of the frons in the male and in the colour of the calypters. Being often the unique species of *Protocalliphora* present in collections, it was erroneously subdivided into two or more species under the names of *sordida*, *azurea*, *braueri*, etc.; the other species *azurea* is more uniform but very often wanting in collections.

The three known species of *Protocalliphora* may be distinguished as follows:

1 (4). Parafacialia without golden spot above.

2 (3). Parafacialia (viewed obliquely from above) smooth and uniformly covered with whitish pollen or dust. The two sexes differ in colour: the male has the thorax and abdomen of metallic dark blue coloration with scarce

¹ In the *Catalogue of Palaearctic Diptera* I have erroneously reported this species under the name *caerulea* R.-D., which belongs to *Protocalliphora*.

pollen; the female showing golden-greenish thorax and metallic green abdomen with bluish reflects and a thin whitish pollen covering all the segments except the last one. Frons of the male more or less narrow, not broader than the ocellar triangle; male genitalia in lateral view show acute paralobes and straight mesolobe. Females with the middle frontal stripe three times broader than one of the parafrontalia; average size 9–11 mm. *caerulea* R.-D.

2 (1). Parafacialia with whitish pollen distributed in irregular rows with black interspaces. In both sexes the thorax is of a dark blue metallic colour with scarce pollen and the abdomen of a glittering bluish-green colour devoid of pollen and with a distinct dark longitudinal median stripe upon the second and third segments. Frons in the male distinctly broader, being about twice as broad as the ocellar triangle; the male genitalia with the paralobes broadly obtuse and with curved mesolobe. Parafrontalia of the female broader, the middle frontal stripe being twice as broad as one of them; average size 11–14 mm. *azurea* Fall.

4 (1). Parafacialia each with a conspicuous golden spot at the upper end. Thorax metallic, greenish-black to bright green colour with grey pollen and three nearly equal longitudinal stripes of the ground colour. Abdomen metallic dark bluish-green to bright cupreous or golden-green colour with scarce silvery pollen; anal segment varies always from cupreous to golden-green colour. Calypters white to buff yellow. Size 7–8.5 mm. Only female known *metallica* T. T.

The synonymy of the three above described species of *Protocalliphora* is as follows:

PROTOCOLLIPHORA.

Hough, 1899, a, p. 66 and b, p. 289.

Avihospita, Hendel, 1901, p. 29 and 68; b, p. 210¹; Aldrich, 1901, p. 68.

1. *Protocalliphora caerulea* (Robineau-Desvoidy).

Phormia caerulea, Robineau-Desvoidy, 1830, p. 466; 1863, p. 846.

Lucilia caerulea, Macquart, 1835, p. 256; Meigen, 1838, p. 295; Schiner, 1862, p. 591; de Meijere, 1902, p. 682, fig. 54.

Protocalliphora caerulea, Falcoz, 1921, p. 139.

Musca azurea, Meigen (nec Fallén!), p. 63; ? Rossi, 1848, p. 59, note.

Calliphora azurea, Schiner, 1862, p. 585; Nowicki, 1867, p. 44; Brauer, 1883, p. 74; Verrall, 1886, p. 231; Strobl, 1893, p. 104; Brauer and Bergentamm, 1894, pp. 546 and 568; Pandellé, 1896, p. 214; Grimshaw, 1901, p. 27.

Protocalliphora azurea, Hough, 1899, p. 289, fig. 11; Aldrich, 1905, p. 524; Bezzi, 1907, p. 544, p.p.; Villeneuve, 1910, p. 313; Nielsen, 1911, p. 205.

Avihospita azurea, Hendel, 1901, p. 29.

¹ The *Catalogue of Palaearctic Diptera*, p. 444, contains also the genus *Philornis* Meinert as a synonym of *Protocalliphora*. The late Dr Nielsen, 1911, p. 207, pointed out this error, which is not mine (only pp. 1–597 of vol. III being my work) but that of Brauer, 1894, p. 568.

Phormia azurea, Villeneuve, 1911, p. 84 and 1913, p. 132; Surcouf and Gonzalez-Rincones, 1912, p. 135; Rodhain and Bequaert, 1916, p. 245; Rodhain and Villeneuve, 1915, p. 593; Roubaud, 1918, p. 420, pl. v; Plath, 1919, a, p. 30, b, p. 191, c, p. 373; Patton, 1920, p. 30.

Musca sordida, Zetterstedt, 1838, col. 657, 1845, p. 1332, and 1859, p. 6185; Bonsdorff, 1866, p. 150.

Pollenia sordida, Rondani, 1862, p. 198; E. Corti, 1897, p. 140.

Avihospita sordida, Hendel, 1901, p. 29.

Protocalliphora sordida, Villeneuve, 1910, p. 313; Kramer, 1911, p. 43, pl. iii.

Phormia sordida, Villeneuve, 1911, p. 84 and 1913, p. 132; Roubaud, 1914, p. 27, and 1915, a, p. 77, b, p. 94, fig.; Rodhain and Villeneuve, 1915, p. 593; Rodhain and Bequaert, 1916, p. 244; Roubaud, 1917, p. 434; Villeneuve, 1918, p. 158; Engel, 1920, p. 256, fig. 8.

Lucilia dispar, Léon Dufour, 1845, p. 205, pl. ii; Zetterstedt, 1849, p. 3269, obs.

Phormia dispar, Robineau-Desvoidy, 1849, p. iv.

Calliphora nidicola, v. Heyden in Nowicki, 1867, p. 44, note.

Phormia nigripalpis, Robineau-Desvoidy, 1863, p. 846.

Phormia corusca, Robineau-Desvoidy, 1863, p. 849.

Avihospita braueri, Hendel, 1901, p. 29.

Geographical distribution. The species has been found throughout Europe, from Lapland to Sicily. Its distribution in North America is not yet thoroughly known, but from Plath's observations it seems that the species is prevalent in the west of the United States. The species was also recorded from Hawaii; if this is not an importation by man, the fly must have a very wide distribution.

Ethology. The habits of the larvae were first described by Léon Dufour and more recently Dr Roubaud has established their habit of intermittent haematophagy and that they cannot live as subcutaneous parasites¹.

