

A Contribution to the knowledge of Brazilian Oestridae

by

DR. ADOLPHO LUTZ

(With Plates 27-29).

The family *Oestridae* is formed by several genera of which the old genus *Oestrus* L. forms the center. Modern authors prefer the name *Oestrinae*, so as to indicate that these parasitical flies are merely a subfamily of the *Muscidae*. I agree with them, but do not go so far as to place them in other subfamilies, to which they may have certain affinities.

The parasitism of the larva of most genera and species may be considered as their most important general character; but they have other points in common and differ from other, non parasitical, flies by other features.

Were it not so, we should have to include *Mydaea pici* in the *Oestrinae*, a thing which nobody has thought of, as yet.

The *Oestrinae* may be subdivided in tribes, instead of subfamilies. One of these (the former *Cuterebrinae*), is composed of the genera peculiar to America, which are characterised by cutaneous parasitism and also by their large size (wanting only in the rather aberrant genus *Dermatobia*).

A detailed and well illustrated monograph of the *Oestrinae*, by BRAUER, was pu-

blished in 1863. A more recent and complete, though much shorter one by ARMI- NIUS BAU appeared in WYTSMAN's *Genera insectorum*. So we are not absolutely dependent on the original papers which are much scattered and of difficult access, though they ought to be consulted whenever possible. There are a few recent ones by AUSTEN, BRAUER and BERG.

To give a short account of our present knowledge, we may state that the *Oestridae* are oviparous or larviparous *Muscidae*, which (as far as we know) always pass their larval stage in mammals, and live either in the skin, the stomach, or the nasal cavities. They reach them either directly or by more or less complicated migrations. The pupae are not formed in the body of the host, but outside. Generally, the imago does not feed but only lives for the propagation of the species. Its body is large, its head big and partly tumefied; the eyes of both sexes are small and set upell apart. Ocelli are always present.

The antennae occupy a rather deep groove. The palpi are rarely developed, they are mostly atrophied or altogether missing.

The scutum is almost quadrangular; the thorax thick, the abdomen slightly detached and always rather short and stout. There are no macrochaetae. The female may have an ovipositor. There are always fine folds or wrinkles in the wings which are of the ordinary type, found in the *Muscae calypteratae*; the same applies to the legs.

A peculiarity worth mentioning is the great likeness between most of these species and aculeate *Hymenoptera*, in general appearance as well as in the way of flying and buzzing. This explains why many large animals are so afraid of them.

The american *Oestridae* are rather different from those of the old world, though they have some affinity to *Cephenomyia*. The larvae of *Dermatobia* somewhat resemble those of *Hypoderma*.

Dermatobia hominis is easily distinguished from all other american species, by its

small size, the absence of hairs, the brickred eyes (in live specimens), striated scutum, hyaline wings and metallic blue abdomen. It seems to be the only species of this genus, but covers an extensive territory and has a long list of hosts of which cattle, though introduced, is the most important and suffices alone to insure the continuity of this species.

The other brazilian *Oestridae* are rather scarce and rarely seen, though their size, quite uncommon in *Muscidae*, and many peculiarities in their appearance draw the attention of the collector. Of the other genera, *Cuterebra* became known in the first period of systematic dipterology; species of *Rogenhoferia* and *Pseudogametes* were also described, though without the later distinction of their genera.

With the help of the above mentioned monographs, I drew up a key for the *Oestrinae* observed by me in Brazil:

- | | | |
|---|---|------------------------------|
| 1. Under side of the head with deep longitudinal fissure containing the proboscis (<i>Cuterebra</i> and other american genera) | 4 | |
| The same, without deep fissure (<i>Oestrinae typicae</i>)..... | 2 | |
| 2. Transversal apical vein absent; small squamulae (<i>Gastricolae</i>) | 3 | |
| 3. Empodia and ocelli distinct..... | | <i>Gastrophilus</i> LEACH |
| 4. Aristae pennate..... | 5 | |
| Arista bare..... | | <i>Rogenhoferia</i> BRAUER |
| 5. Arista pennate, on the upper side only..... | 6 | |
| « « « both sides..... | | <i>Pseudogametes</i> BISCHOF |
| 6. Face with callosities. Tarsi broad..... | | <i>Cuterebra</i> CLARK |
| « without callosities. Tarsi slender..... | | <i>Dermatobia</i> MACQUART |

Follows a list of South-american species:

1. *Cuterebra ephippium* LATR. 1817 Cayenne.
2. « *apicalis* GUÉR. 1829-38, Brazil.
3. « *patagona* GUÉR, 1829-38. Patagonia.
4. « *analis* MACQ. 1843, Brazil.
5. « *cayennensis* MACQ. 1843, Brazil.
6. « *rufiventris* MACQ, 1853. Brazil.
7. « *megastoma* BRAUER, 1863, South-America.
8. « *funebri* AUSTEN, 1895. Trinidad.
9. « *nigricincta* AUSTEN, 1895. Brazil.

There are also four new species of *Cuterebra*:

10. *Cuterebra sarcophagoides* n. sp. Brazil State of São Paulo.
11. « *nigricans* n. sp. Brazil, State of São Paulo.
12. « *infulata* n. sp. Brazil, State of Rio de Janeiro.
13. « *Schmalzi* n. sp. Brazil, State of Santa Catharina.

14. *Rogenhoferia grandis* GUÉR. 1829-38 ? Brazil, Argentina.
15. « *trigonocephala* BR. 1863. Brazil, State of Bahia.
16. « *dasyopoda* BR. 1896. Brazil, State of Espirito Santo.
17. *Pseudogametes Hermanni* BR. & BISCH. 1900, Brazil.
18. « *semiater* WIED. 1830. Brazil, State of Rio de Janeiro.
19. *Dermatobia cyaniventris* MACQ. 1843. Brazil.
20. *Gastrophilus asininus* BR. 1863. Brazil (introduced).

Of the species mentioned, *C. analis* MACQ. is the same as *C. apicalis* GUÉR.; this may be readily seen by the good drawing which accompanies this author's description. If the specimen described by LATR. as *ephippium* had lost the hairs on the scutum, the same may apply to it. This form has not been found in Brazil, nor has *patagona* GUÉR. been seen. *C. cayennensis* MACQ. and *funebria* AUST. do not seem to be natives; the first is not easily distinguished from *apicalis*; the home of *megastoma* BR. is uncertain. Consequently we must consider only the following three species of *Cuterebra* as natives: *C. apicalis* GUÉR., *C. rufiventris* MACQ. and *C. nigrocincta* AUSTEN.

I have no specimens of the two last ones; they must be rare and probably belong to a very limited region as they have apparently not been found since. On the other hand, I have four new species to describe. Adding two species of *Rogenhoferia*, two of *Pseudogametes* and one of *Dermatobia* to these, we have twelve native species. There is also a *Gastrophilus* but it is undoubtedly of foreign origin.

I will now proceed to describe the different genera and species, leaving my remarks on their morphology and biology, for the second part of the paper.

Descriptive Part.

I. Genus *Cuterebra*.

This genus is exclusively American and its many species cover the entire continent. The North-American type is rather different from that of the Brazilian species, to which this paper is limited. One of them is relatively common in this country and can be found in many places; the others are rarer

and limited to more restricted zones. Much time and many collaborators are needed to collect the necessary material for a study on *Cuterebra*. My collection looks small and yet it is probably the richest in native species. Although it is now many years old, there seems small likelihood of its increasing, so I shall not delay the study of the specimens any longer.

