

FLY PARASITES (DIPTERA: OESTRIDAE AND
GASTEROPHILIDAE) OF THE AFRICAN
ELEPHANT *LOXODONTA AFRICANA*
(BLUMENBACH) AND THEIR PROBLEMS

by

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and

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The African elephant is known to be parasitized by the larvae of the following oestroid flies (Zumpt, 1965):

Pharyngobolus africanus Brauer—Pharyngeal region

Platycobboldia loxodontis (Brauer)—Stomach

Rodhainomyia roverei (Geddoelst)—Stomach

Ruttenia loxodontis Rodhain—Dermal tissue

Neocuterebra squamosa Grünberg—Dermal tissue

Pharyngobolus africanus Brauer

Pharyngobolus africanus, the “African Elephant Throat Bot Fly”, was described from a third instar larva found in the upper oesophagus of an African elephant which had died in the Zoological Garden of Vienna (Brauer, 1866). The larvae of this species were re-discovered by Rodhain and Bequaert (1915 and 1919) in the Congo, and they also found and described the 2nd larval stage. In addition, a few adult flies were able to be hatched, but they were crippled, so that at first Rodhain and Bequaert refrained from giving a description, apparently in the hope of obtaining better specimens in the future. This did not happen, and thus in 1927 Rodhain published a description of the male and female based on these specimens. They are evidently lost.

Fortunately another female fly could be hatched when several mature larvae were sneezed out by an elephant newly imported from the Congo to the Zoological Garden in Basle. Zumpt (1965) saw this species and gave the following short re-description:

“A very stout fly of 13–15 mm body-length. The ground colour is

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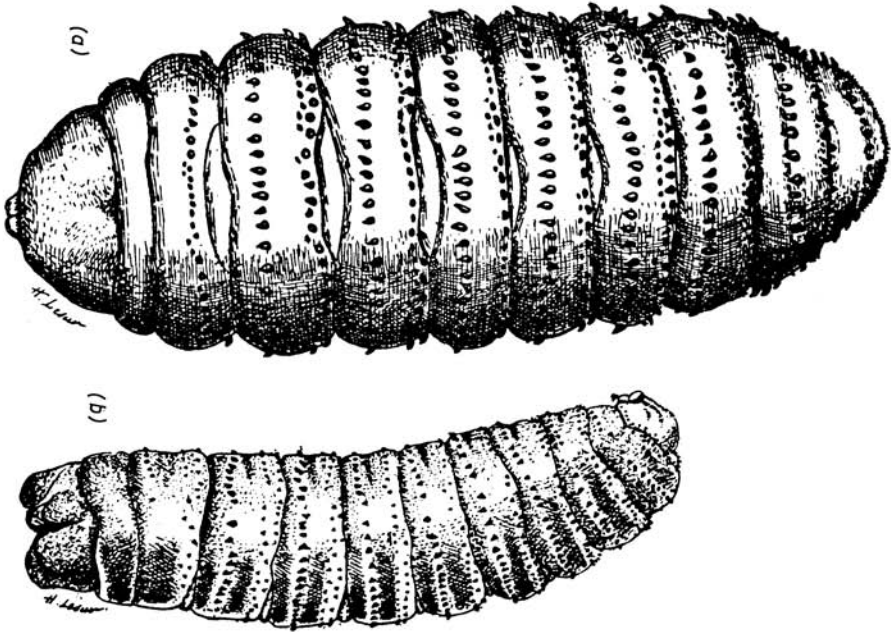


Fig. 1. *Pharyngobolus africanus* Brauer
 Third (a) and second (b) larval stage (after Rodhain and Bequaert).
 The mature larva measures 20–23 mm in length.

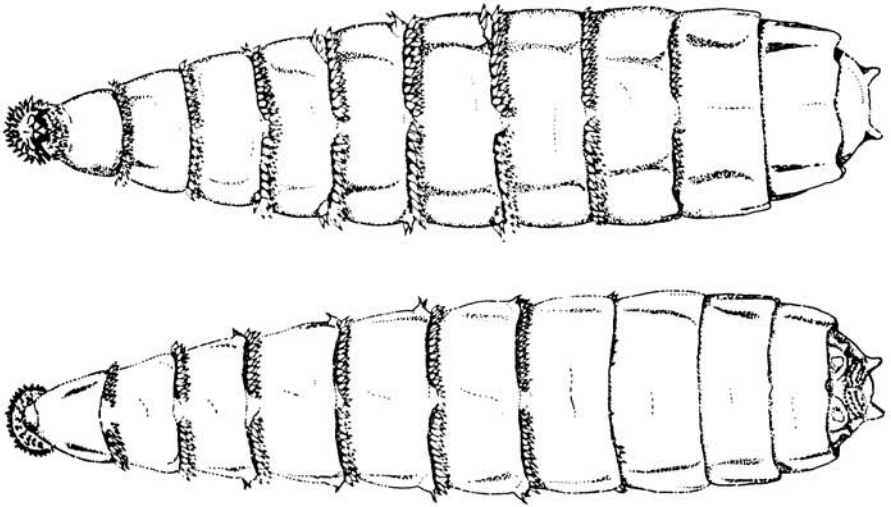


Fig. 2. *Cobboldia loxodontis* Brauer
 Dorsal and ventral view of the third larval stage (after Zumpt). The
 mature larva measures up to 28 mm.