The species has been observed in nests of *Corvus*, *Passer*, *Hirundo*, *Cotyle*, *Parus*, *Ruticilla*, etc. in Europe, and of *Pipilo*, *Hylocichla*, *Merula*, *Ampelis*, *Dendroica*, *Petrochelidon*, *Passer*, *Carpodacus*, *Zonotrichia*, *Melospiza*, *Astragalinus*, etc., in North America. All these birds belong to the *Passeres*.

2. *Protocalliphora azurea* (Fallén).

Musca azurea, Fallén, 1816, p. 245 and 1821, p. 46; Zetterstedt, 1838, col. 657 and 1845, p. 1334; Bonsdorff, 1866, p. 150.

Pollenia azurea, Rondani, 1862, p. 197.

Protocalliphora azurea, Bezzi, 1907, p. 544, p.p.; Villeneuve, 1910, p. 313, p.p.; Kramer, 1911, p. 43, fig.

Phormia azurea, Engel, 1920, p. 257, fig. 9.

¹ According to Roubaud the puparia of this fly are sometimes parasitised by a Hymenopteron *Nasonia brevicornis* Ashm.

Musca chrysorrhoea, ? Meigen, 1826, p. 60.

Calliphora chrysorrhoea, Macquart, 1835, p. 263; Schiner, 1862, p. 585; Brauer, 1883, p. 74; Strobl, 1894, p. 70; Brauer and Bergenstamm, 1894, p. 546.

Protocalliphora chrysorrhoea, Hough, 1899, p. 289; Aldrich, 1905, p. 524.

Avihospita chrysorrhoea, Hendel, 1901, p. 29.

Avihospita n. sp., Hendel, 1901, p. 30.

Phormia chrysorrhoea, Tyler Townsend, in Plath, 1919, pp. 374 and 380.

? *Calliphora splendida*, Macquart, 1845, p. 324.

Phormia caerulea, Kramer, 1917, p. 27.

Geographical distribution. This fly has apparently the same distribution in Europe as the other species, but is much more rare and there are only a few precise records, those of all the earlier writers being in my opinion very doubtful. It has been assumed here that the descriptions in which the sexual dichroism is not clearly indicated, apply to the true *azurea*, because Fallén's original description refers to a species in which the males and the females are equally coloured. But even in this last case a confusion with *Protophormia terraenovae*, R.-D., is always possible. The species is also recorded from North America, its distribution there being not yet determined.

Ethology. The larval stages were described by Engel in 1920, and compared with those of *caerulea*. The habits of these larvae seem to be the same. Engel has obtained the species from subterranean nests of *Riparia riparia*, and this is the unique precise record, which indicates a very peculiar habitat.

3. *Protocalliphora metallica* (Tyler Townsend).

Phormia metallica, Tyler Townsend, 1919, p. 379; Plath, 1919, p. 376.

? *Protocalliphora azurea*, Coutant, 1915, p. 145.

Geographical distribution. This species as far as it is known is exclusively a North American one; its range extends throughout the United States chiefly in the East, being very rare in the West. It is possible that the above mentioned *splendida*, Macquart, from Texas, may be synonymous with the present species.

Ethology. Plath found the larvae in nests of *Merula migratoria*. The larva from nests of *Corvus americanus* fully described by Coutant, may possibly belong to the present species; at any rate this larva cannot be that of *azurea* or of *caerulea* owing to the very important differences pointed out by Roubaud, 1918, pp. 423-424.

* * * *

The larvae of the above named species of *Passeromyia* and *Protocalliphora* live in bird nests, and attracted by positive thermotropism to the naked bodies of the young nestlings, they can suck their blood. But this type of intermittent haematophagy makes it impossible for them, as shown by Dr Roubaud, to become permanent parasites. There are however several records of fly-larvae found in subcutaneous tumours on young birds and attributed

erroneously to *Protocalliphora*. These records are enumerated here separately, as they do not belong to the above named flies.

In Europe they are as follows:

Schneider, 1866, p. 89, and Kirsch, 1867, p. 245, pl. iii, figs. 3-4, on *Passer domesticus*, attributed to *Prot. caerulea*.

Portschinsky, 1887, p. 17, pl. i, figs. 9-10, on *Anthus pratensis*, attributed to *Prot. azurea* (*Pollenia*).

Meinert, 1889, p. 315, on *Emberiza miliaria*, attributed to *Prot. caerulea*.

Brauer and Bergenstamm, 1894, p. 546, on *Passer domesticus*, attributed to *Prot. caerulea*, and on *Riparia riparia*, attributed to *Prot. azurea*.

Pavay-Vajna, 1909, p. 288, on *Motacilla alba*, attributed to *Melinda cognata* (*Onesia*).

Heinroth, 1916, p. 158, on *Motacilla*, attributed to *Prot. caerulea*.

And in North America:

Henshaw, 1908, p. 87, on *Sialis sialis*, attributed to *Prot. azurea*.

Miller, 1909, p. 1, the same.

Plath, 1919, p. 377, on *Astragalinus tristis*.

It is probable that there are here more than one kind of parasite, belonging to the Calliphorine or other flies.

The genera *Onesia* and *Melinda* must be excluded from this list, as Dr Keilin's researches show that the former is parasitic in earthworms and the latter lives in snails (1915 and 1919). The gen. *Lucilia* seems to be questionable, as Hesse's observations of 1921, p. 154, are not convincing.

If we have to deal with some Calliphorine larva, the gen. *Nitellia* must be taken into consideration. This genus was established in 1830 by Robineau-Desvoidy, but was united with *Pollenia* by all subsequent writers except Hendel and Tyler Townsend. It differs from *Pollenia* in having the common basal stem of the Radius ciliated above, as in *Protocalliphora*, with which it shows moreover a notable resemblance in the shape of thorax, in the flattened body and in the whole facies. The type species (*vespillo* Fabricius, 1786) is common in Europe and is present even in North America; its bionomics are still unknown.

III. PHILORNIS.

Muscid larvae, typically living as subcutaneous parasites on birds, have been found only in the Neotropical Region. They belong to the Anthomyiidae and not to the Calliphorinae.