BRAUER gave a very minute description of *Cuterebra*, the most important parts of which may be found in BAU from whom I quote:

"Characters: Head large, generally broader than the thorax, hemispherical, rounded, and convex. Vertex slightly or not at all prominent, flat behind, with well marked edge. Antennal groove excavated, heart-shaped; either single or divided by a central rather prominent ridge.

Antennae approximate at the base, drooping, the two first segments short, the third short or elongate, oval. Arista at base of the anterior border; upper side pennate. Mouth forming a deep and long fissure on the under side of the head.

Proboscis large, corneous, generally retracted, geniculated at the base, the terminal part compressed and of the same length as the oral fissure.

Under face very much swollen, not excavated under the eyes. There are shining black calli on the head, which are sometimes smooth, sometimes wrinkled. Scutum almost square, or longer than broad.

Wings dark but diaphanous, with transversal apical vein. First posterior marginal cell open. Anal lobes large, mostly darker than the rest of the wing membrane, erect on the side of the scutellum. Squamulae very large.

Legs strong, short and thick. Tarsi broad and flat. Ungues slightly bent, pulvilli rectangular and broad, shorter than the unguis.

Abdomen thick, heart-shaped, inclining to globular form. Last ring semilunar, with an arched postero-inferior incision in the male which embraces the broad flat, shield-like genital ring; in the female, it has an angular inferior border, forming a triangular or quadrangular fissure enclosing the small semilunar genital segment.

Larvae: Ovoid, thick, with a pair of oral hooks on the cephalic segment.

Antennae nipple-shaped with two chitinous rings, recalling ocelli; anterior stigma forming transversal slits between the cephalic ring and the next one. Body convex above, concave below, with longitudinal furrows. On segments 3–9 three pairs of lateral elevations bearing strong thorns or sharp prickles (BRAUER), or covered with smooth scales (AUSTEN). The last ring of the body is glabrous and may be retracted into the preceding one thus forming a stigmatic cavity: it is narrower and shorter than the preceding rings. Posterior stigmata crescent or kidney shaped."

The callosities of the face and some smaller ones on the pleura and the abdomen characterise the genus, but are of little use in distinguishing the species, as their arrangement is the same in all of them. They may vary in size, but also in individuals of the same species, as the tomentum around them is easily rubbed off. Size and shape of the antennae vary somewhat in the different species and may be used for classification.

The pattern of the skin of known larvae and pupae may be used for recognising them as it seems different in the three species in my collection.

Their host may also furnish important data as, unlike *Dermatobia*, all the known species are very specialised in their choice of them.

Alulae and squamulae are large, striking and very characteristic; so are the delicate folds on the wings, though they may be found in some other flies.

Cuterebra apicalis has a red band across its dark eyes, a fact I first noticed in a live female. When the insect dies, the band disappears rapidly and was therefore not known.

I shall now describe the species observed; no key is needed, as those described by me, can be recognised by the illustrations; the other descriptions cannot very well be used, unless they are compared with the types.

1. *Cuterebra apicalis* GUÉRIN

(Pl. 27, fig. 1; Pl. 29, fig. 1 face of ♀; fig. 1a face of ♂.)

This is the most common species and is found more often than all the others together. It may be readily recognised by the illustration, but to avoid confusion with other doubtful or similar species, I add a few words. It is medium-sized; the body of the largest specimen, a male, is 23 mm., the wing 16 mm. long; while the smallest measures are 17 mm. for the body and 14 for the wing, the length of the body varying more than that of the wing. The ground color of both body and wing is chestnut or rusty brown. On the dorsum of the abdomen, it becomes nearly black but keeps its steely blue glint; on the legs it may be dark reddish brown, but never black, though the hairs on them are black; the frontal calli are piceous. The tomentum on the scutum (which in well preserved specimens is thick and velvety) is generally ochraceous and sometimes becomes whitish or reddish-yellow; it varies a little, according to the way in which the light strikes it, as the ground colour is perceived when the tomentum is rather thin. In a specimen from JOINVILLE, the ground is so exceptionally dark that the scutum looks blackish and the scutellum (the ground of which ought to be hidden by the tomentum, in well-preserved specimens) looks almost black. (Perhaps *cayennensis* is only a dark specimen of *apicalis* which is very likely to be found in Cayenne; whether *ephippium* LATR. is synonymous seems more doubtful). The wings have a rather weak blackish yellow ground color which is darker in the female than in the male; the alulae of both sexes are considerably darker than the wings. The eyes

of the female (and probably those of the male) have a diagonal brick-red streak during life. Near the apex of the dorsal ridge, found on the third antennal segment of the female, there is a small but deep pit which is probably a sense organ and is wanting in the other sex.

This species covers a large ground and is found even in Mexico. The larvae live in *Holochilus vulpinus* LICHT. and probably in other american *Muridae*. I have specimens from the states of Espirito Santo, Rio de Janeiro, São Paulo and Santa Catharina.

2. *Cuterebra rufiventris* MACQUART.

(Dipt. exot. Suite, 3^e. Subdiv., p. 21 (178) 1843).

Original description:

"Thorace nigro. Abdomine rufo. (Pl. 2, fig. 4).

Long. 9 l. ♂ Face à duvet et poils d'un jaune blanchâtre; une petite tache arrondie, noire, nue, luisante, pointillée de chaque côté des joues, près du bord des yeux; espace concave nu, à reflets blancs. Front mat, à petits poils noirs; un espace antérieur à petits poils jaunâtres; un autre espace, alongé, triangulaire, en avant des ocelles, d'un noir luisant; deux autres espaces arrondis, luisants, à petits poils noirs de chaque côté, au bord des yeux; l'un, fort pointillé, à la hauteur de l'insertion des antennes; l'autre, peu pointillé, un peu plus bas. Antennes d'un brun noirâtre; les deux premiers articles à petits poils jaunâtres; style à moitié antérieure noire, postérieure testacée, ainsi que les cils. Yeux bruns. Thorax d'un noir mat; deux bandes nues un peu grisâtres, peu distinctes au bord antérieur, ne dépassant pas la suture; côtés et poitrine à duvet jaunâtre; une tache, oblongue de duvet noir en avant de l'insertion des ailes, et un peu de duvet noir en avant de cette tache; ycusson nu et testacy en-dessous. Abdomen couvert d'un ypais duvet; premier segment noir, à bord postérieur fauve; deuxième et troisième d'un fauve rougeâtre, quatrième d'un fauve jaunâtre. Pieds noirs;

cuisses testacées au côté intyrieur; pelottes jaunâtres. Cuillerons bruns, bordys de testacy. Ailes brunes, noirâtres à la base et au bord extyrieur.

Du Brésil, aux environs de Pará".

Austen believes that the specimen described by MACQUART is a male and gives a long description of a female from Ecuador, from CLARENCE BUCKLEY's collection. I give its dimensions only: Length 23, 5 mm.; width of vertex $3 \frac{2}{3}$; of head $9 \frac{1}{3}$; of thorax at the base of the wings 9; of abdomen (2^d segm.) 11,5 mm. Length of thorax, with scutellum 11,5 mm; (a black and white illustration).

3. *Cuterebra nigricincta* AUSTEN.

Austen also gives a detailed and illustrated description of a new species, one specimen of which was found by BATES in Pará.

Unless the female be different, the species is easily recognised. Consequently I shall only give its diagnosis and its dimensions:

"♂ Length 19,5 mm.; width of vertex 3 mm.; width of head 8 mm.; width of thorax (at base of the wings) $8 \frac{2}{3}$ mm.; width of abdomen (second segment) 10 mm., length of wing 16,5 mm.

