

## Revision of *Chauliooestrus* Villeneuve, a genus of Miltogrammatinae (Diptera: Sarcophagidae)

by

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### ABSTRACT

*Chauliooestrus* Villeneuve, 1925 is revised and transferred from the Oestridae (Gasterophilinae) to the Sarcophagidae (Miltogrammatinae). Two species are recognised: *C. denudatus* (Villeneuve, 1921), which is recorded from Botswana, Malawi, Namibia, South Africa and Tanzania; and *C. leza* sp. n., which is described on specimens from Botswana, Namibia and Zimbabwe. The male terminalia and cephalopharyngeal skeleton of the first instar larva of *C. denudatus* are described for the first time, and *C. leza* is recorded as a parasite of the termite *Hodotermes mossambicus* Hagen.

### INTRODUCTION

The genus *Chauliooestrus* Villeneuve has remained enigmatic since its description by Villeneuve (1925a b). Villeneuve himself obviously favoured a sarcophagid ancestry but placed the genus in 'les Tachino-Oestrides' (p. 24), an assemblage of species that he explicitly considered not to be monophyletic and which he apparently erected to acknowledge the 'processus de convergence' that led to this 'oestridomorphisme' (p. 26), and perhaps also because the strongly modified external morphology of the members often defied their true phylogenetic relationship. Later, Townsend (1931 1938) erected the tribe Chaulioestrini (sic!), to accommodate *Chauliooestrus* in the Cuterebridae. Emden (1945: 419) excluded *Chauliooestrus* from the Oestridae and stated that 'The genus can only be a Calliphorid or a Muscid, and it would seem to fit better into the former group', and he accepted Villeneuve's (1925a) original indication of an assignment to the Sarcophagidae. [Note that Emden's concept of Calliphoridae included the current Sarcophagidae.] Zumpt (1956 1958 1961 1965 1972) monographed the Subsaharan (ie., Afrotropical exclusive of Madagascan) Calliphoridae, Sarcophagidae and Oestridae (s.l.), but did not treat or comment on *Chauliooestrus*. Wood (1987: Table 1) followed Zumpt (1965) and did not list *Chauliooestrus* either, although Pont (1980), who catalogued the Afrotropical Oestridae (s.l.), listed *Chauliooestrus* as a genus of Gasterophilinae (treated as a family). No other reference to the genus exists in the literature.

Villeneuve (1925a b) originally included only a single species in *Chauliooestrus*, namely the type-species *C. capensis* Villeneuve, 1925a, but Emden (1947: 627) transferred *Pododexia denudata* Villeneuve, 1921 to *Chauliooestrus* and synonymised it with *capensis*. Pont (1980), however, listed both *denudatus* and *capensis* as separate species in *Chauliooestrus* (erroneously maintaining a feminine ending of *denudata*).

## ACKNOWLEDGEMENTS AND ABBREVIATIONS

I extend my most sincere thanks to J. G. H. Londt, Pietermaritzburg; A. C. Pont and N. L. Wyatt, London; and N. E. Woodley, Washington, D. C., for loan of specimens. P. Grootaert, Brussels; L. Matile, Paris; and H.-P. Tschorsnig, Stuttgart, kindly searched for the holotype of *Chauliooestrus capensis* in the collections of IRSN, MNHN and SMNS, respectively, and D. M. Wood informed me of its absence from CNC. Thanks are due also to H. Enghoff, Copenhagen, for permission to work in the collections of ZMUC after hours.

M. E. Petersen, Copenhagen, provided valuable linguistic improvements.

Institutions referred to in the text have been abbreviated with the following acronyms:

BMNH	= The Natural History Museum, London, England.
CNC	= Canadian National Collection of Insects, Ottawa, Canada.
IRSN	= Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium.
MNHN	= Musée National d'Histoire Naturelle, Paris, France.
NMSA	= Natal Museum, Pietermaritzburg, South Africa.
NRS	= Naturhistoriska Riksmuseet, Stockholm, Sweden.
SMNS	= Staatliches Museum für Naturkunde, Stuttgart, Germany.
USNM	= National Museum of Natural History, Washington, D.C., USA.
ZMUC	= Zoological Museum, University of Copenhagen, Denmark.

Genus *Chauliooestrus* Villeneuve

*Chauliooestrus* Villeneuve, 1925a: 25. Type-species: *Chauliooestrus capensis* Villeneuve, 1925a, by monotypy.