It seems that in Central and South America there are several species which at present are not well distinguished. The first case was recorded by Macquart in 1853 from San Domingo under the name of *Aricia pici* parasitic on *Picus striatus*¹. The species was subsequently reported under the same name by Blanchard in 1896 who on Brauer's authority established its synonymy with *Mesembrina anomala* Jaennicke. The birds infested were *Oriolus cayennensis*

¹ Macquart's assertion that Sallé had seen similar tumours in Mexico on other birds (*Icterus*) and even on squirrels is doubtful; the latter case may have been due to some Cuterebrine larva

and *Or. mexicanus* from French Guiana. Blanchard had already recorded it in 1895 under the name of *Spilogaster anomalus* as a subcutaneous parasite of man.

In 1901 A. de Miranda Ribeiro accepted the above synonymy on the authority of Prof. Mik of Vienna, to whom he had sent specimens for identification. These specimens were caught on the bird *Peristera rufaxilla*.

Meinert in 1889 had already described, from an unidentified Brazilian bird nestling, a muscid larva as *Philornis molesta* which evidently belongs to the same group. Other allied forms were described in 1895 by Tyler Townsend from the West Indies under the name of *Mydaea spermophilae*, found on birds of the genera *Spermophila* and *Mimus*.

In two papers of 1911 and 1913 the late Dr J. C. Nielsen has studied very thoroughly two species of bird parasites under the names of *Mydaea anomala* and *Mydaea torquans*; the material examined was obtained from Argentina, and the larvae were found as subcutaneous parasites in tumours on various birds, both old and young ones; *torquans* occurring on birds of the genera *Spermophila*, *Mimus*, *Homorus* and *Pitangus*, and *anomala* on *Xiphocolaptes albicollis*.

The Rev. J. Aiken (1913) has described *Mydaea pici* from British Guiana and has recognised four different species belonging to the present group. On the contrary Lutz and Neiva in 1912, mentioning that subcutaneous larvae are frequent on young birds in Brazil, think that they all belong to a single species, *Mydaea pici* Macquart. Engel in 1920 expressed a similar opinion.

In 1916 Neiva and Penna recorded *Mydaea pici* from numerous birds in Central Brazil, saying that the larvae are so frequent as to be commonly named "berro"; they were found on birds of the genera *Cassicus*, *Furnarius*, *Molothrus*, *Paroaria*, *Amazona*, *Pionus*, etc., mostly belonging to the *Passeres*.

The late Prof. Stein in 1918 revised Mik's types of 1901 under the name of *Mydaea anomala*; and in the World Catalogue of 1919 stated that *anomala* and *torquans* form a single species.

In my opinion there are in the Neotropical Region several species of Anthomyidae, the larvae of which live in subcutaneous tumours of birds. This opinion is supported by the fact that in a collection of Brazilian flies belonging to this group sent to me some years ago by Dr Lutz, Prof. Stein has recognised the following species of *Mydaea*: *brevipectinata* Stein, *latipalpis* Stein, *sparsiplumata* Stein and *tinctinervis* Stein, all described in 1918. It is probable that some of these species were bred from subcutaneous larvae.

As a conclusion, we can provisionally place the South American Anthomyidae with the larvae forming the subcutaneous tumours in birds together under the generic name of *Philornis*.

PHILORNIS.

Meinert, 1889, p. 315.

1. *Philornis pici* (Macquart).

Aricia pici, Macquart, 1853, p. 657, pl. xx, 2.

Hylemyia pici, Osten Sacken, 1878, p. 167; Aldrich, 1905, p. 553.

Mydaea pici, Miranda Ribeiro, 1901, p. 156, pl. i; Busck, 1906, p. 2; Lutz and Neiva, 1912, p. 133; Aiken, 1913, p. 3 (sep.), figs. 1-11; Rodhain and Bequaert, 1916, p. 247; Neiva and Penna, 1916, p. 111; Keilin, 1917, pp. 399 and 436; Stein, 1919, p. 123; Engel, 1920, p. 250.

? *Hylemyia angustifrons*, Loew, 1861, p. 41.

Mesembrina anomala, Jaennicke, 1867, p. 377, pl. ii, fig. 4.

Spilogaster anomala, Brauer and Bergenstamm, 1893, p. 209, note 114, 1; Blanchard, 1895, p. 118 and 1895, p. 652, pl. 17, figs. 5-9.

Mydaea anomala, Nielsen, 1913, p. 252, figs. 1-4; Aiken, 1913, p. 3 (sep.); Keilin, 1914, p. 114 and 1917, p. 399; Stein, 1918, p. 212.

Philornis molesta, Meinert, 1889, p. 315, pl. vi.

Geographical distribution. If all the above records belong really to one species, it must have a wide range of distribution over Neotropical Region, from Cuba, San Domingo and Central America to Argentina.

Ethology. Well illustrated by Meinert and others. The larva pupates in a cocoon of earth cemented by a white substance. This fact seems to be uncommon in Anthomyiidae, but is observed also in the tropical *Synthesiomys nudiseta*, v. d. Wulp, besides the cases recorded by Dr Keilin, 1917, p. 437.

2. *Philornis torquans* (Nielsen).

Mydaea torquans, Nielsen, 1913, p. 252, fig. 3; Aiken, 1913, p. 3 (sep.); Keilin, 1914, p. 114 and 1917, p. 399.

Mydaea anomala, Nielsen, 1911, p. 195, figs. 1-14.

Geographical distribution. At present only known from Argentina.

Ethology. The larva pupates freely, without producing a cocoon.

3. *Philornis spermophilae* (Tyler Townsend).

Mydaea spermophilae, Tyler Townsend, 1893, p. 381; 1894, p. 173 and 1895, p. 79; Aldrich, 1905, p. 543; Aiken, 1913, p. 3 (sep.).

Mydaea spermophila, Keilin, 1917, p. 399.

Geographical distribution. Only known from Jamaica; but Townsend, *l.c.*, records a different species, which infests birds in Trinidad.

Ethology. The larva does not make a cocoon for pupation.