Black; dorsum of the thorax, except a small area on the anterior margin, clothed with black pile; central portion of the pleurae also clothed with black pile; abdomen metallic brassy green, shining, thickly clothed with silky golden-yellow pile, with a conspicuous band of black pile on the posterior margin of the third segment, the base also clothed with black pile."

4. *Cuterebra infulata* n. sp.

(Pl. 27, fig. 4. Pl. 29, fig. 4 (Face).

In this species, (shown in figure 4) all the lighter parts are covered with reddish yellow hairs. This applies to the face, the lateral edges of scutum and scutellum, where there is a band of long hairs, the whole ventral aspect, the inside of the tibiae and a large

part of the femora, starting from the base. Antennal groove and front soot colored; ocellar tubercle shining black. In scutum and scutellum, the ground is yellowish chestnut or reddish brown and covered with short and scarce hairs. Dorsum of abdomen either black or covered with reddish yellow hairs. Ground of legs almost black. Wings blackish with ferruginous base. The frontal calli can be seen in Pl. 9, fig. 4.

Total length of the somewhat bent body 20, that of the wing 17 mm. It corresponds to the largest specimens of *apicalis* but is a little stouter.

The only specimen was caught in Petropolis on November the 4th, 1909, by Mr. J. G. FOETTERLE.

C. infulata is intermediate between *apicalis* and *Schmalzi*, a good deal smaller than the latter but like it in general appearance and colour of the tomentum.

5. *Cuterebra nigricans* n. sp.

(Pl. 27 fig. 2; pl. 29 fig. 2 (face))

At first sight, this species is very like *apicalis*, but a careful examination reveals differences. As it has been obtained only once (by raising) it is probably rare and not widely spread. For these reasons I do not consider it identical with *cayennensis*, especially as the legs are not really black. From *apicalis* it differs in the following way; The front is reddish brown, the ocellar tubercle and callosities black, the latter very different from those of *apicalis* (v. fig. 1, 1a & 2). Scutum and scutellum black, with sooty hairs; only on the anterior border of the scutum there are silky yellow hairs, forming a crescent while on its sides two lateral striae of similar hairs are seen; these join at the end of the scutellum. Upper and under side of the abdomen like those of *apicalis*. Legs dark chestnut red with black hairs; under side of the femora lighter. Wings translucent, but much darker than in the male of *apicalis*; alulae nearly black. Abdomen very flat on top; on the scutum three faint striae of

darker colour. Length of body 21-22 mm.; length of wing 17 mm.

The only specimen was reared in Porto Martins, State of S. Paulo, from a larva found on a native rat. It was dated 31. III. 08. The empty puparium is like that of *C. apicalis* but very much darker.

6. *Cuterebra sarcophagoidea* n. sp.

(Pl. 27, fig. 5; 29, fig. 5 (face).)

This species was named *sarcophagoidea* because both colour and markings remind one of *Sarcophaga*; this likeness is particularly striking in fresh specimens, though they are much bulkier than even the largest *Sarcophagae*. *C. sarcophagoidea* is smaller than the other species of *Cuterebra*, but rather stout; this, and the broad tarsi produce a clumsy appearance. The ventral side is greyish white; this color reaches the upper margin of the antennal pit, and extends over the pleura and even the dorsum abdominis, where it takes the form of broad basal bands, with wide interruptions on the first ring and narrower and fainter ones in the next segments.

Ground of antennal pit, dusted with grey, borders, black in varying extension. Frons grey; ocellar callus, in shape of an acute triangle, reddish in front, black behind; facial calli black; upper ones without a sheen. Scutum and scutellum grey turning to reddish, with central reddish-brown stria and four fainter and interrupted striae on each side; the external follows the margin. They look reddish or blackish, according to the incidence of the light. Legs chestnut red; on the apex of tibiae and tarsi the hairlets are black, on the rest of the tibiae and on the femora whitish. Wings translucent, sepia brown; apex and anterior margin darker, base and veins more reddish; alulae sepia brown; thoracic squamae lighter with pale edge.

Both specimens, probably males, were caught in Jacutinga, in the northwestern part of the state of S. Paulo, at the end of April 1907. They were flying round the trunk of a tree, at a good height from the ground.

The description of *megastoma* BRAUER reminds one of this species, but the illustration in BAU's monograph looks very different.

7. *Cuterebra Schmalzi* n. sp.

(Pl. 27, fig. 3; Pl. 29, fig. 3 (face).)

Total length over 26 mm; that of wing about 20 mm.

Under side of face and thorax clothed with yellowish white hairs, which extend to the superior edge of the antennary pit and form a narrow band at the edge of the scutum. Front blackish-brown, with a few lighter intervals; ocellar tubercle shining. Ground of scutum grey, turning to reddish brown behind, as also in the scutellum; both without long hairs. In the center, a broad velvety streak of darker color, also passing on to the scutellum without reaching its apex. Each side shows two more stripes, but they are shorter and blurred, specially the inner ones. Between the central and the lateral bands, in the anterior part, a rather broad shining white triangle and other similar but shorter spots, between the lateral stripes. In certain lights the rest of the intermediary space also seems light, though it shows much less distinctly. Dorsum of abdomen thickly clothed with silky, reddish golden hairs. Both specimens have a central crescent shaped spot of dark color in the first ring; its convexity somewhat exceeds the posterior margin. The second and third segments of one specimen have a large, apical, velvety black band, which crosses the whole dorsum and ends in a point at the ventral extremity. In the other specimen, there is only a broad, crescent shaped spot on the apical margin of the second article; its convexity is directed forwards, and, at its broadest (in the median line), it hardly covers half the ring.

Abdomen very thick, convex in two directions.

Legs brown with a tinge of red, black cilia, and a few short yellow hairs, at the base only. Wings pale sepia brown, the

basis redder; alulae darker. Thoracic squama large, brown, with lighter edge, and dark rim inside.—The specimen with the dark bands seems to be a male; its eyes are hardly larger, but the antennal pit is narrower, and the last article undimpled. Unfortunately this segment is wanting in the other specimen.

This very conspicuous species, is dedicated to the late entomologist JOÃO SCHMALZ, from Joinville, who collected these and two other specimens. (Note: These have also been offered to our collection.)

II. Genus *Rogenhoferia*.

10. *Rogenhoferia dasypoda* BRAUER.

(Pl. 28, fig. 8.)

BRAUER established the genus *Rogenhoferia* in 1863, giving a very detailed description of it in "Verh. d. k. k. zool. bot. Ges." in Vienna, which was reprinted in his monograph. I shall not reproduce it here, but give the translation of another detailed description, which tallies with the characters of the species observed by me. There are three known species. The first described was *grandis* GUÉR., from *Patagonia*, which was placed amongst the *Cephenomya*, but withdrawn later on by BRAUER. CARLOS BERG thinks it was the same species that he observed near the capital of the Argentine Republic. He considers it a typical *Rogenhoferia* and describes both sexes, as well as the larva.