*Chauliooestrus*: Villeneuve (1925b: 48), Townsend (1931: 381, 1938: 180), Emden (1945: 389, 1947: 627); erroneous subsequent spelling of *Chauliooestrus*. [Note that Pont (1980) treated this spelling as an incorrect original spelling. As nothing in the two papers of Villeneuve (1925a b) indicates that they may be considered one interrupted paper, I prefer to list the variant spelling as subsequent.]

*Diagnosis*: First flagellomere short, 0.9–1.1 × as long as pedicel; orbital bristles reduced; ♂ head dichoptic, with (reduced) orbital bristles; eye not enlarged; postocular setae of about equal size; genal groove enlarged; postcranium concave with lateral parts swollen; vibrissa not differentiated from adjacent genal setae; palpus and proboscis shortened; costal spine absent; distal part of wing vein M bent in obtuse angle; lower calypter large; infrasquamal setulae absent; mid tibia with one anterodorsal bristle; alpha setae absent on abdominal sternites; propisternum, prosternum and metasternum bare; ♀ terminalia shortened, reproductive tract with three equal-sized spermathecae, all spermathecal ducts joining common oviduct separately, accessory glands elongate; ♀ larviparous, larvae incubated in double-sac uterine pouch; first instar larval cephalopharyngeal skeleton without clypeal arch, with large, straight labrum and weak mandibles; puparial posterior spiracles recessed; processus longi (♂ abdominal sternite 10) shortened and directed laterally; aedeagus with broad epiphallus, dorsolateral processes fused in median line and acrophallus a simple continuation of aedeagal tube.

## DISCUSSION

Although Emden (1945) tentatively suggested a possible inclusion in the Muscidae, there is little doubt that *Chauliooestrus* belongs to the Tachinidae family-group (Oestroidea of McAlpine 1989), this being based on the presence of distinct meral bristles (although often reduced in *C. denudatus*), the bent condition of vein M, the enlarged lower calypter, and the presence of a parameral apodeme ('Gelenkfortsatz' of Tschorsnig (1985)).

McAlpine (1989) provided explicit lists of possibly apomorphic character states assumed to characterise the groundplan of each member of the Tachinidae family-group, and it is evident that *Chauliooestrus* does not fit in either the Tachinidae, the Rhinophoridae, the Oestridae or the Calliphoridae. The oestrid appearance, in particular, is rather superficial and based on the reduced mouthparts, a reduction in the number of bristles, a concave postcranium, the somewhat reduced eye-size, and the relatively swollen abdomen. These character states are best developed in *C. denudatus*, but even here not very oestrid-like: the mouthparts are very short but much better developed than those of the Gasterophilinae, Hypodermatinae and Oestrinae; the setae covering the general surface of the body, legs and abdomen are very like those of non-oestrid Calyptratae, not being hair-like as in all Oestridae. Only the concave postcranium and possibly the swollen postgena are oestrid-like, but the concavity as such is found in a fully equivalent condition in the Miltogrammatinae (the Nearctic *Euphyto* Townsend excepted).

An assignment to the Sarcophagidae, on the other hand, as was initially suggested by Villeneuve (1925a), is supported by the double-sac uterine incubatory pouch, the larviparous habit, the triangular ventral bridge of the cephalopharyngeal skeleton of larva I, the recessed posterior puparial spiracles, and the structure of the aedeagus with fused dorsolateral processes (given as a groundplan character state for the Sarcophagidae by Pape (1987)).

Within the Sarcophagidae, an assignment to the subfamily Miltogrammatinae (as defined by Pape (1987)) is best corroborated: *Chauliooestrus* does not possess a row of parafacial bristles, the epiphallus is not reduced, and the acrophallus has not attained a position on the ventral surface of the aedeagus, which are synapomorphic character states defining the clade [Paramacronychiinae + Sarcophaginae.] On the other hand, the dichoptic male head, the concave postcranium, the equal-sized postocular setae and the triangular ventral bridge of the cephalopharyngeal skeleton of larva I are character states shared by all other Miltogrammatinae and here considered to be apomorphic at the level of the Sarcophagidae. Absence of infrasquamal setulae and only one mid tibial ad bristle may define subgroups within the Miltogrammatinae and therefore further corroborate an assignment to this subfamily.