These three flies can be distinguished as follows:

1 (4). Third antennal joint about twice as long as the second¹; abdomen

¹ The figure given by Blanchard, 1896, pl. 17, figs. 5-8, if really belonging to *pici* (*anomala*), must be somewhat inaccurate, showing, in opposition with the figures of Macquart, Jaennicke, Miranda Ribeiro and Aiken, a much longer third antennal joint and a bare arista.

more or less yellowish at the base; legs as a rule entirely yellowish, at least in the male.

2 (3). Frons more narrow, the parafrontalia of the male almost touching above, and the middle stripe of the female being not broader than one of the parafrontalia; sides of the face yellowish; legs entirely yellow even in the male *pici* Macquart.

3 (2). Frons broader, the parafrontalia of the male well separated to the vertex and the middle stripe of the female broader than one of the parafrontalia; sides of the face silvery; legs of the female with blackish femora. *torquans* Nielsen.

4 (1). Third antennal joint about three times as long as the second; abdomen entirely black and the silvery pollen forms a somewhat marmorate pattern; legs brownish, with basal portion of femora darker. *spermophilae* T. T.

IV. *CARNUS*.

The unique non-pupiparous Dipteron, which in the adult stage is parasitic on birds, is the strange *Carnus hemapterus*; the fly is haematophagous and is to be found chiefly on young birds, while the larva lives in the nests, but is saprophagous.

The fly was described and figured by Nitzsch about a century ago, was redescribed and figured by Egger in 1854 under the same name, and owing to a misinterpretation of the original description was in 1862 renamed by Schiner as *Cenchrinobia eggeri*. Thus for a long time it has been believed that there were two species, one belonging to the Pupipara, and one to the Acalypterata of the family Borboridae (Schiner), or Sepsidae (Brauer).

Collin in 1911, in a short but important paper, has cleared up the matter recognising but a single species and locating it in the family Milichiidae.

In the subsequent year there appeared the paper of Prof. de Meijere, with the confirmation of the singular fact that the fly emerges from the puparium fully winged, and loses subsequently the wings, short stumps of which remain only as in the Pupiparous gen. *Lipoptena*. Thus in my paper of 1916 on the reduction of wings in the Diptera, I have included *Carnus*, with *Lipoptena*, *Echestypus* and *Ascodipteron*, in no. 7 of my graduation, p. 108.

A supposed second species of the gen. *Carnus* was described in 1913 by Stobbe, but its distinction seems to be very doubtful. Engel in his recent paper has added some new records, and therefore this interesting fly is at present known to occur on birds of the genera *Aquila*, *Falco*, *Picus*, *Lynx*, *Sylvia*, *Sturnus* and *Coloeus*. I have received from Prof. B. Grassi a couple of specimens caught at Maccarese, near Rom, by Luigioni on a nestling of *Falco*; these specimens are dark coloured and bristly as in *setosus*.

CARNUS.

Nitzsch, 1818, p. 305 and p. 283.

Cenchrudobia, Schiner, 1862, p. 435, and 1864, p. 334.

1. ***Carnus hemapterus***, Nitzsch.

Carnus hemapterus, Nitzsch, 1818, p. 305; Germar, 1822 (?), pl. 24 and 25; Egger, 1854, p. 3, pl. ii, figs. 7-11; Bezzi, 1900, p. 522; Collin, 1911, p. 138; Bezzi, 1911, p. 115; de Meijere, 1912, pp. 1-18, figs. 1-12; Melander, 1913, p. 237; Stobbe, 1913, p. 193; Bezzi, 1916, pp. 108 and 177; Wasielewski and Wuelker, 1918, p. 117; Engel, 1920, pp. 249 and 258; Frey, 1921, p. 151, pl. x, fig. 125.

Cenchrudobia eggeri, Schiner, 1862, p. 436 and 1864, p. 335; Brauer, 1880, p. 117, 3 and 1883, pp. 40 and 87; Bezzi, 1900, p. 521; Becker, 1905, p. 36.

Carnus setosus, Stobbe, 1913, p. 193.

Geographical distribution. Only known from Europe: Finland, Germany, Austria, Hungary, Roumania and Middle Italy.

V. *CHORTOPHILA* AND *NEOTTIOPHILUM*.

It may be finally recorded that in bird nests are to be found many other species of *Myiodaria*, which are not parasitic, but only inquiline, living probably on excrement or on organic refuse. Falcoz in 1914, p. 60, has pointed out the great number of dipterous larvae found in bird nests. It is to be noted that these flies, as far as is known, belong to the lower forms of *Anthomyidae* and even to the *Acalypterata*.

Of the former there are only the two following species, one from Europe and one from North America:

1. ***Chortophila cannabina***, Stein, 1916, p. 169; Kramer, 1917, p. 49; Engel, 1920, p. 258.

Germany; bred by Kramer from larvae in nest of *Acanthis cannabina*.

2. ***Chortophila nidicola*** (Aldrich).

Hylemyia nidicola, Aldrich in Plath, 1919, p. 380.

State of Washington, U.S.A.; bred by Plath from larvae found in various bird nests.

Among *Acalypterata* flies there is the following very interesting genus:

NEOTTIOPHILUM.

Frauenfeld, 1868, p. 894.

1. ***Neottiophilum praeustum*** (Meigen).

Dryomyza praeusta, Meigen, 1826, p. 257.

Neottiophilum praeustum, Mik, 1882, pp. 98 and 194, 1887, p. 34 and 1894, p. 166; Brauer, 1883, pp. 40 and 86; v. Roeder, 1892, p. 204 and 1895, p. 270; Strobl, 1894, p. 86; Becker, 1902, p. 219 and 1905, p. 38; Bezzi, 1911, p. 115; Kramer, 1917, p. 58; Engel, 1920, p. 250.

Neottiophilum fringillarum, Frauenfeld, 1868, p. 895.

Blephariptera cartereauvi, Bigot, 1881, p. 370.

Geographical distribution. At present known only from Central Europe: France, Germany and Austria. The adult fly seems to be rare, and was found mostly in houses, on windows; it lives probably on trees.