The type is *Rogenhoferia trigonophora*, from Bahia; it was described and illustrated by BRAUER, and has apparently not been found again. Later on BRAUER described another species, *R. dasypoda*, from Espirito Santo. The following is a translation of his description:

"Large entirely black species, save for the reddish-yellow arista and shiny brownish tomentum on the lower side of the hind tarsi. The last segments bear a few yellow hairs. Vertex half the width of head (about 3 mm.), clothed to the margin with short black hairs; *genae* shiny, almost bare from the level of the base of the antennae; at the

edge of the eyes and below it, clothed more densely with black hairs. Distinct ocellar area with three yellowish ocelli, almost bare and prolonged to the fissure of the ptilinum in a bare longitudinal line. Antennal groove, bare, shiny, with distinct keel. Vibrissal ridge with dense tufts almost forming a moustache, at the slightly prominent edge of the mouth. Lunula excavated, antennae short, the second article only little longer than the first, the three together forming a curve with internal concavity. Arista bare, rather long and slender, with elongate thickening limited to the base: the second article short. Cheeks broad, shining with few scattered hairs, of the same height as the eyes, with longer hairs only at the posterior margin. Rudiment of proboscis distinctly black and hairy.

Wings longer than the abdomen and covering it in repose; entirely blue black, but for the anterior margin at the apex, from the ends of the second and third vein and along the apical transverse vein where it is brownish hyaline. Alulae rather large, blue black; squamae brown black; halteres black, small transverse vein oblique, anterior to the end of the auxiliary vein. Apical transverse vein first forming a right angle at the bend, afterwards nearly straight, the bend with a fold but without an appendix. Legs strong, tibiae somewhat bent and base of the hind femora somewhat thickened, with short and dense pile; only the base of the hind femora with dense tufts of longer hairs and on the hind tibiae a brush of longer hairs which occupies the whole dorsal side, excepting the basal fourth. The last four tarsi somewhat dilated, chiefly the 1st and 2d pair; the first tarsus of hindlegs nearly twice as long as the second. Ungues and pulvilli large and strong. Abdomen with dense black pile, the apical edges of the segments with more scattered hairs, very shiny; the shiny part extends the middle, so as to form a longitudinal design, but does not show the triangles seen in *C. trigonophora*. The hypopygium small and depressed, shut in a circular pit in front of the sharp edge of the preceding

segment; it seems formed by two or more telescoped rings, which may be somewhat extruded downwards or slightly forwards (♀) and be enclosed by the rim of the fourth ring. Looking at the head from below, one sees the groove of the proboscis, beginning behind the angle of the vibrissae, as a furrow, enlarged backwards so as to form a deep oval pit, in the middle of which the rudimentary proboscis sticks out. . . No palpi are found.

Length of body 18 mm, including the folded wings 22 mm.

Length of wing 16 mm.

Espirito Santo, Brazil.

The specimen shown in the figure was caught on Dec. 1st 1908 by Mr. FOETTERLE in Petropolis. It is undoubtedly *R. dasypoda* BRAUER.

11. *Rogenhoferia trigonophora* BRAUER.

(Verh. der K. K. zool- bot. Ges.-Vienna 1863).

I only give the dimensions and a translation of the diagnosis from BRAUER's description:

"Diagnose: *R. atra*; holosericea, thorace supra atro, ad suturam pilis aureis parum piloso; abdomine atro, linea dorsali triangularis nudis, lucidis; segmentorum marginibus pilis aureis cingulatis; alis nigro-fuscis, violaceo-micantibus.

Width of vertex 3 mm.; width of head 7 mm., length of body 17 mm., length of wing 14 mm. Habitat: Bahia, Brazil. Received from my friend A. Rogenhofer".

(Note: I have since received 4 specimens, collected by Mr. J. ZIKÁN in Passa Quatro, Minas. They agree with in BRAUER's description, but in his drawing the golden hairs are rather too striking.)

III. Genus *Pseudogametes* BISCHOF.

The following extract from "*Anzeiger der Kais. Akademie der Wissenschaften, Mathem. Naturw. Abth., Jhrg. XXXVII. Wien 1900*" refers to this genus:

Prof. F. BRAUER, presents the following

communication by JOSEPH BISCHOF, medical student: "Preliminary characterisation of some genera of Muscaria."

I give only the passage which refers to *Pseudogametes*:

"*Pseudogametes* n. gen. It differs from *Cuterebra* by its arista which is pennate on both sides and also from *Rogenhoferia* BRAU. and *Bogeria* AUST., which have bare aristae.

Type: *Hermanni* n. sp.; ♂ from Minas Geraes. Length 16,8 mm.

It is in every way so like *Rogenhoferia dasypoda* that it might be taken for the male of this species."

At another meeting (N. XV. page 155.) F. BRAUER presents another notice by the same author under the title: Some new genera of Muscidae. (This does not seem to have been printed.)

The types of these genera are in the Hofmuseum in Vienna; *Pseudogametes* was sent by Prof. HERMANN in Erlangen.

I give the following description of the genus which is based on a study of the two known species:

Large, stout and very hairy flies, with thick and broad, ciliated legs. Head and abdomen depressed, so that the axis of the body seems curved when seen from the side. The facial profile is not convex, but the margins of the antennary pit, especially the lower one, are very prominent. The hairy front protrudes between the eyes, when it is looked at from above; the rest of the face forms a continuous callosity covered with long but isolated hairs; *genae* and *malae* separated by a gutter like depression. The whole body especially the very prominent scutellum is clothed with long non ramified hairs. Wings dark, with large lobules and open apical cell; angle of transversal apical vein sometimes with short appendix ending in a fold of the membrane; the fifth vein very often reaches the margin, but the piece outside the transversal vein is very much reduced and sometimes very difficult to see, only the base being distinct. Antennal groove very excavated, median ridge obliterated, the ground in its upper part slightly dusty, for the rest

shining, sometimes a little wrinkled. Third antennal article undimpled, much longer than the other two together, closely applied, whereas the pennate arista is salient, with more outstanding upper hairs. Eyes small, but very convex; in the female they are of the same size but set wider apart. This genus differs from *Rogenhoferia*, not only by the arista but also by the shape of the antennary pit and the head.

12. *Pseudogametes Hermanni*, Bischof, 1900.

(Pl. 28, fig. 7).

I have two specimens of this species; their size and uniformly black color, agree with BISCHOF's indications. (The rest of the characters can be taken from the description of the genus.) They were caught in the North-West of São Paulo, on a tree, at a good height from the ground, and evidently have habits very similar to those of the following species:

13. *Pseudogametes semiater* WIED.

(*Musca semiatra* WIED.)

We give the original diagnosis and an english translation of the description:

"Capite, thoraceque atris, scutello abdominisque tergo rufis; antennis sub fronte semioccultis. - 7l. From Brazil.

"Head deep, black, frons large, protruding in front above the antennae, so as to half-hide them, shining at the sides. Under face very much depressed below the antennae, the anterior edge sloping considerably, the sides clothed with black hairs. Ground color and hairs of thorax deep black; scutellum thickly clothed with long reddish-yellow hairs. Dorsum of abdomen with thick reddish-yellow pile; venter deep black. Wings blackish-brown, venation as in *Musca*. Squamae blackish brown. Legs black. Obtained from Dr. LUND".

Though WIEDEMANN hinted that this fly belonged to some new genus, he did not connect it with *Trypoderma* (*Cuterebra*) or other Oestrinae. His specimen, pro-

bably a male, seems to be the only one in dipterological collections; it may have been gathered by Dr. LUND near Rio de Janeiro, where he was in 1826. This species seems to be rare, as my now numerous specimens took many years to collect and were all found in the same place, except one male from Alegre in Espirito Santo.

WIEDEMANN's description leaves no room for doubt about the identity of my specimens nor does it call for further particulars. The rarely seen females are larger, with broader abdomen, darker wings and the colored hairs less reddish and more yellow.

This species is well illustrated in one of the plates accompanying our article.