Within the Miltogrammatinae, generic phylogenetic relationships are in the main obscure, and tribal divisions (Verves 1986a b) are badly in need of explicit diagnoses. The phylogenetic affinities of morphologically aberrant taxa like *Chauliooestrus*, therefore, are difficult to assess.

The two species here included in *Chauliooestrus* do not key out in Zumpt's (1961) generic key to Afrotropical Miltogrammatinae (*C. leza* will, however, run

to *Senotainia* Macquart if the eyes are considered hairy). It is interesting that the claws of *C. denudatus* are long (although Villeneuve (1925b: 50) stated *C. capensis* to have 'Griffes courtes'), as long claws have a rather restricted occurrence in the Miltogrammatinae, eg. the Nearctic *Eumacronychia* Townsend, the Palaearctic *Chrysogramma* Rohdendorf (in part) [preocc., no current replacement name], the South African *Xiphidiella* Zumpt, and the widespread *Senotainia*. However, as *C. leza* has shorter claws more like the general condition in the Miltogrammatinae, this character bears no information on generic phylogeny.

An argument for a close phylogenetic relationship to *Noditermitomyia* Séguy would be based exclusively on the termite-parasitising habit, which probably arose from kleptoparasitism in nests of Sphecidae, which seems to be the groundplan life habit within the subfamily. Termite parasitism as such, however, can hardly be considered a character (or character state), and according to the original description of *N. arabops* Séguy, this species apparently shares no character states with *Chauliooestrus* that are not shared by most other miltogrammatine genera. Note that *Noditermitomyia sensu* Zumpt (1961) may be monophyletic, corroborated by the shared possession of a closed wing cell  $r_{4+5}$  and a reduced costal spine, but Verves (1988) widens the concept by synonymising *Noditermitomyia* with *Lamprometopia* Macquart, apparently not accepting Zumpt's (1952) suggestion of treating the latter as a synonym of *Senotainia*.

The broad epiphallus of *Chauliooestrus* may indicate a relationship with the Old World *Phylloteles* Loew. A straight distal part of vein M is likewise found in some species of this genus, but *Phylloteles* is well corroborated by the flattened arista in males (Pape 1989), leaving little support for including *Chauliooestrus* in this genus.

In conclusion, there is little doubt of the monophyly of *Chauliooestrus* and as there are no convincing arguments that its included species belong in any other named miltogrammatine genus, generic status (as defined above) seems justified. Present data, however, do not give indications of the phylogenetic affinities of *Chauliooestrus*.

#### Key to species of *Chauliooestrus*

- 1 Lunula projecting as a bilobed scale, overhanging antennal scape. Ocellar setae and proclinate orbital bristles not developed. First flagellomere 0,9–1,0 × as long as pedicel. Facial plate deeply sunk, pit-like, and facial ridges almost contiguous for a considerable distance below antennae. Vein M concave beyond bend. Length of claws 0,7 (♀) and 1,0 (♂) × as long as fifth tarsomere. Bigger species (8,5–10,0 mm) ..... **denudatus**
- Lunula not projecting, not bilobed. Ocellar setae present, proclinate orbital bristles 1–3. First flagellomere 1,0–1,1 × as long as pedicel. Facial plate not pit-like, and facial ridges approximated (but not almost contiguous) at level of vibrissal angle only. Vein M straight beyond bend. Length of claws 0,5 (♀) and 0,75 (♂) × as long as fifth tarsomere. Smaller species (4,5–7,0 mm) ..... **leza**

*Chauliooestrus denudatus* (Villeneuve, 1921)

Figs 1–5, 7

*Pododexia denudata* Villeneuve, 1920: 152. Lectotype ♀, by present designation (NMSA): South Africa, Cape Province, Willowmore.