black, but the scutellum and part of the frontal stripe are red-brown in the specimen before me. The pollinosity is silvery white and in the female densely covers the outer two-thirds of the parafrontalia, whereas the inner third is glossy and shows a characteristic, very coarse sculpture, consisting of dense, oblique ripples. Mesonotum and abdomen are also partly pollinose, the latter with a tessellate pattern. The pilosity is short and deep black. Eyes in male large and closely approximated; in the female they are smaller and widely separated from one another, frons at vertex measuring four-fifths of eye-length. Antennal groove wide and deep, provided with a narrow median convexity of even height. Antennae dull black. Mouth-parts reduced to a median globular cone and two swellings below it. The wings are hyaline, only slightly infuscated at base. Legs completely black and stout."

Larvae of the 2nd and 3rd stages (Fig. 1) have been recovered from many places, and especially in the former Belgian Congo they seem to be quite common parasites of elephants. *P. africanus* is further known to occur in Uganda, in Zambia and in Rhodesia, however, larvae have not yet been seen by us from the Kruger National Park or other parts of the Republic of South Africa.

The life-history of this parasitic fly has still to be studied. So far it is only known that the 2nd and 3rd larval stages are found attached to the wall of the pharyngeal region and probably also of the upper oesophagus. The mature larvae are sneezed out through the trunk. The pupation, as in all oestroid flies, takes place in the soil, and the flies are very short-lived, having rudimentary, non-functional mouthparts. Eggs are probably not deposited, but batches of 1st larval instars are discharged into the nostrils or orbits. The migration route of these larvae can only be guessed at.

Platycobboldia loxodontis (Brauer)

On one of Livingstone's expeditions, Dr. J. Kirk discovered fly-maggots in the stomach of an elephant shot on the Zambezi river. They were eventually received by the French entomologist Dr. R. Blanchard (1893) who figured a 3rd instar larva and labelled it as "*?Cobboldia spec.*", because it was very similar to the larva of *Cobboldia elephantis* (Steel) a parasite of the Indian elephant and also found in the stomach. The first description with no nomenclatorial standing was given by Brauer (1897), after he had obtained some larvae from the explorer Dr. O. Neumann. Soon it was found that Kirk's larva (Fig. 2) was a common parasite of the African elephant. Rodhain and Bequaert (1915) succeeded in rearing the adults, Gedoelst (1923) described all three larval stages which are found simultaneously in the stomach, and Zumpt (1964) was able to prove that the mature larvae are leaving the host via its mouth. The eggs are found attached to the base of the tusk. The flies die in captivity within a few days.

The adults (Fig. 3) are, in general appearance, strikingly different

from those of *Cobboldia elephantis* of the Indian elephant. The body is flattened dorso-ventrally, with the frons strongly protruding. In both sexes the head is bright orange, whereas the thorax and abdomen show a uniform, metallic blue colouring; the legs are deep black. The whole wing is tinged with black. In the male the frons at its narrowest point is about as broad as one eye is long, and is distinctly broader in the female. Furthermore, the male frons is quite densely beset with black hairs,