Ethology. The fly was bred from puparia found in nests of *Fringilla coelebs* and of *Passer domesticus*, but almost nothing is known about the larva.

VI. CONCLUSIONS.

1. The Myiodaria living with birds show a parallelism between the grades of their parasitic adaptation and their systematic position.

2. The lower forms—*Acalypterata* have saprophagous larvae, living in the nests of several orders of birds: Scansores, Passeres and Raptores. In the larval stage they feed upon decaying organic matter, while in the adult stage they are, in some cases, blood-sucking (*Carnus*).

3. The intermediate forms—*Anthomyidae* show two grades of adaptation: (a) lower forms, the larvae of which are mainly saprophagous or phytophagous (*Chortophila*) and which, like the *Acalypterata*, live in the nests upon decaying substances; (b) higher forms the larvae of which are mainly carnivorous and have adapted themselves to two modes of life: (A) as subcutaneous parasites (*Philornis*) of Scansores, Columbæ, and Passeres; (B) as intermittent haematophaga, on Passeres (*Passeromyia*).

4. The higher Myiodaria—the *Calliphorinae* show in their larval stage the two last types of parasitic adaptation, i.e. (a) intermittent haematophagy (*Protocalliphora*), and (b) possibly a subcutaneous mode of life on Passeres only.

5. The adult flies of all the intermediate and higher Myiodaria are non-bloodsucking. It seems to be a rule among the Diptera that the forms with haematophagous adults have non-haematophagous larvae and *vice versa*.

6. All these facts have to be taken into consideration in the study of other parasitic Myiodaria and especially the heterogeneous groups like Pupipara and Oestridæ which, undoubtedly, are of polyphyletic origin, and are derived from lower, intermediate and higher Myiodaria.

VII. BIBLIOGRAPHY.

AIKEN, J. (1913). A subcutaneous larva of Mydaea. *B. G. Medical Annual*, pp. 1-4, 3 pls.

ALDRICH, J. M. (1901). Synonymische Notiz. *Wien. Ent. Zeit.* xx, p. 68.

— (1905). *A Catalogue of North American Diptera (or Two-winged Flies)*, pp. 680. Washington.

BECKER, TH. (1902). Die Meigen'schen Typen der sogen. *Muscidae acalypteræ* (*Muscaria holometopa*) in Paris und Wien. *Zeitschr. für Hym. und Dipt.* II, pp. 209-256, 289-320, 337-349.

— (1905). *Katalog der paläarktischen Dipteren*, IV, pp. 328. Budapest.

BEZZI, M. (1900). Sulla presenza del genere *Chionea* Dalman in Italia, e la riduzione delle ali nei ditteri. *Rendic. Istit. Lomb. Milano*, XXXIII, pp. 511-526.

- BEZZI, M. (1907). *Katalog der paläarktischen Dipteren*. III, pp. 1-597. Budapest.
- (1911). Études systématiques sur les Muscides hématophages du genre *Lyperosia*. *Arch. de Parasit.* Paris, xv, pp. 110-143, 15 figs.
- (1916). Riduzione e scomparsa delle ali negli insetti ditteri. *Natura*, Milano, VII, pp. 85-182, 11 pls.
- BIGOT, J. M. F. (1877). Diptères nouveaux ou peu connus. XI. Notes et mélanges diptérologiques. *Ann. Soc. Ent. Fr.* (5) VII, pp. 260-262.
- (1881). Diptères nouveaux ou peu connus. XXVI. *Ibid.* (6) I, pp. 363-371.
- (1887). Diptères nouveaux ou peu connus. Muscidi (J. B.). *Bull. Soc. Zool. Fr.* XII, pp. 581-617.
- BLANCHARD, R. (1895). Note in *Bull. Soc. Zool. Fr.* XX, p. 118, séance du 14 Mai.
- (1896). Contributions à l'étude des Diptères parasites. (Troisième série.) XI. Sur l'*Aricia pici* Macq. *Bull. Soc. Ent. Fr.* LXV, pp. 652-654, pl. XVII, figs. 5-9.
- BONSDORFF, J. E. (1866). *Finlands Twåvingade Insekter (Diptera)*, etc. Andra delen, pp. 306. Helsingfors.
- BRAUER, F. (1880). Die Zweiflügler des Kaiserlichen Museums zu Wien. I. *Denkschr. d. math.-naturwiss. Cl. der K. Akad. d. Wiss. Wien*, XLII, pp. 105-216, pl. 6.
- (1883). Die Zweiflügler des Kaiserlichen Museums zu Wien. III. *Ibid.* XLVII, pp. 1-100, pl. 5.
- BRAUER, F. and BERGENSTAMM, J. v. (1893). Die Zweiflügler des Kaiserlichen Museums zu Wien. VI. Vorarbeiten zu einer Monographie der *Muscaria schizometopa* (exklusive Anthomyidae). Pars III. *Ibid.* LX, pp. 89-240.
- (1894). Die Zweiflügler des Kaiserlichen Museums zu Wien. VII. Vorarbeiten zu einer Monographie der *Muscaria schizometopa* (exklusive Anthomyidae). Pars IV. *Ibid.* LXI, pp. 537-624.
- BUSCK, A. (1906). *Mydaea pici* Macq. *Proc. Ent. Soc. Washington*, VIII, pp. 2-3.
- COLLIN, J. E. (1911). On *Carnus hemapterus* Nitzsch (*Cenchrinobia eggeri* Schiner) and its systematic position among the Diptera. *Novit. zoolog.* XVIII, pp. 138-139.
- COQUILLETT, D. W. (1910). The type-species of the North American genera of Diptera. *Proc. U.S. Nat. Museum*, XXXVII, pp. 499-647.
- CORTI, E. (1897). Aggiunte alla Fauna ditteologica della provincia di Pavia. Terza Centuria. *Bull. Soc. entom. ital.* XXIX, pp. 136-143.
- COUTANT, A. F. (1915). The habits, life-history and structure of a blood-sucking Muscid larva (*Protocalliphora azurea*). *Journ. of Parasit., Urbana, Ill.* I, pp. 134-150.
- DUFOUR, L. (1845). Histoire des métamorphoses de la *Lucilia dispar* (Diptère). *Ann. Soc. Ent. Fr.* (2) III, pp. 205-214, fig.
- EGGER, J. (1854). Beiträge zur bessern Kenntniss des *Carnus hemapterus* Nitzsch. *Verhandl. zool.-bot. Ver. Wien*, IV, pp. 3-7, pl. I, figs. 7-11.
- ENGEL, E. O. (1920). Dipteren, die nicht Pupiparen sind, als Vogelparasiten. *Zeitschr. f. wiss. Insektenbiol.* XV, pp. 249-258, 9 figs.
- FALCOZ, L. (1914). Contribution à l'étude de la Faune des Microcavernes. Faune des terriers et des nids, pp. 185, 1 pl., 38 figs. Lyon.
- (1921). Matériaux pour l'étude de la faune pholéophile Première. Note: Diptères. *Bull. Soc. Ent. Fr.* pp. 137-142.
- FALLÉN, C. F. (1816). Beskrifning öfver de i Sverige funne flugarter, som kunna föras till slägtet *Musca*. *Vetensk. Acad. Handl.* pp. 226-254.
- (1821). *Diptera Sueciae*. Vol. II, *Monographia Muscidum*, Pars IV, pp. 41-48 (resp. Sundewall). Lundae, 1818-1825.
- FRAUENFELD, G. (1868). Zoologische Miscellen. XV. *Verh. der zool.-bot. Ges. Wien*, XVIII, pp. 885-902.
- FREY, R. (1921). Studien über den Bau des Mundes der niederen Diptera *Schizophora*, etc. *Acta Soc. Faun. et Flora Fenn.*, 48. pp. 3-245, pl. X.