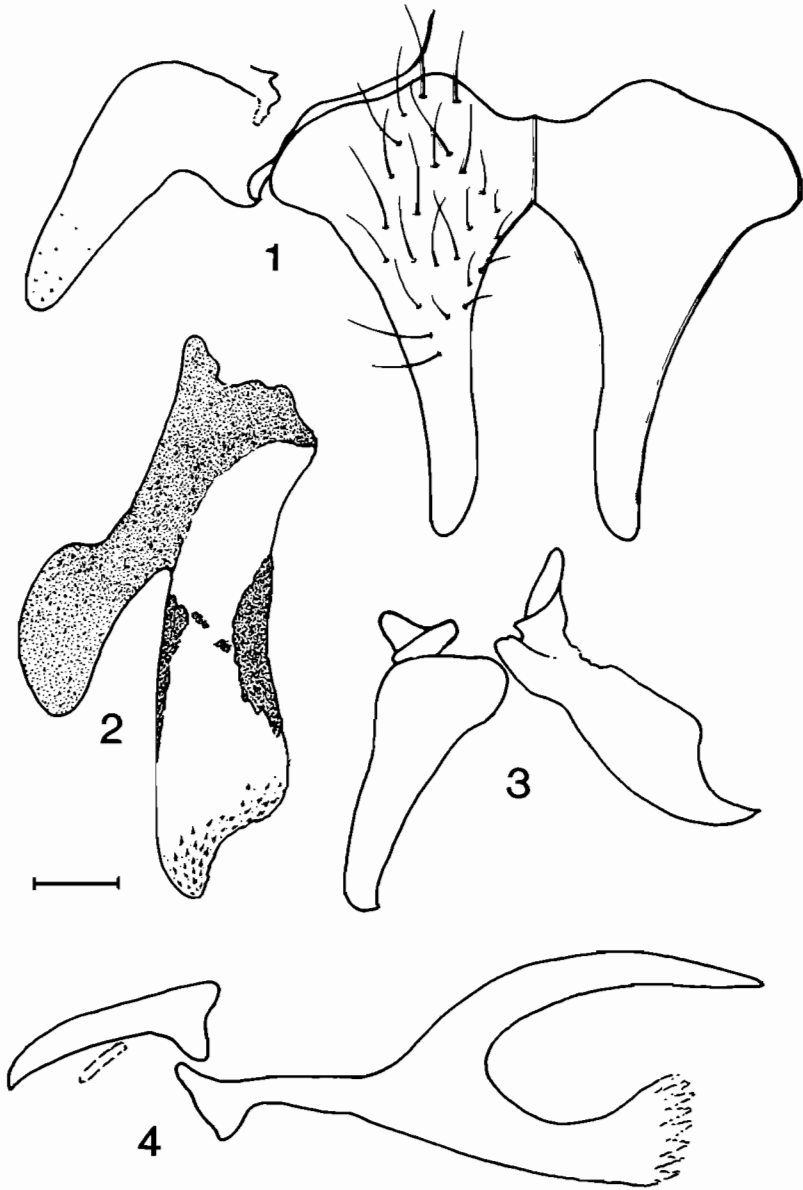
*Chauliooestrus capensis* Villeneuve, 1925a: 25. Holotype ♀, not located: South Africa, Cape Province.

Type material: Lectotype ♀: *Pododexia denudata*: SOUTH AFRICA: *Cape Province*: Willowmore, 25.iii.1920, Brauns (in NMSA; in perfect condition). Paralectotype ♀: *Pododexia denudata*: SOUTH AFRICA: *Transvaal*: i.1917, Brauns (NMSA). [Note that Emden (1947: 627) referred to the original type material as 'type and paratype', but as he did not specify which of the two syntypes (which he did not examine himself) he considered to be the 'type', this cannot be regarded as a valid lectotype designation. I have chosen the female from Willowmore as lectotype, as this bears the handwritten label 'type' (red ink), while the Transvaal female bears a similar label reading 'paratype'. I have provided the specimens with suitable labels.]

Additional material: BOTSWANA: 1 ♀, Kanye, i.1956, Zumpt (BMNH). MALAWI: 1 ♀, SE 1435AC, 35 km N Mangochi, 10 km N Club Makokola, 10–11.iii.1987, J. & A. Londt, Sandy grassveld (NMSA). NAMIBIA: 1 ♀, Waterberg National Park, entrance via Road 2512, 20.iii.1984, Stuckenberg & Londt, *Acacia* thornveld (NMSA) [dissected, terminalia and larvae in glycerine]; 1 ♂, Noachabeb, 27 mls NNE Grunau, 10–12.i.1972, Southern African Exp. B.M. 1972–1 [terminalia on separate slide] (BMNH); 1 ♀, W47, 32 mls SE Ondangua, 1.iv.1972, Southern African Exp. B.M. 1972–1 (BMNH). SOUTH AFRICA: *Transvaal*: 1 ♀, Lydenburg Dist., 1896, P. A. Krantz (NMSA); 2 ♀, Pienaar's River, 1898, Jutrzencka (NMSA & ZMUC); 2 ♀, Waterberg Dist., 1898–99, Jutrzencka (NMSA). *Natal*: 1 ♀, Junction of Blaauwcraantz and Tugela Rivers, [no date], G. A. K. Marshall (BMNH). TANZANIA: 1 ♀, '5342' [handwritten original label], 'Tanzania 19 Ex Coll. W. H. Potts. B.M. 1967–472' [printed label, obviously a later addition] (BMNH).