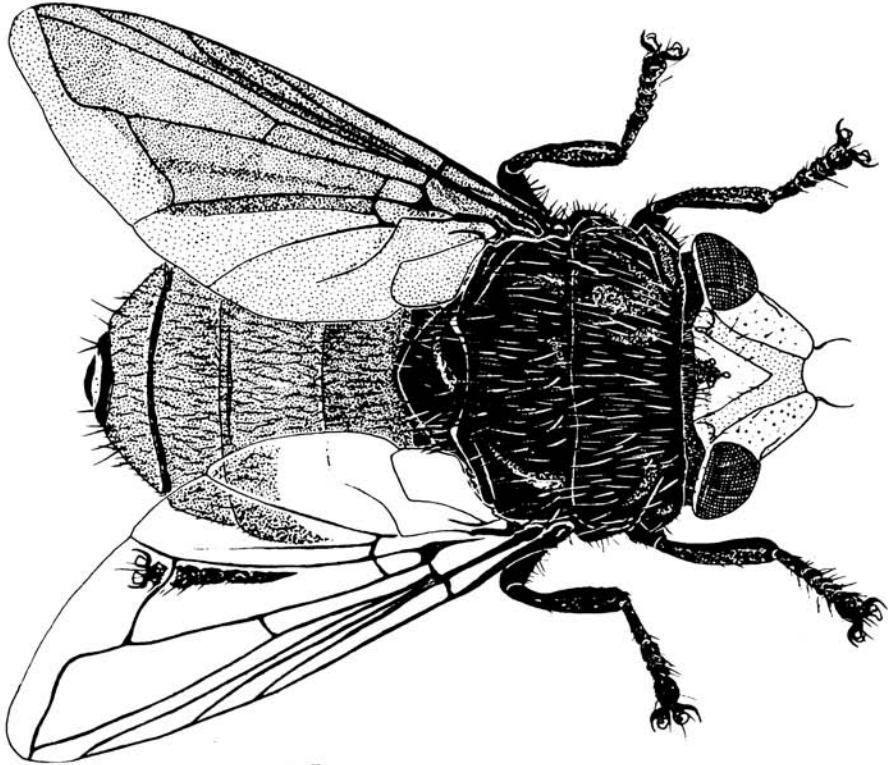


Fig. 3. *Cobboldia loxodontis* Brauer
Female fly. Body-length: 10–14 mm (original).

whereas in the female only a few pale and much shorter hairs are visible. Dorsum of thorax in the male with a short, dense, black pilosity; in the female the dorsum is sparse pilose and therefore more glossy. The abdomen too shows a different appearance in the sexes, being glossy dark blue and densely pilose in the male, but shorter and less densely pilose and covered with a greyish blue pollinosity in the female. The body-length in both sexes is between 10 and 14 mm.

Townsend (1934_a) created the genus *Platycobboldia* for the “Blue Elephant Stomach Bot Fly” (see further down).

As already mentioned, all three larval stages are simultaneously found in the stomach, but as Dr. P. Albl in Zambia (by letter) and we could state (in the Kruger National Park), almost exclusively in the peaked

end which is provided with circular folds of mucous membrane. The niches between them contain sticky slime. Dr. Albl made some interesting observations on the behaviour and distribution of the larvae in the alimentary tract which will be published elsewhere in the near future.

P. loxodontis has been recorded from many places in South Africa including the Kruger National Park, from Rhodesia, Zambia, Mozambique, Kenya and Uganda, Tanzania, the Congo, Chad, Cameroon, Ghana and the Ivory Coast, and it will probably occur everywhere its host is still found.

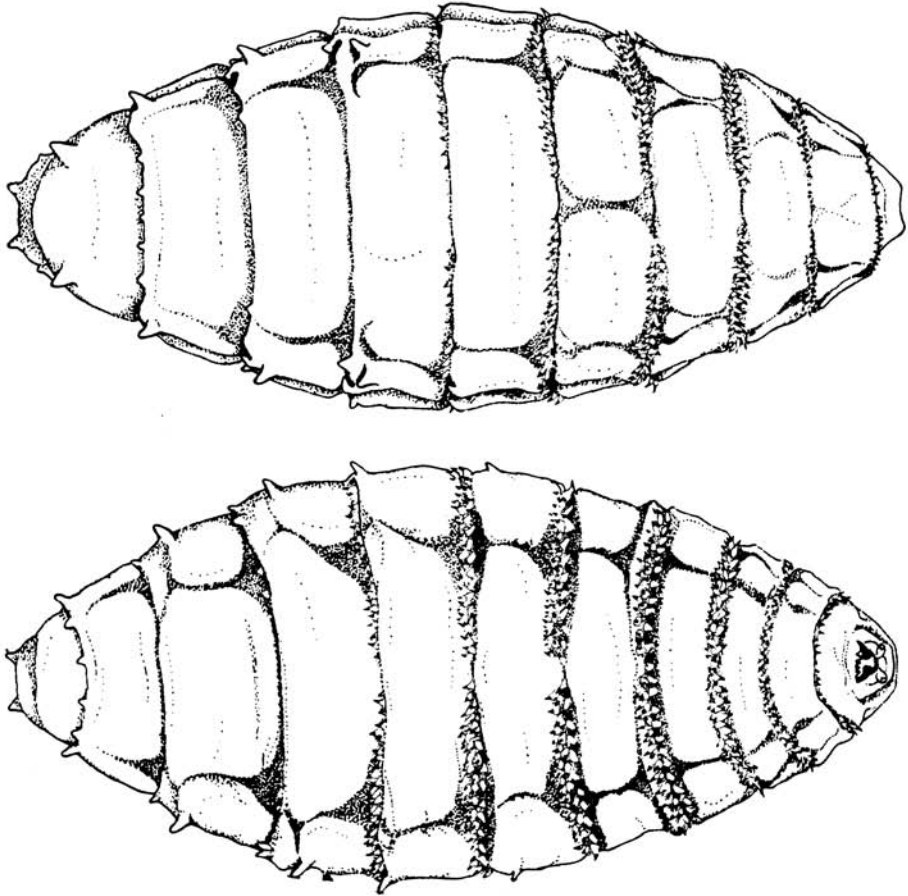


Fig. 4. *Cobboldia roverei* Gedoelst
Dorsal and ventral view of the third larval stage. The mature larva is probably over 20 mm long (after Zumpt).