It was discovered in Petropolis by Mr. FOETTERLE, who makes a special study of Lepidoptera. Over a hundred specimens, almost all males, were collected in several years; with only two or three exceptions, they all occupied the same small section of the trunk of the same tree, 3-4 meters from the ground. They were found in the summer months only and chiefly in February. The first appeared almost exactly at 9 o'clock in the morning; they settled on the bark remaining there for hours on stretch and were almost always solitary, never in large numbers.

The whole aspect of the voluminous body of *Pseudogametes* is so like that of the American *Oestrinae*, specially of *Rogenhoferia* that most dipterologists who examined them did not hesitate to consider them as such. Only WIEDEMANN, who hardly knew this group, used the word *Musca*, while TOWNSEND considers it allied to *Mesembrina*. Though it is hardly likely that *P. semiater* is a parasite of Vertebrates, I believe, that, for the time being at any rate, it should be classed with the *Oestrinae* of which it may be a more primitive form, likely to supply interesting philogenetic indications.

IV. Genus *Dermatobia*.

Dermatobia was separated from *Cuterebra* by BRAUER in 1860. The former seems to consist of only one species which for the

sake of priority ought to be called *D. hominis* (SAY), though *cyaniventris* (MACQ. 1843) and *noxialis* (GOUDOT 1845) are better known names. I will only make a few remarks about it as it has already supplied enough matter for publication. The drawings contained in them are not quite satisfactory, therefore I also give a new one.

The specific characteristics coincide with the generic ones; I give a synopsis of the most evident. "Size small as in *Calliphora*. Wings hyaline, with slightly developed lobules. Legs slender and bare with less broad tarsi. Scutum not metallic, striated. Abdomen bare, metallic blue".

BRAUER gives a very minutions description of this genus and BAU a more condensed version of it. Follows a translation of the latter, with a few additions of my own in brackets: "Head broader than thorax, hemispherical. Eyes small. Frons broad, forming a conical protuberance. Antennal groove deep, elongatedly oval; dividing ridge rudimentary. Antennae touching each other at their base, drooping. First and second articles short, the third more than twice the length of the first two, ridge-shaped (sub-cylindrical, with dorsal ridge); at the base it broadens backwards, being narrower at the apex. Arista (springing from the ridge), outstanding in a latero-horizontal direction, pennate on dorsal side. Mouth opening rather wide. Proboscis retracted. Under face somewhat vesicular. Scutum almost square.

Legs delicate, slender. Tarsi slight, not flattened. Ungues slender, somewhat longer than the empodia. Wings rather long, with elongated hemispherical lobule. Transversal apical vein present; first posterior marginal cell open. Fourth longitudinal vein without appendix, squamae large. Abdomen heart-shaped, flat, sharpened at the rear. Dorsal tergites folded under, metallic; abdominal ones small, lustreless."

Dermatobia cyaniventris MACQUART.

Say's description is unknown to me. MACQUART's is as follows; "*Cuterebra cyaniventris* NOB.

Long. 5,5/ ♀. Face jaune. Front noir à duvet grisâtre et base testacée. Antennes jaunes; troisième article quatre fois aussi long que le deuxième; style ne paraissant cilié qu'en dessus. Thorax d'un noir bleuâtre, à léger duvet gris et poils noirs serrés. Abdomen déprimé, d'un beau bleu métallique, un peu violet. Pieds d'un fauve clair. Cuillerons et ailes un peu brunâtres.

Du Brésil. Muséum.

In his important monograph GOUDOT gives a slightly more detailed description;

"Longueur 17 mm; antennes jaunes, le premier article ayant à son extrémité une petite houppe de poils noirs courts, le troisième à lui seul au moins aussi long que les deux autres, le style un peu brun, n'ayant de cils qu'en dessus. yeux bruns avec une bande noirâtre au milieu; front avancé obtus, brun, à poils noirâtres; à face et cavité frontale fauves, couvertes de petits poils formant duvet, qui font paraître ces parties d'un blanc soyeux; thorax brun nuancé de bleuâtre, tacheté de gris et noir formant des zones longitudinales, couvert de poils très courts noirs. écusson comme le thorax; abdomen chagriné, d'un beau bleu couvert de très petits poils noirs, avec son premier anneau et le bord antérieur du second d'un blanc sale, ayant des poils de la même couleur; pattes fauves, à poils fauves; ailes brunes. Individu mâle.

Habitation; la Nouvelle-Grenade".

The eyes of living specimens are brick red and show no pattern. The ground color varies a little on face and legs; for the rest our specimens agree with the descriptions and are undoubtedly of the same kind.

We will not describe the larvae, which vary a good deal from one stage to another. On this account I suppressed the parts dealing with them (and with the pupae), in the foregoing descriptions.

The scutum is not properly described. The pattern on it varies with the incidence of light (as in *Sarcophagae*), and in old specimens is often obliterated. Our illustration gives a good idea of its most common aspect.

I have examined a great many specimens, from different states, without finding any specific differences.

To the already long list of hosts of *Dermatobia* may be added *Grison vitatus*, in which Dr. TRAVASSOS found a larva afterwards examined by me.

V. Genus *Gastrophilus* LEACH.

The larvae of the genus *Gastrophilus* live in the stomach of *Equidae* and are easily carried to distant countries. I, for instance, have found a species, which attacks horses on the island of Oahu (Hawaii) where horses were unknown before the advent of the white race. Another instance is the finding of a fly I determined here (shown in fig. 9) which had hitherto been only known from the North of Africa. I was told that a similar fly was found in Maranhão, but was unable to obtain a specimen. Up to now, I have not heard of other observations of imported *Oestrinae* in Brazil, but a kind of *Rhinoestrus* attacking sheep has been introduced to the River-Plate and may already have found its way to this country.

BRAUER gives very full descriptions of the genus and its species. I will only reprint the indications which are useful for the determination of the genus and the species *G. equi* and *asininus*.

Gastrophilus LEACH.

Wings without transversal apical vein, the fourth ending at the posterior margin.

Abdomen sessile; antennary arista bare, squamae small, generally with long cilia, not covering the halteres; mouth-parts very small; palpi small, spherical, well inside the small oral depression; proboscis attached to the membrane that covers the oral depression, not extensible".

Gastrophilus equi FABR.

Transversal posterior vein always present and placed immediately behind the small one. Wings hyaline, with smoke-colored transversal band in the middle, and either an

elongated spot or two smoky dots, at the point. The female has a rather long, stout, downward bent ovipositor. Trochanters, with a long and bent hook on the under side, in the male; with a tubercle, in the female; both with a corresponding notch on the under side of the femora. Abdomen brownish-yellow, variegated. Length of body 13-16 mm. Testaceous species, with brown spots and greyish yellow hairs; thorax with interrupted belt of black hairs, behind the suture; more rarely with reddish hairs only".

Gastrophilus asininus BRAUER

(Pl. 28, fig 9.)

Speaking of two flies bred by BILHARZ in Egypt, from larvae expelled by a donkey, BRAUER says:

"Their general aspect is very different from all my specimens of *C. equi* and after examining them, both Mr. WINNERTZ and Prof. WESTWOOD thought they might belong to a new species. They differ from *G. equi* in the following things: the hairs on the scutum are uniformly reddish brown; the abdomen is almost free from spots; the wings are much wider and have a brown streak which is much broader in the middle than at the posterior margin; the brown color extends to the back of the fifth longitudinal vein. A very similar specimen from Nubia is to be found in WINTHEM's collection. . . Should the african specimens prove to belong to another species, closely allied to *G. equi*, I propose the name of *G. asininus*".