Description: ♂: Length 9,3 mm.

*Head*: Eye small, bare. Profrons protrudent, gena very high due to small eye and very large genal groove. Vibrissal angle poorly defined. Postgena swollen, genal sulcus forming distinct vertical groove or fold. Fronto-orbital plate, parafacial plate, and gena with silvery grey microtomentum, frontal vitta orange and without microtomentum. Narrowest part of frons measuring  $0,3 \times$  head width, frontal vitta almost parallel-sided but slightly wider towards lunula. Inner vertical bristles short but distinctly differentiated from adjacent setulae, one pair of postocellars, no ocellars, frontal bristles reduced and only present as setulae along anterior half of frontal vitta. Fronto-orbital plate without orbitals but with numerous small setae situated in distinct sockets that give the area a pitted appearance. Parafacial plate similarly setulose. Antenna short, first flagellomere  $0,9 \times$  as long as pedicel. Arista  $1,8 \times$  as long as first flagellomere, micropubescent with hairs much shorter than arista diameter. Antenna entirely brown. Lunula distinctly projecting as a bilobed scale-like structure. Palpus and proboscis short, brown.



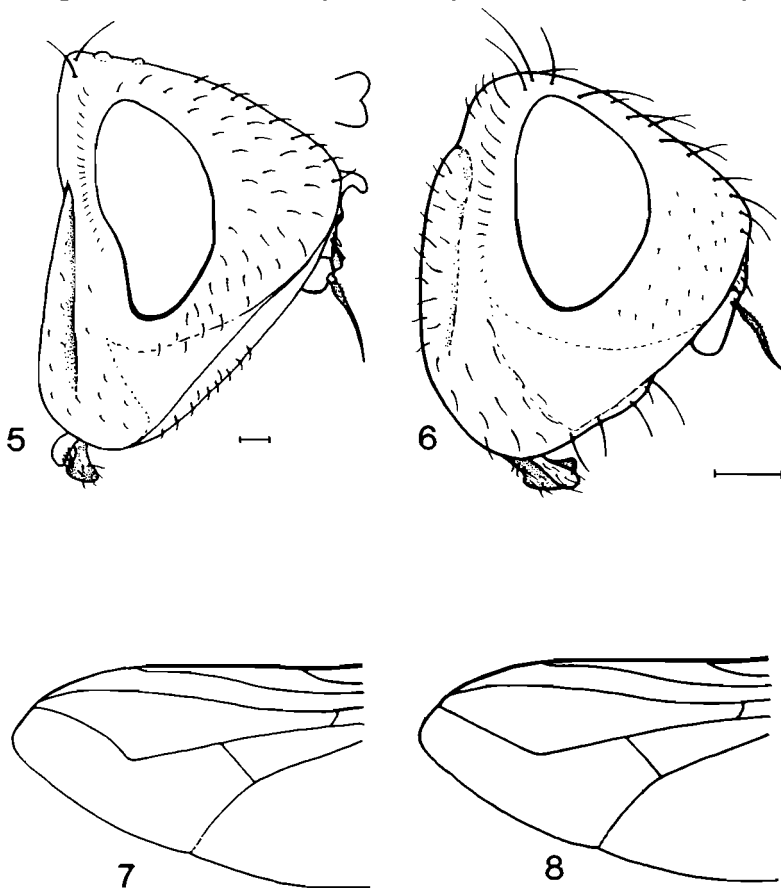
Figs 1-4. *Chauliooestrus denudatus*, ♂ terminalia (drawn from slide-mount) and larval morphology. 1. Cerci and left surstylus, posterior view, setae of right cercus omitted. 2. Aedeagus, antero-lateral view (epiphallus therefore appearing more slanted than in lateral view). 3. Right paramere and gonopod, lateral view. 4. Cephalopharyngeal skeleton of first stage larva. Scale line: 0,1 mm (Figs 1-3); 0,025 mm (Fig. 4).