Rodhainomyia roverei (Gedoelst)

In 1915, Gedoelst described another *Cobboldia* species from two 3rd instar larvae found in the stomach of an elephant in the Congo. This type of larva was quite similar to that of *P. loxodontis* but distinctly se-

parable by a pair of conical, lateral protuberances on the seventh to the eleventh segments (Fig. 4).

Only a few months later and unaware of Gedoelst's studies, Rodhain and Bequaert (1915) published a description of "*Cobboldia chrysidiformis*", based on the male and female adult flies reared from larvae which had been recovered from the stomach of elephants in Uele and the Middle Congo. The imagines were again strikingly different from those of *Platycobboldia loxodontis* and *Cobboldia elephantis*, showing, among other features, a bright metallic green and bluish-violet body, so that a few years later, Bequaert (1920) felt induced to create the new genus *Rodhainomyia* for this species.

Rodhain and Bequaert (1915 and 1919) mentioned expressly that in the stomachs of the Congo elephants, normally two kinds of larvae were found. The one type coincided with that described by Brauer as *C. loxodontis*, the other was new to them and they referred it to *C. chrysidiformis*. Later, Bequaert found that this type of larva had been described by Gedoelst as *C. roverei*. Because *C. roverei* has priority over *C. chrysidiformis*, the "Green Elephant Stomach Bot Fly" was listed since 1957 (Benoit) as *Rodhainomyia roverei* (Gedoelst).

In August 1968, Dr. U. de V. Pienaar, biologist at the Kruger National Park, kindly informed the S.A.I.M.R., that a few elephants had to be shot and that an examination for parasites would be appreciated. Mr. J. Ledger, one of the junior Professional Officers of the Department of Entomology and Parasitology, attended the shooting and immediately examined the corpses. One of his first discoveries was the quite unexpected presence of the "Green Elephant Stomach Bot Fly", of which he caught one male specimen on the wing near a dead elephant at Skukuza. A great number of larvae were then recovered from the stomach and the mouth of this elephant. A certain number of fully grown larvae were isolated on sand, and 3 ♂♂ and 6 ♀♀ hatched after 25 to 29 days, but they all belonged to *Platycobboldia loxodontis*. The examination of the remaining larvae, preserved in alcohol, also proved to belong to this species.

Two more elephants were able to be checked at Tshokwane in the Kruger National Park. The isolated larvae from one of them yielded again 3 ♂♂ and 1 ♀ of *P. loxodontis*, those hatched from the second elephant, however, one male and one female, were conspecific with the adult flies described by Rodhain and Bequaert as *Cobboldia chrysidiformis* (Fig. 5). We now checked and compared very carefully all larvae (several hundred specimens) recovered from the elephants at Skukuza and Tshokwane, including the empty pupal shells from which the two kinds of flies had hatched, without finding any constant morphological differences, and especially without detecting the quite characteristic type of larva described as *C. roverei* by Gedoelst.

On a second trip to the Kruger National Park in February 1969, five more elephants, killed in an area between Skukuza and Crocodile