My specimen tallies perfectly with BRAUER's description and is clearly different from the real *G. equi* which I have in my collection. I am sure it is another species and consequently accept the name proposed by BRAUER.

The ovipositor is clearly shown in my specimen, a female which was caught in the south of Minas. It is almost certain that it was introduced by asses, imported for the breeding of mules.

(Note.—Dr. ESPIRIDIÃO QUEIROZ observed the emigration of several larvae from

a horse, lately arrived from Europe. They probably belonged to some species of *Gastrophilus*).

On the parasitism of the american Oestrinae.

Dermatobia hominis has been observed in a vast territory and has a great number of very different hosts. Of these, the ox is nowadays the most important and is in itself quite sufficient to guarantee the active propagation of the species as it seems unable to get rid of it. Dogs used in hunting commonly show the larvae and people not rarely. The horse, on the other hand, is though almost entirely the mules also in a lesser degree. This fact can not be due to a defensive act, which might explained it in case of a direct transmission, but not in that of an indirect one.

The other kinds of Oestrinae only attack rodents. BRAUER claims to have examined *Cuterebra* larvae found by NATTERER in *Sciurus aestuans* and *Didelphis philander* in Ipanema; the latter must be an exceptional case. These small marsupials must still less be included among the hosts of *Rogenhoferia* though BRAUER has done so. During 35 years I have not had any confirmation whatever of this assertion and, in the last 10 years, all inquiries in this direction gave negative results.

Even among the rodents, only a few species are attacked, a fact which proves that the *Oestrinae* are very specialised in their choice of hosts. The most affected are the native *Muridae* from which I gathered two kinds of *Cuterebra* and BERG one of *Rogenhoferia*. In certain places, especially on the coast, many squirrels (*Sciurus aestuans* vulgo *caxinguelé* or *serelepe*) have been found with larvae differing from those of *C. apicalis* by their darker color, more like that of *C. nigricans*. In North-America the hares are attacked by a species of *Cuterebra* and of *Bogeria*, but *Lepus brasiliensis* seems free from larvae in the skin. It is strange that all the large rodents like the *capivara* (water-hog) the *aguti* and the *paca* seem completely immune; the same probably applies to introduced *Muridae*.

There was not a single infected specimen among the thousands of rats, *Mus decumanus* or *albiventris*, examined while I was director of the bacteriologic Institute of S. Paulo, though there were two infected specimens of *Holochilus vulpinus*, among the very few rats belonging to other species.

Whatever the mode of infection, it seems evident that the larvae can only attack a few, selected species.

The parasitism is well supported though the larvae may attain the size of the hosts head; this may be due to the fact that the parasite is not free in the subcutaneous tissue, but imprisoned in a sac, probably formed by a sebaceous gland or another dilated follicle of the derma. As can be seen in *Dermatobia*, the larvae have prickles or rough scales and provoke a sero-purulent secretion on which they live. When the larva is removed, the secretion stops at once, long before the wound is shut. Cellulitis is sometimes observed on the scalp of children, but it is due to abnormal conditions and does not occur in loose skinned animals, which do not try to get rid of the parasite by violent means. I do not think it probable that the *Cuterebra* larvae living in the scrota of North-American squirrels provoke castration. If the testicles have not simply been displaced to the abdomen, it is more likely that they were removed by another male of the same species, as is often the case in domestic rabbits. The development of the cutaneous larvae is slow and, if their parasitism were not well supported, the continuity of the species would be endangered.

The material for a study on the larvae is scant and generally badly preserved, except that of the already rather well known *Dermatobia*, so I will not enter into a discussion of their characteristics.

It is impossible, as yet, to be even sure of the genus to which larvae belong. *Cuterebra*, *Bogeria* and *Rogenhoferia* are all cutaneous parasites of Rodents. For *Pseudogametes* it has never been proved and I know of no host of cutaneous larvae in Petropolis, where my specimens were caught. If there

were one, it could hardly escape detection, on account of the relative frequency of the species and the large size the larvae must attain, especially as the region of Petropolis is well known.

Sex differences in American Oestrinae. Biological notes.

It is very difficult to determine the sex of dry specimens of our *Oestrinae*. The size and distance between the eyes give no reliable clue, specially where only one sex is present.

Some have very small antennae, but this does not seem to be a sex character; it is rather due to imperfect distension. (Like the wings, the antennae only develop after the fly has left the puparium and are small and shrivelled at the time of the ecdysis). The females of *C. apicalis* have a dimple in the terminal article of the antennae; this is not found in the male but may also be wanting in other species. In *Pseudogametes semiater*, the female has a bigger abdomen and is altogether larger than the male, but the difference is not always very accentuated in this and in other species.

The ventral sclerites of our *Oestrinae* are quite reduced; the dorsal ones pass on the under side, so that the lateral membranes become ventral. In dried specimens they are retracted, and with them also the posterior extremity of the abdomen, so that the genital appendices are hidden. In recently transformed specimens the abdomen is distended by liquid so that after pressure, or even directly, the segments, which later on will be retracted, may show plainly.

It is then easy to distinguish the female *Dermatobia*, by its ovipositor, from the male which has a distinct and rather complicated sexual structure of dark chitin. The female also protrudes her ovipositor, when she hovers around animals.

In order to determine the sex of dried specimens, the last ventral segment may be removed, or the contents of the abdomen examined; in the female they consist almost entirely of eggs. By the use of these methods,

I found out that the females of *Cuterebra* and *Pseudogametes* also have an ovipositor, though it is shorter, the males a well formed genital structure. There is a great analogy between their organs and those of the domestic fly. The eggs are always shaped like bananas and have a lid at one of the extremities. In one female *Dermatobia* I counted over 900 eggs and NEIVA found a mean number of 750-800. TOWNSEND calculated that there are about 10,000 ripe eggs in a species of *Cuterebra* he examined; the eggs are very small in proportion to the size of the animal.

On the whole, there are more female than male specimens of *Dermatobia* and *Cuterebra*, caught. Of *Pseudogametes*, at least of the species *semiater* there are more males than females seen. These Oestrids fly perfectly but are rather lazy and remain seated in the same place for hours. I have seen *Dermatobia* absorb liquids by means of the proboscis. It does not seem to mate in the first days after ecdysis. All our *Oestridae* buzz and a *Cuterebra*, shut in a breeding glass, makes a noise like a *Bombus*.

I have often witnessed the ecdysis of *Dermatobia* and even had it cinematographed. The fly dislocates the lid at the end of the puparium by violent efforts of the ptilinum which swells to the size of the head and works in and out with rhythmic motion. By applying pressure, the ptilinum may be extruded even some time after the ecdysis. On leaving the pupa the fly walks briskly; the wings take a little time to dry and fill with air; the rest of the body also requires some time to dry and assume its natural colour and consistence.

As in other diptera, the ecdysis is rarely made in darkness. After waiting the necessary time 33-37 days according to NEIVA's and own observation, the ecdysis may be rapidly obtained by exposing the pupa to sunlight after keeping it in a dark place, or even by lifting the lid and breathing on the imago, as BRAUER advises. Unless I am mistaken, the pupa state of a *Cuterebra apicalis* bred by me one, lasted eighty days; for

Rogenhoferia grandis it may amount to forty three days, as observed by Berg.

Dermatobia was raised several times from larvae obtained from animals by SCHMALZ, LUTZ, YOUNG, NEIVA and others. They can be collected after leaving their host, or while they are doing so, or contemporary larvae may be extracted. I prefer to raise them in saw-dust. They burrow at once and the external covering is formed in a few days by the desiccation of the outer skin. They will even metamorphose entirely exposed, if not allowed to get too dry. *Cuterebra* and its allied genera do not seem to offer greater difficulty, if larvae in the last stage (or living hosts which allow one to wait for the ripening of the larvae) are obtainable.