- GERMAR, E. F. (1822-?). *Fauna Insectorum Europae*. Fasc. IX, tab. 24-25. Halae, 1817-1840.
- GILBERT, P. A. (1919). A Dipterous Parasite of Nestling Birds. *Emu*, XIX, pp. 48-49.
- GRIMSHAW, P. H. (1901). *Fauna Hawaiiensis or the Zoology of the Sandwich (Hawaiian) Isles*, etc. Vol. III, Part I, *Diptera*, pp. 1-77, 3 pls. Cambridge.
- HEINROTH, — (1916). *Journ. f. Ornithologie*, I, pp. 158-159.
- HENDEL, FR. (1901 a). Beitrag zur Kenntniss der Calliphorinen (Dipt.). *Wien. Ent. Zeit.* XX, pp. 28-33.
- (1901 b). Ueber einige neue oder weniger bekannte europäische *Muscaria schizometopa*. *Verh. zool.-bot. Ges. Wien*, LI, pp. 198-211.
- HENSHAW, W. H. (1908). A parasitic fly injurious to our native birds. *The Auk*, Cambridge, Mass. (N.S.), XXV, pp. 87-88.
- HESSE, E. (1921). Bemerkung zu: E. Engel, Dipteren, die nicht Pupiparen sind, als Vogelparasiten. *Zeitschr. f. wiss. Insektenbiol.* XVI, p. 154.
- HOUGH, G. DE N. (1899 a). Some North American genera of the Dipterous group *Calliphorinae* Girsch. *Entom. News*, x, pp. 62-66.
- (1899 b). Synopsis of the *Calliphorinae* of the United States. *Zoolog. Bull.* II, pp. 283-294, 11 figs.
- JAENNICKE, F. (1867). Neue Exotische Dipteren aus den Museen zu Frankfurt a. M. und Darmstadt. *Abhandl. der Senckenb. Ges.* VI, pp. 311-407, pl. 2.
- KEILIN, D. (1915). Recherches sur les larves de Diptères Cyclorhaphes. *Bull. Sci. de la Fr. et de la Belg.* (7) XLIX, pp. 15-198, pls. I-XVI, fig. 27.
- (1917). Recherches sur les Anthomyides à larves carnivores. *Parasitology*, IX, pp. 325-450, pls. v-xv.
- (1919). On the life-history and larval anatomy of *Melinda cognata* Meigen (*Diptera Calliphorinae*) parasitic in the snail *Helicella (Helicomanes) virgata* Da Costa, with an account of the other *Diptera* living upon Molluscs. *Ibid.* XI, pp. 430-455, pls. XXII-XXV, 6 figs.
- KIRSCH, TH. (1867). Ueber zwei Fliegenlarven aus dem Nacken eines jungen Sperlings. *Berl. ent. Zeitschr.* XI, pp. 245-246, pl. III, figs. 3-4.
- KRAMER, H. (1911). Die Tachiniden der Oberlausitz. *Abh. naturf. Ges. in Görlitz*, XXVII, pp. 1-50, pls. 1-3.
- (1917). Die Musciden der Oberlausitz. *Ibid.* XXXIII, pp. 1-96, figs.
- LOEW, H. (1861). *Diptera aliquot in Insula Cuba collecta*. *Wien. Entom. Monatsschr.* V, pp. 33-43.
- LUTZ, A. and NEIVA, A. (1912). Notas dipterológicas. A proposito da *Mydaea pici* Macquart. *Mem. do Inst. Osw. Cruz, Rio de Janeiro*, IV, pp. 130-135.
- MACQUART, J. (1835). *Histoire naturelle des Insectes, Diptères*, II, pp. 703, pl. 12. Paris.
- (1845). Diptères exotiques nouveaux ou peu connus. Supplément. *Mém. Soc. Sci. Lille* (1844), pp. 133-364, pl. 20. Also sep., Paris, 1846, pp. 238, 20 pls.
- (1851). Diptères exotiques nouveaux ou peu connus. Suite du 4^e Supplément publié dans les Mémoires de 1849. *Mém. Soc. Sci. Lille* (1850), pp. 134-294, pl. 14. Also sep., Paris, 1851, IV, with the first part, pp. 105 and 158, 28 pls.
- (1853). Notice sur une nouvelle espèce d'Aricie, Diptère de la tribu des Anthomyzides. *Ann. Soc. Ent. Fr.* (3) I, pp. 655-660, pl. XX, n. II.
- MEIGEN, J. W. (1826). *Systematische Beschreibung der bekannten Europäischen zweiflügeligen Insekten*, Fünfter Theil, pp. 412, pl. 13. Hamm.
- MEIJERE, J. C. H. DE (1902). Ueber die Prothoracalstigmata der Dipterenpuppen. *Zoolog. Jahrbüch.* XV, pp. 623-692, pls. 32-35.
- (1912). Zur Kenntnis von *Carnus hemapterus* Nitzsch. *Schrift. d. Phys.-Ökon. Ges. zu Königsberg*, LIII, pp. 1-18, figs. 1-12.
- MEINERT, FR. (1889). *Philornis molesta*, en paa Fugle snyltende Tachinarie. *Vidensk. Meddel. nat. Foren.* pp. 304-317, pl. VI.