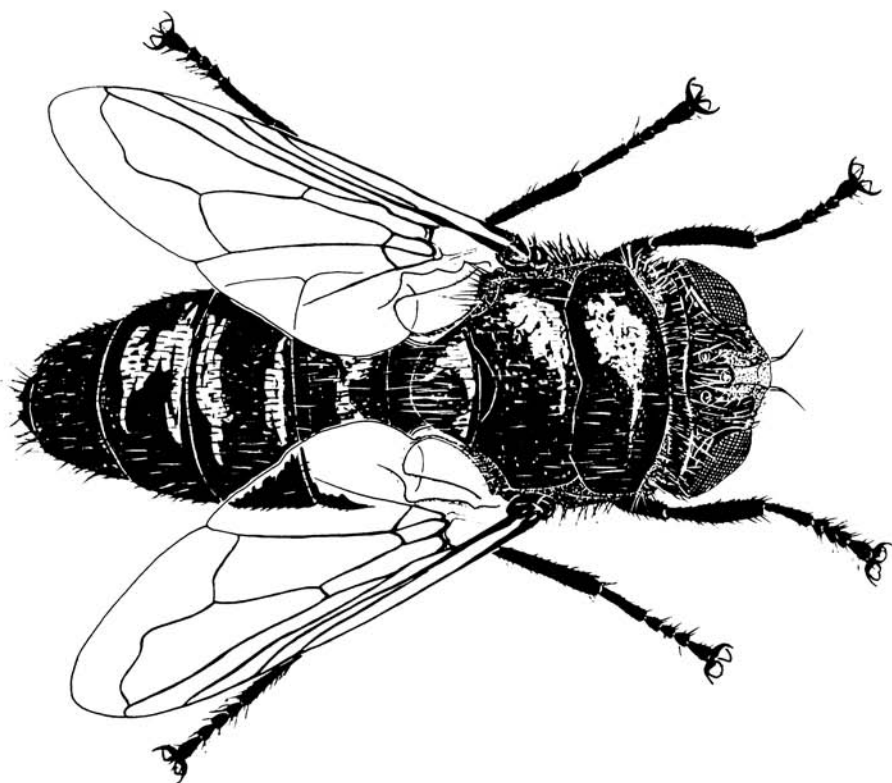


Fig. 5. *Cobboldia chrysidiformis* Rodhain and Bequaert
Female fly. Body-length: 9–14 mm (original).

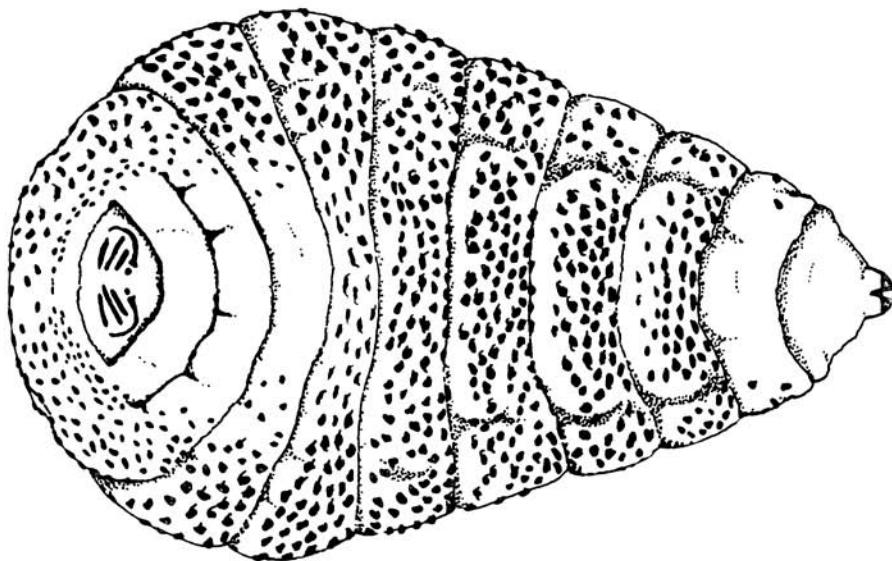


Fig. 6. *Ruttenia loxodontis* Rodhain
Third larval stage. Body-length: 7–10 mm (after Zumpt).

Bridge, were examined and another "Green Elephant Stomach Bot Fly" could be hatched and the pupal case preserved which was not separable from pupal cases on hatched flies of *P. loxodontis*. A careful examination of the larvae found in this special elephant did not reveal Gedoelst's larva, and therefore confirms the first observation.

What conclusions should be drawn from these findings? We think that it can be taken for granted that the type of larva described by Gedoelst as *C. roverei* and referred by Rodhain and Bequaert to *C. chrysidiformis* does not represent the third larval instar of the "Green Elephant Stomach Bot Fly", but another distinct species, known so far only from 3rd instar larvae in the Congo. The 3rd larval stages of the Blue and the Green Elephant Stomach Bot Flies cannot be separated at present. Rodhain and Bequaert's name "*chrysidiformis*", based on the imagines, is therefore to be restored for the "Green Elephant Stomach Bot Fly".

Ruttenia loxodontis Rodhain

The 3rd larval instars (Fig. 6) were found in skin boils on the buttocks, the abdominal flanks, the chest and the thighs of the African elephant. Rodhain (1924 and 1927) described them and also received several hatched flies, which are quite outstanding in morphological respect (Fig. 7), especially in respect to the wing-venation and the leaf-like third antennal segment. The two sexes are very similar to one another and