Still have a few words to say on the egg laying of our *Oestridae*; up to now it has not been witnessed, nor have recently laid eggs and larvae been found. It may however be affirmed that they are oviparous; many specimens, some of which have been caught by me while hovering around animals with extended ovipositor, were examined and excluded all doubt on this point. They never contained any larvae in or outside the egg shells. *Dermatobia* is not commonly seen flying in day time, but in the course of some years I got more than a dozen specimens, which were caught on horses together with Tabanids. I myself have seen several specimens flying round horses and once round a person, and picked three live specimens from a very tame black bull; they were noticeable as the brick red colour of their eyes contrasted with the dark skin of the animal. All these specimens contained well developed eggs but no formed larvae.

According to GONÇALEZ-RINCONES and SURCOUF the eggs are laid on leaves from which they pass to the venter of mosquitos, by adhesion and infect animals stung by them. In the Welcome Institute in London, I saw a specimen of the *Ianthinosoma Lutzi* with a cluster of eggs; as I expected, the seemed to have been deposited on the insect itself. They could not be distinguished

ed from egg clusters which I had thrice observed on the back of *Anthomyia Heydenii* WIED., sitting on horses, long before the appearance of the paper referred to. I kept a specimen on a pin, but saw no larva emerging and now this specimen has been lost.

On this specimen the eggs were very close together and so small that they might have been laid by another fly of the same kind, but this is not the case. In a fazenda, where Dr. ARAGÃO spends his holidays, it was noticed that specimens of *Dermatobia*, caught near horses, held other small diptera in close embrace between their legs. He showed me this while I was staying at the place. If these eggs really belong to *Dermatobia*, as these observations seem to prove, they must be directly laid on the diptera which absorb blood or sweat, such as the *Anthomyia* caught on horses and cattle by me. They may easily be captured by *Dermatobia* and the eggs deposited by the forward bent ovipositor. This also explains why people in the affected countries attribute larvae in the skin to mosquitos or even to other flies.

I have two other much older observations on the same point to report. One of my collectors told me that once while in the woods he distinctly felt a sting on a part of his skin, from which three days later, I extracted the smallest *Dermatobia* larva I had seen up to then. Another time, I saw a patient suffering from typhoid fever, who had two bernes in the sacrolumbar region. He told me that one, day when his bed was made, a big blue fly was found crushed in it. The back of this hospital in which another case, that of a nurse, was turned toward uncultivated grazing grounds and the windows were constantly open, in spite of a great number of mosquitoes coming in from that side.

In the first case the transmission was probably due to a mosquito, in the second to a fly, which might even have been a *Dermatobia*, carrying the eggs of another one. It is quite evident that if the eggs are laid directly on insects caught on animals, to which they often return, the result is much more

likely to be favourable than if the eggs were laid on leaves chiefly visited by insects which do not seek out larger animals.

It would also be necessary to stick the eggs on the leaves by their cephalic end, so that they might fix themselves by the caudal extremity on the mosquito. All this is very unlikely and finds no analogy among other known facts.

The statement made by MORALES in Guatemala (that the eggs are laid directly on the insects) is thus confirmed. TOWNSEND also shares this opinion.

Concerning the egg laying of *Cuterebra*, nothing is to be found in the literature. As TOWNSEND remarks, the large number of eggs is not compatible with their being deposited on the host. Some years ago, I kept a female *Cuterebra* with a very tame white rat, I obtained no eggs and even lost the fly, which was probably eaten by the rat. Another time, I tried to obtain eggs by a rather strong pressure on the abdomen of another female of the same species, but without result. I then shut the fly in a small wire case. Next morning I found the wire netting dotted with many small eggs. They were firmly attached by their base and had already become black. They were observed for some time but no larvae emerged. The cage was exhibited twice but got lost afterwards

Additional observations.

The present paper had been ready for a long time, when I found an opportunity to make some new observations on the egg laying and development of *Dermatobia* and also on the existence of *Oestrus (Rhinoestrus) ovis* in this country. I publish them here so as to complete what I have already said.

On the evening of Sept. 7th 1916, while on a fazenda near Juiz de Fora, I saw, by the aid of a field glass, two *Dermatobia* flies sitting on calves at the edge of a wood. Soon after, they alighted on the horses of our carriage and were caught. One of them contained a great many eggs. Shortly afterwards,

I saw a fly with a typical egg cluster on the left side of its abdomen. It hovered around the horses and the people and was finally caught. It proved to be a small male of *Synthesiomyia brasiliensis* BR. & BERG. and carried ten eggs stuck on solidly, lid downwards. This fly was put into a small glass tube with a piece of banana, but it died on the morrow.

It was then pinned on a piece of pith of *Fatsia papyrifera* so that the eggs might be observed and brought near the skin of any animal. They were examined every day and breathed upon so as to imitate the conditions found near the skin of a warm blooded animal, or approached to the human skin.

On the 11th the darkening colour, and the more distinct lid of the eggs, indicated the development of the larvae. On the 12th, the fly was examined under low power, after having been breathed upon; an open lid and the head of an emerging larva was seen. It was brought near the skin of my forearm and after some hesitation, passed on to it, where it was observed by a binocular microscope. It moved about rather rapidly without showing any inclination to burrow. The anterior $\frac{3}{7}$ ths were densely covered with large and small thorns, the posterior $\frac{4}{7}$ ths were bare. It had the typical form of a *Dermatobia* larva already. The fly was then put near to the arm of another person and a second larva emerged, and tried to burrow in the skin. Much later, another larva was induced to pass on to the arm of a third person, but it began to dry up before penetrating.

I then transferred the two first larva to the shaven dorsal skin of a dog, and put the fly in the vicinity of the same; four or five other larvae emerged almost entirely from the eggs and soon passed on to the skin where they remained for some time, being unable to penetrate at once. Some time afterwards they had all disappeared.

This experience tends to prove that the non perspiring skin of the dog has more attraction for the larvae than the human skin in the same condition.

Partly emerged larvae may retire into their eggshells again and their lids close down

over them.

Of the two *Dermatobia* I had caught, one died at once; the other one was imprisoned with a fly which it caught several times, failing to deposit eggs on it. It seemed already rather weak and died soon after. I found many rather developed eggs in both of them.

At four o'clock of the same day, I allowed another larva to get on my skin, but it did not burrow; it was removed and used for a microscopic preparation later on.

On the following day, at half-past eight a. m. there was still one egg with a larva in it which on being brought near my arm, passed on it at once and moved about for a long time, almost like a geometrid larva, without trying to burrow. These movements were not felt. On doubling the skin over it, a slight irritation was felt and the larva was seen to burrow in an almost horizontal direction. It took a long time to introduce its first articles and an hour to penetrate up to its last fourth, which remained horizontal and visible from the outside, being only covered by the corneous layer. The penetration of the larva caused a slight caustic pain, unlike that of a sting. When the burrowing was finished, I felt nothing more.

On the next day, there was no alteration in the dogs skin. My arm showed some redness at the point of penetration where the last fourth of the larval skin still appeared; it was apparently empty and suggested a moult. From noon to evening I felt a slight itching.