- MELANDER, A. L. (1913). A Synopsis of the Dipterous Groups Agromyzinae, Milichiinae, Ochthiphilinae and Geomyzinae. *Journ. N. Y. Ent. Soc.* xxi, pp. 219-300, pl. viii.
- MIK, J. (1882). Ueber die Dipteren-Gattung *Neottiophilum* Frnfd. *Wien. Ent. Zeit.* i, pp. 194-197. The synonymy was already given in the same vol. p. 98, note 2.
- (1887). Dipterologische Miscellen, iv, p. 21. Ein seltenes Dipteron. *Ibid.* vi, pp. 34-35.
- (1894). Dipterologische Miscellen (2 Serie), v. *Ibid.* xiii, pp. 164-168.
- MILLER, — (1909). *Worthington, Soc. Bird Life*, no. 2, pp. 1-8.
- MIRANDA RIBEIRO, A. DE (1901). Sobre a *Mydaea pici* Macq. *Archiv. do Mus. nac. de Rio de Janeiro*, xi, pp. 153-156, pl. i.
- NEIVA, A. and PENNA, B. (1916). Viagem científica pelo Norte da Bahia, sudoeste de Pernambuco, sul do Piauí e de norte a sul de Goiás. *Mem. do Instit. Osw. Cruz*, Rio de Janeiro, viii, pp. 74-224, 28 pls.
- NIELSEN, J. C. (1911). *Mydaea anomala* Jaenn., a parasite of South American birds. *Vidensk. Meddel. fra nat. Foren.* lxiii, pp. 195-208, figs. 1-14.
- (1913). On some South American species of the genus *Mydaea*, parasitic on birds. *Ibid.* lxv, pp. 251-256, 4 figs.
- NITZSCH, C. L. (1818). Die Familien und Gattungen der Thierinsecten (*insecta epizoica*) als ein Prodomus der Naturgeschichte derselben. *German Mag. d. Entomol.* iii, pp. 261-316.
- NOWICKI, M. (1867). Faunistische Miscellen. *Verh. der nat. Ver.* Brünn, p. 44.
- OSTEN SACKEN, C. R. (1878). *Catalogue of the described Diptera of North America* (Second Edition), pp. 276. Washington.
- PANDELLÉ, L. (1896). Études sur les Muscides de France. *Rev. d'Entom.* Caen, xv, pp. 214-215.
- PATTON, W. S. (1920). Note on the occurrence of *Passeromyia heterochaeta* Villeneuve, in India. *Ind. Journ. Med. Res.* viii, pp. 30-31, 1 pl.
- PAVAY-VAJNA, FR. (1909). *Onesia cognata* als Vogelparasite. *Aquila*, xvi, pp. 288-290.
- PLATH, O. E. (1919 a). Parasitism of nestling birds by fly larvae. *The Condor*, xxi, pp. 30-39.
- (1919 b). A Muscid larva of the San Francisco Bay Region which sucks the blood of nestling birds. *Univ. Calif. Publ. Zool.* xix, pp. 191-200.
- (1919 c). The prevalence of *Phormia azurea* Fallén (larva parasitic on nestling birds) in the Puget Sound Region and data on two undescribed flies of similar habit. *Ann. Ent. Soc. Amer.* xii, pp. 373-381. With Appendices by Townsend and Aldrich.
- PORTSCHINSKY, J. (1887). Diptera europaea et asiatica nova aut minus cognita (cum notis biologicis). *Hor. Soc. Ent. Ross.* xxi, pp. 3-20, pl. i.
- ROBINEAU-DESVOIDY, J. B. (1830). Essai sur les Myodaires. *Mém. Savants étrang. Acad.* Paris, ii, pp. 1-813.
- (1849). Note sur la synonymie de la *Phormia regina* (Diptère). *Ann. Soc. Ent. Fr.* (2) vii, Bull. p. 4.
- (1863). *Histoire Naturelle des Diptères des environs de Paris*, ii, pp. 920. Paris.
- RÖDER, V. v. (1892). Ein neuer Fundort der Dipteren *Neottiophilum praeustum* Mg. und *Acyglossa diversa* Rond. *Entom. Nachr.* xviii, pp. 204-206.
- (1895). Neue Fundorte der Diptere *Neottiophilum praeustum* Meig. *Wien. Entom. Zeit.* xiv, p. 270.
- RODHAIN, J. (1914). Sur une larve de *Muscinae* vivant dans le nid de *Passer griseus* au Congo. *Rev. zool. Afric.* iii, pp. 213-217.
- RODHAIN, J. and VILLENEUVE, J. (1914). *Passeromyia*, genre nouveau des *Anthomyidae* (Dipt.), à larve hématophage parasite des jeunes oiseaux. *Bull. Soc. Path. exot.* viii, pp. 591-593.
- RODHAIN, J. and BEQUAERT, J. (1916). Histoire de *Passeromyia heterochaeta* Villen. et de *Stasisia (Cordylobia) Rodhaini* Ged. *Bull. Sci. de la Fr. et de la Belg.* (7) xlix, pp. 236-289, 1 pl., 14 figs.