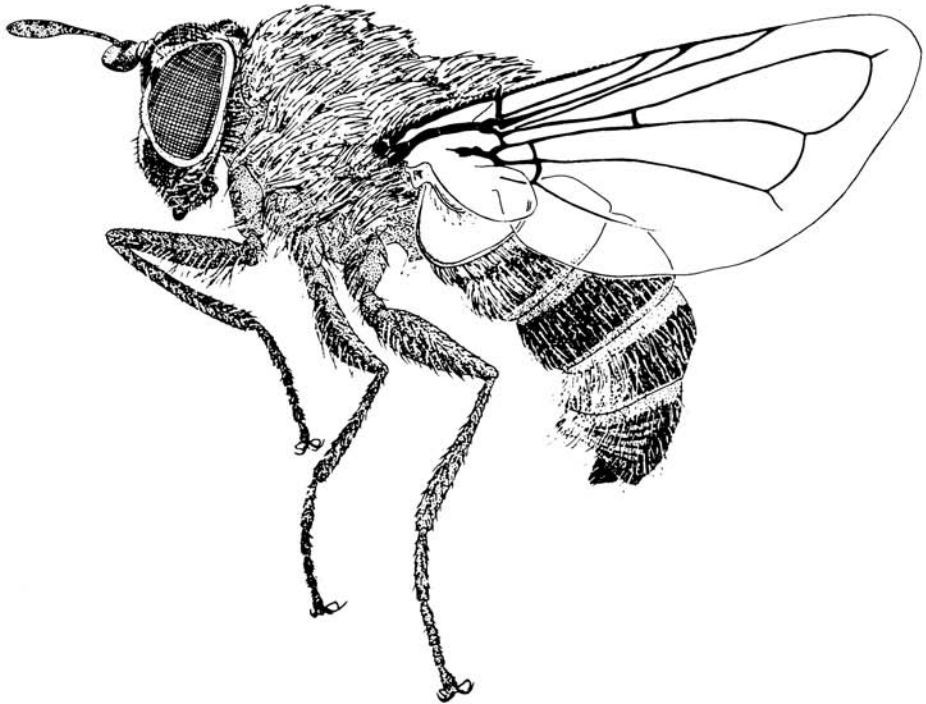


Fig. 7. *Ruttenia loxodontis* Rodhain
Female fly. Body-length: 7-9 mm.

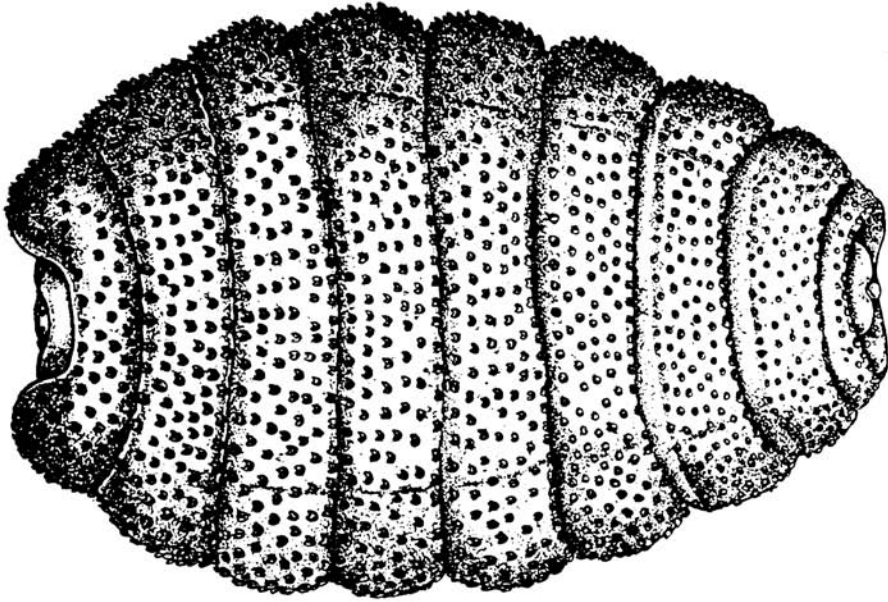


Fig. 8. *Neocuterebra squamosa* Grünberg
Third larval stage. Mature larva up to 25 mm long (after Rodhain and Bequaert).

somewhat reminiscent of a *Gasterophilus* species, the body being covered with long yellow hairs. The length of the body varies from 7 to 9 mm. The "African Elephant Skin Maggot" is only recorded from the Congo. Its life-history has not been studied.

Neocuterebra squamosa Grünberg

The second and third instar larvae (Fig. 8) are found in the dermal tissue of the foot, in pockets with a narrow opening towards the crevices of the sole. They were discovered by Dr. Zenker in southern Cameroon and later also found in the Congo, where the imago could be reared (Rodhain, 1927). The fly is dark metallic blue or violet and measures 14 to 22 mm in length (Fig. 9).

Generic classification in the Gasterophilidae

The stomach flies and skin flies of the African elephant have been placed by Zumpt (1962 and 1965) in the Gasterophilidae, whereas *Pharyngobolus africanus* is a member of the Oestrinae.