Next morning, the dog showed no signs of infection. On my arm, was a dry scab at the site of penetration. When this was removed, there appeared an extremely fine orifice, from which a drop of serum could be expressed. Under the microscope the movements of the posterior end of the larva could be seen but it was retracted when the serum was removed. In the afternoon the same phenomena were even more distinct. After being carefully shaved, the skin of the dog showed several orifices from which serum exsuded; it sometimes con-

tained air bubbles. The caudal ends were rather retracted and difficult to perceive.

On the 17th (the next day) there was a very characteristic papule on my arm. I removed the central crust and expressed a drop of serum; in the afternoon it occurred to me to cover the droplet on the arm with a cover glass. A still quite slender and almost colourless breathing tube which showed distinct movements was then projected. The same process enabled me to see the equally slender and colourless posterior end of another larva in the dog.

Next day (on the 18th) I tried to obtain the emergence of the larva which provoked a slight itching, in my arm, by covering it with gelatine and agar. It projected the posterior end but was unable to come out and remained motionless for some time. I then removed it by pressure which somewhat damaged it. Its appearance was almost like that on the first day and there was no sign of a moult. In the morning only one of the larvae was visible in the dog; it looked very much larger.

On the 20th the larvae in the dog showed tracheal openings and very much enlarged posterior ends.

I was able to obtain two eight days old larvae; one whole, the other in fragments. They had moulted and were very much longer; the posterior part especially had grown in every direction. The whole larva, observed for some time, at the temperature of the room, showed no signs of life. It was 7 mm long. The exsudation of the sac, occupied by the larva, was mixed with pus.

On the 22d, another larva was observed, but it was impossible to extract it, even after incision of the sac. The larva was obtained the next day, by plugging the hole. The part of the body covered with spines was much shorter than the last, very elongated segments. The posterior ends of the large tracheae were yellow. The maggot had attained one centimeter of length, thus suggesting that the stouter thorny part must have reached the subcutaneous tissue. The skin of the larva was entire but eviscerated.

The viscera were recovered separately.

A short time after this, our artist caught a fly on a fazenda in the Serra da Bocaina, on which he saw the characteristic spot due to a cluster of *Dermatobia* eggs. It was an *Anthomyia* which often seeks out man and animals so as to lick their sweat; the species was probably *A. lindigii* SCHINER. The cluster it carried was composed of seventeen eggs, attached to the abdomen near the middle of the left latero-inferior region. It remained alive for a day, dying afterwards. The eggs showed no signs of life; their brownish colour deepened and they shrivelled. On opening them, I found dead larvae, which had probably been unable to reach a suitable host in time. In fact the fly was caught far from a pasture but near running water. I kept the fly and the egg cluster separately.

On the occurrence of *Oestrus ovis* in Rio de Janeiro and the neighbouring states.

On Sept. the 30th, 1916, I received a fly caught by Mr. A. LUCE in the Rua S. Francisco Xavier, in a suburb of Rio. Recognizing an *Oestridae* and knowing that there were some sheep near the place, I immediately compared it with BRAUER's detailed description of *Oestrus (Rhinoestrus) ovis* and found that it undoubtedly belonged to this species. Later on, I examined two sheep which had died in the same place, showing the symptoms observed in severe cases of *Myiasis oestrina* but found no larvae. The infection was probably brought from a fazenda in the Serra da Bocaina, where animals descended from European stock had shown the same symptoms.

I searched for larvae in the slaughterhouses. At that time none were found in Rio but I obtained some from Petropolis; they had been found in native sheep bought in the neighbourhood. Later on I also received some from Dr. ESPIRIDIANO QUEIROZ, physician in Tres Corações (Minas).

Rhinoestrus ovis was doubtlessly impor-

ted, and that is by no means unusual. It is commonly found in sheep from the the River Plate and the larvae are well known to the people working at the slaughter houses who however know nothing of the flies.

BRAUER included Brazil in the habitat of *Oestrus ovis*. He was perhaps referring to

Rio Grande, as the occurrence in São Paulo and Rio was not noticed before. I had no native specimen in my collection. Nowadays however it must be found in several places. The specimen, caught in Rio proves that this fly is not confined to the cooler mountains, but also invades the tropical regions.

Literature.

The literature up to 1906 can be found in the two following monographs:

- BRAUER, FR. Monographie der Oestriden. Wien 1863.
BAU, ARMINIUS Diptera, Fam. Muscaridae. subfam. Oestrinae, WYTSMAN
Genera Insectorum, No. 43 Brussels 1906.

Papers published after this date, or on species mentioned in the present article:

- BERG, CARLOS Entom. Zeit. Stett., Bd 37, p. 268, 1876; Bd. 42 p. 45, 1881. Stettin. — on *Rogenhoferia grandis*.
AUSTEN, E. E. On the specimens of the genus *Cutiterebra* etc. Annals and Mag. of Nat. Hist.; (6), XV, pp. 337-396, 1895.
Further notes on *Cutiterebra*. Ibidem Vol. XVI, 1896. (Contains a discussion of the specimens in the Brit. Mus. and descriptions of new genera and species).

Of the extensive bibliography on *Dermatobia* we only mention:

- BLANCHARD, R. Bulletin de la Soc. Entom. de France, Vol. LXV, 1899, p. 541.
SURCOUF, JACQUES La transmission du Ver macaque par un moustique. C. R. Ac. Sc. 1913, T. 156, No 18, p. 1406.
SAMBON, L. W. Observations on the life-history of *Dermatobia hominis* etc. Rept. Advis. Committee, Trop. Dis. Res. Fund for 1914, London 1915. App. p. 119-150.
TOWNSEND, CHARLES On the reproductive. . . habits of *Cuterebra* and *Dermatobia*. Science, Vol. XLII, N. 1077, p. 252.
(The last three works refer especially to the transmission of the eggs of *Dermatobia*.)

There are also four Brazilian papers on *Dermatobia* and another on observations made in Joinville. (Brazil)

- MAGALHÃES, PEDRO S. Subsidio ao Estudo das Myiases. Rio de Janeiro 1892.
NEIVA, ARTHUR Contribuição ao Estudo da *Dermatobia cyaniventris* MACQ. Rio de Janeiro 1908.
Algumas informações sobre o berne. Chacaras e Quintaes, Vol. II, No 10, July, 1910.
Informações sobre o berne. Memorias do Inst. O. Cruz T. VI, Fac. III, 1914.
SCHMALZ, J. B. Zur Lebensweise der brasil. Dasselfl. (*D. cyaniv.*) Insekten Boerse, Jahrg, 18, No. 28, p. 220, 1901.

Explanation of Plates 27-29.

(See Vol. IX, n. 1, 1917.)

Plate 27.

- Fig. 1 *Cuterebra apicalis* GUÉRIN
 « 2 « *nigricans* n. sp.
 « 3 « *Schmalzi* n. sp.
 « 4 « *infulata* n. sp.
 « 5 « *sarcophagoides* n. sp.

Plate 28.

- Fig. 6 *Pseudogametes semiater* WIEDE-
 MANN.
 « 7 *Pseudogametes Hermannii* BISCHOF
 « 8 *Rogenhoferia dasypoda* BRAUER

- Fig. 9 *Gastrophilus asininus* BRAUER
 « 10 *Dermatobia hominis* SAY.

Plate 29.

- Fig. 1 Face of *Cuterebra apicalis* ♀
 « 1a « « « « ♂
 « 2 « « « *nigricans*
 « 3 « « « *Schmalzi* ♀
 « 4 « « « *infulata*
 « 5 « « « *sarcophagoides*
 « 6 Abdomen of *Dermatobia hominis*
 SAY.
 « 7 Abdomen of *Gastrophilus asininus*
 BRAUER ♀.