- RODHAIN, J. (1919). Nouvelles observations sur la biologie de *Passeromyia heterochaeta* Villeneuve. *Bull. Biol. de la Fr. et de la Belg.* LII, pp. 499–510, 2 figs.
- RONDANI, C. (1862). *Dipterologiae italicæ Prodrum*, v, pp. 239. Parmae.
- ROSSI, F. (1848). *Systematisches Verzeichniss der Zweiflügelichen Insecten (Diptera) des Erzherzogthumes Österreich mit Angabe des Standortes, der Flugzeit und einigen andern physiologischen Bemerkungen.* pp. 86. Wien.
- ROUBAUD, E. (1914). *Études sur la Faune Parasitaire de l'Afrique occidentale Française.* Premier Fascicule, pp. 250, 4 pls., 70 figs. Paris.
- (1915 a). Hématophagie larvaire et affinités parasitaires d'une mouche Calliphorine, *Phormia sordida*, parasite des jeunes oiseaux. *Bull. Soc. Path. exot.* VIII, pp. 77–79.
- (1915 b). Les Muscides à larves piqueuses et suceuses de sang. *C.R. Soc. Biol. Paris*, LXXVIII, pp. 92–97, fig. 2.
- (1917). Observations biologiques sur *Nasonia brevicornis* Ashm. chalcidide parasite des pupes des muscides. *Bull. Sci. de la Fr. et de la Belg.* (7) I, pp. 425–439, 1 fig.
- (1918). Précisions sur *Phormia azurea* Fall. Muscide à larves hémophages parasites des Oiseaux d'Europe. *Bull. Biol. de la Fr. et de la Belg.* LI, pp. 420–430, pl. v.
- ROUBAUD, E. and VAN SACEGHEM, R. (1916). Observations sur quelques Insectes et Acariens parasites du Bétail au Congo Belge. *Bull. Soc. Path. exot.* IX, pp. 763–767.
- SCHINER, J. R. (1862). *Fauna austriaca. Die Fliegen (Diptera).* I Theil, pp. 674, 2 pls. Wien.
- (1862). Vorläufiger Commentar zum dipterologischen Theile der "Fauna austriaca." v. *Wien. Entom. Monatsschr.* VI, pp. 428–436.
- (1864). *Fauna austriaca. Die Fliegen (Diptera).* II Theil, pp. 658. Wien.
- SCHNEIDER, O. (1866). Notiz in *Isis, Sitzungsber.* Dresden, p. 89.
- STEIN, P. (1909). Neue Javanische Anthomyiden. *Tijdschr. voor Entom.* LII, pp. 205–271.
- (1916). Die Anthomyiden Europas, etc. *Archiv f. Naturgesch.* LXXXI, pp. 1–224.
- (1918). Zur weitem Kenntnis aussereuropäischer Anthomyiden. *Ann. Mus. nat. Hung.* XVI, pp. 147–244.
- (1919 a). Die Anthomyiden Gattungen der Welt, analytisch bearbeitet, nebst einem Kritisch-systematischen Verzeichnis aller aussereuropäischen Arten. *Archiv f. Naturg.* LXXXIII, pp. 85–178.
- (1919 b). Anthomyiden aus Java, Sumatra, Waigeo und Ceram. *Tijdschr. voor Entom.* LXII, pp. 47–86.
- STOBEE, R. (1913). Zur Kenntnis der Gattung *Carnus* Nitzsch (= *Cenchrudobia* Schiner) mit 1 nov. sp. (Dipt.). *Deutsch. Ent. Zeitschr.* pp. 192–194.
- STROBL, G. (1893). Beiträge zur Dipterenfauna des österreichischen Littorale. *Wien. Ent. Zeit.* XII, pp. 89–108.
- (1894). Die Dipteren von Steiermark. II Theil. *Mittheil. d. Nat. Ver. für Steierm.* XXX, pp. 1–152.
- SURCOUF, J. M. and GONZALEZ-RINCONES, R. (1912). *Essai sur les Diptères Vulnérants du Venezuela.* Deuxième Partie, pp. 240, 100 figs. Paris.
- TOWNSEND, C. H. TYLER (1893). *Notes from the Museum, Institute of Jamaica*, Nov. 22, no. 70.
- (1893 a). A bot-like Anthomyid, parasite of a bird. *Journ. Instit. Jamaica*, I, pp. 381–382.
- (1894). The grass-quit bot, an Anthomyid parasite of nestling birds. *Ibid.* II, pp. 173–174.
- (1895). Contributions to the Dipterology of North America. II. *Trans. Am. Ent. Soc.* XXII, pp. 55–80.
- (1916). On Australian Muscoidea, with description of new forms. *Insec. Insc. Menstr.* IV, pp. 44–45.

- TOWNSEND, C. H. TYLER (1919). New genera and species of Muscoid flies. *Proc. U.S. Nat. Mus.* LVI, pp. 541-592.
- VERRALL, G. H. (1886). A hundred new British species of Diptera. *Ent. Monthly Mag.* XXII, pp. 179-182, 199-202, 230-234.
- VILLENEUVE, J. (1910). Notes synonymiques sur quelques Diptères—Types. *Deutsch. Ent. Zeitschr.* pp. 311-313.
- (1911). Notes diptérologiques. I. Sur le genre *Phormia* R. D. *Wien. Entom. Zeit.* XXX, pp. 84-85.
- (1913). De quelques Tachinaires à grande extension géographique. *Feuille des jeunes Natur.* XLIII, pp. 131-132.
- (1915). Diptères nouveaux d'Afrique. *Bull. Soc. Ent. Fr.* LXXXIV, pp. 225-227, fig.
- (1918). Sur *Phormia sordida* Zett. *Ibid.* no. 10, pp. 158-159.
- WASIELEWSKI, T. VON and WUELKER, G. (1918). Die *Haemoproteus*-Infektion des Turmfalken. *Beih. zum Arch. f. Schiffs- u. Tropen-Hyg.* XXII, pp. 117-212, 4 pls., 11 figs.
- ZETTERSTEDT, J. W. (1838). *Insecta Lapponica descripta.* col. 1140. Lipsiae, 1838-1840.
- (1845). *Diptera Scandinaviae disposita et descripta.* Tomus quartus, pp. 1281-1738.
- (1849). *Ibid.* Tomus octavus, pp. 2935-3366.
- (1859). *Ibid.* Tomus tredecimus, pp. 4943-6190.