The Gasterophilidae are subdivided into four subfamilies, namely the:

Cobboldiinae with the genera *Cobboldia* Brauer, *Platycobboldia* Townsend and *Rodhainomyia* Bequaert,
Gasterophilinae with the genera *Gasterophilus* Leach and *Gyrostigma*, Brauer,

Rutteniinae with the genus *Ruttenia* Rodhain,

Neocuterebrinae with the genus *Neocuterebra* Grünberg.

The Gasterophilinae develop in members of the families Equidae and Rhinocerotidae (Order: Perissodactyla), whereas the other three sub-families are host-specific to elephants (Order: Proboscidea).

A striking and most interesting observation concerns the morphology of the adult flies in the Gasterophilidae which shows such a great discontinuous variation, that a taxonomist being familiar mainly with non-parasitic diptera would split the Gasterophilidae sensu Zumpt into several families and genera. This has been done by Enderlein (1934) and Townsend (1934). On the other hand, the morphology of the larval forms is quite uniform and seems to allow the conclusion that the members of the Gasterophilidae are much closer related to one another than the adult morphology suggests. This view is also supported by biological facts. Cobboldiinae and Gasterophilinae are intestinal parasites of host genera which are related to one another. The African and Indian elephants harbour, according to morphology and bionomics, the most primitive Gasterophilidae, the Cobboldiinae. In the rhinoceroses, a more advanced genus occurs, namely *Gyrostigma*, and the Equidae are hosts of *Gasterophilus* species which combine the intestinal parasitism with a dermal one in the 1st larval stage.

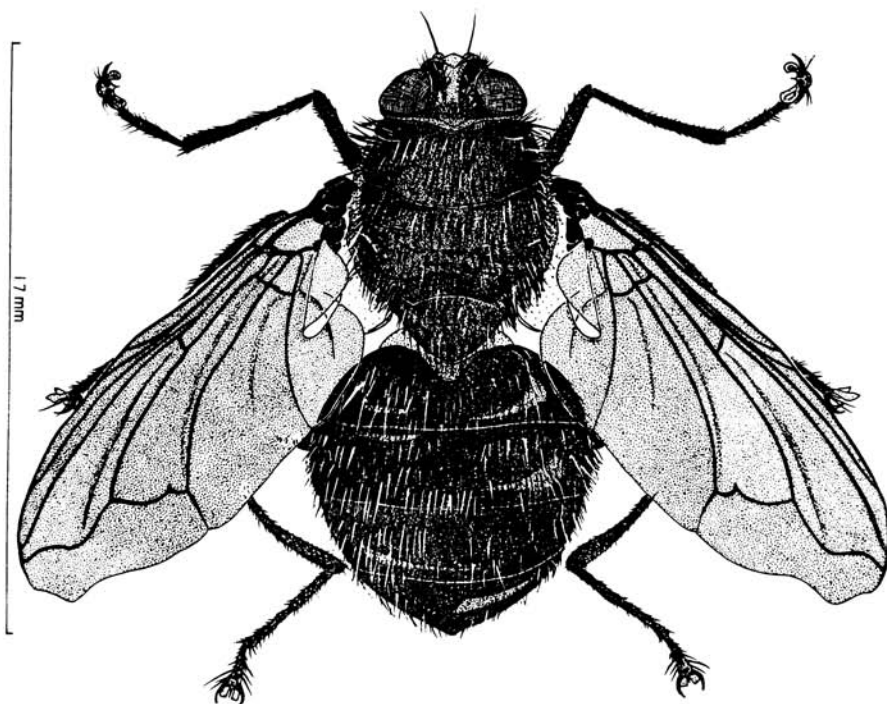


Fig. 9. *Neocuterebra squamosa* Grünberg
Female fly. Body-length: 14–22 mm (original).

Ruttenia loxodontis and *Neocuterebra squamosa* are skin parasites, and their systematic position has always been a matter of dispute. Zumpt (1962 and 1965) also placed them only tentatively to the Gasterophilidae and kept them in distinct subfamilies. This step probably comes nearest to the phylogenetic truth, and Oldroyd (1964) has called it the "common-sense view".

The morphological discrepancy in the adult and larval stages has been briefly discussed by Zumpt (1966) at the First International Congress of Parasitology in Rome, 1964. The "running wild features" of the imagines may be induced by the inferior role the adult flies play in the life-cycle of the species. Such a discrepancy is also observed in the Oestridae, although to a lesser degree.

The splitting of the genus *Gasterophilus* by Enderlein and Townsend into several distinct genera has not been accepted by later authors (Grünin, 1955), and also *Gyrostigma pavesii* (Corti) and *G. conjungens* Enderlein are placed into one single genus, in spite of the striking differences in the adult stages.

All African Cobboldiinae described so far have been originally placed into the genus *Cobboldia*, and taking into consideration the above systematic situation, this point of view seems to be justified. We therefore lump again all genera of Cobboldiinae, and the systematic-synonymic catalogue of the Elephant Stomach Bot Flies reads as follows:

Genus *Cobboldia* Brauer

- Cobboldia* Brauer, 1887. *Wien. ent. Ztg* 6: 218.
Rodhainomyia Bequaert, 1920. *Bull. Soc. ent. Fr.* 89: 68.
Platycobboldia Townsend, 1934. *Ent. News* 45: 277.
Bequaertomyia Séguy, 1937. *Gen. Ins.* 205: 366.

1. *Cobboldia elephantis* (Steel)

(Black Elephant Stomach Bot Fly—India, Burma)

- Oestrus elephantis* Steel, 1878. *Med. Exam.* 1878: 886.
Gastrophilus elephantis Cobbold, 1882. *Trans. Linn. Soc. Lond.* 2 (2), Zool., 249, fig.
Cobboldia elephantis Brauer, 1887. *Wien. ent. Ztg* 6: 220 figs; Rodhain and Bequaert, 1919. *Bull. scient. Fr. Belg.* 52: 404; Brunetti, 1923. *Fa. Brit. India, Dipt.* 3: 392, figs.; Zumpt, 1965. *Myiasis in man and animals in the old world*, p. 137, figs.

2. *Cobboldia loxodontis* Brauer

(Blue Elephant Stomach Bot Fly—Ethiopian region)

- Cobboldia elephantis africani seu loxodontis* Brauer, 1897. *Denkschr. Akad. Wiss. Wien* 64: 267.
Cobboldia loxodontis Roubaud, 1914. *Et. Fa. parasit. Afr. occ. fr.* 1: 206,

figs.; Rodhain and Bequaert, 1919. *Bull. scient. Fr. Belg.* 52: 412, figs.; Gedoelst, 1923. *Annls Parasit. hum. comp.* 1: 354, figs.
Platycobboldia loxodontis Zumpt, 1958. *Proc. R. ent. Soc. Lond. (B)* 27: 13; and 1965. *Myiasis in man and animals in the old world* p. 134, figs.
Cobboldia parumspinosa Gedoelst, 1915. *Rev. zool. afr.* 4: 158.

3. *Cobboldia chrysidiformis* Rodhain and Bequaert

(Green Elephant Stomach Bot Fly—Congo, South Africa)

Cobboldia chrysidiformis Rodhain and Bequaert, 1915. *Bull. Soc. Path. exot.* 8: 773; 1919. *Bull. scient. Fr. Belg.* 52: 421, figs. (adult only, larvae refer to *C. roverei* Gedoelst).

Rodhainomyia chrysidiformis Zumpt, 1958. *Proc. R. ent. Soc. Lond. (B)* 27: 14 (adult only).

Rodhainomyia roverei Zumpt, 1965. *Myiasis in man and animals in the old world* p. 136, fig. (adult only).

4. *Cobboldia roverei* Gedoelst

(3rd larval stage known only—Congo)

Cobboldia roverei Gedoelst, 1915. *Rev. zool. afr.* 4: 156.

Rodhainomyia roverei Zumpt, 1965. *Myiasis in man and animals in the old world* p. 136, figs.

Rodhainomyia chrysidiformis Rodhain and Bequaert, 1915. *Bull. Soc. Path. exot.* 8: 774; 1919. *Bull. scient. Fr. Belg.* 52: 425, figs.

Summary

The discovery of the "Green Elephant Stomach Bot Fly" *Cobboldia chrysidiformis* Rodhain and Bequaert in the Kruger National Park revealed that its 3rd larval stage is apparently not separable from that of the "Blue Elephant Stomach Bot Fly" *Cobboldia loxodontis* Brauer, and that Rodhain and Bequaert (1915), while describing their species, referred a specifically different 3rd larval stage to their imagines of *C. chrysidiformis*. This 3rd instar larva had previously been described by Gedoelst (1915) as *Cobboldia roverei*, but the imago is still unknown.

Furthermore, the great interspecific variability of the adult species of Gasterophilidae, and the uniforming of the larval forms within the subfamilies erected by former authors, is discussed. For this and biological reasons, the elephant stomach bot flies are united again in one single genus—*Cobboldia* Brauer—erected for *C. elephantis* (Steel), a parasite of the Indian elephant.

Acknowledgements

Great thanks are expressed to Mr. A. M. Brynard, Nature Conservator, and Dr. U. de V. Pienaar, biologist at the Kruger National Park, who kindly arranged for the examination of several elephants for parasites, which was consequently performed by Mr. J. Ledger of the South African Institute for Medical Research, Johannesburg. Furthermore, the authors wish to thank Professor J. Gear, Director of the S.A.I.M.R., for providing the necessary research facilities.

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