**Thorax:** Black with grey microtomentum forming three indistinct stripes. Chaetotaxy reduced:  $acr = 0 + 1$ ,  $dc = 0 + 3$ ,  $ia = 0 + 1$ ,  $sa = 1 + 1$ ,  $h = 2 - 3$ . Scutellum marginals: 1 pair weak discals, 2 pairs laterals, 1 pair apicals. Katepisternal and meral bristles not developed, notopleuron bare except for usual 2 bristles.

**Wing:** Membrane hyaline but with faint brownish tinge along veins (especially in Tanzanian specimen), basicosta light yellow, veins brown or yellowish. Costal spine not differentiated, base of vein  $R_{4+5}$  with 1-2 setulae dorsally, 1 setula ventrally. Bend of vein M obtuse, concave towards posterior margin beyond this. Cell  $r_{4+5}$  open.

**Legs:** Femora mainly blackish with grey microtomentum, tibiae and tarsi reddish. Bristles short. Fore tibia with 1 p; mid tibia with 1 av, 1 ad, and 2 p; hind tibia with 1 av and 1 ad. Fore tarsus  $1,17 \times$  as long as fore tibia. Claws and pulvilli of all legs  $1,0 \times$  as long as fifth tarsomere.

**Abdomen:** Black with extreme hind margins of tergites orange. Grey microtomentum forming tessellate, changing pattern very like that found in many species of



Figs 5-8. *Chauliooestrus* spp., details of adult morphology. 5-6. ♀ head profile. 7-8. Semidiagrammatical outline of wings (not drawn to scale). 5, 7. *C. denudatus* (Villeneuve). 6, 8. *C. leza* sp. n. Scale lines: 0,2 mm (Fig. 5); 0,3 mm (Fig. 6).

*Blaesoxipha* Loew s.s. Marginal setae more strongly developed but no distinct median marginals present.

Terminalia: Tergite 6 and syntergosternite 7+8 partly fused. Cercus and surstylus of the usual miltogrammatine type but surstylus apparently fused to epandrium. [Note: The single male recovered was dissected by Dr F. Zumpt, who slide-mounted the terminalia; pressure from the coverslip caused some distortion and the latter observation needs confirmation from glycerine preparations when additional material becomes available.] Aedeagus with broad epiphallus.

♀: Length 8,5–10,0 mm.

Very like ♂ but differing as follows: Eye smaller, narrowest part of frons  $0,46 \times$  head width. Meron with 0–2 bristly setae. Wing cell  $r_{4+5}$  open or closed at margin.

Larva I: Length 0,8–1,0 mm.

Cephalopharyngeal skeleton of first instar larva with no trace of clypeal arch. Dorsal cornu narrow and without incision from posterior end; anterior end articulating with labrum and bridged ventrally with its counterpart (bridge appearing as an almost triangular ventral flange in lateral view). Labrum well developed and almost perfectly straight. A pair of weak sclerotised plates flanking the labrum are here interpreted as mandibles.

Distribution: Botswana, Malaŵi, Namibia, South Africa, Tanzania.

Biology: Unknown.

Remarks: The synonymy of *capensis* with *denudata*, proposed by Emden (1947), is here accepted although the holotype of the former has not been examined. This was stated by Townsend (1931: 381) to be in Rambouillett, ie. in Villeneuve's private collection, where Townsend evidently saw it, but I have not been able to locate the holotype in any of the collections consulted for the present study (see list of acronyms in preceding section). It may possibly be found in the botfly collection of the late L. P. Mesnil (Wood, *pers. comm.*), but I have not been able to trace the depository of this material.

The original description of *Chauliooestrus capensis* is short and was apparently not intended to be comprehensive as Villeneuve (1925*b*) gave a full description with etymological information in the same journal issue. It fits the type specimens of *Pododexia denudata* in every detail except, perhaps, for the 'Griffes courtes' (p. 50). Compared with *C. leza* and most other Miltogrammatinae, the claws of *C. denudatus* are distinctly longer, and even if the comparison was meant to be with the rather long-clawed Sarcophaginae, it still seems a misapplication to use the term 'short'. The description leaves no doubt, however, that *C. capensis* is different from *C. leza*, which has short or medium-sized claws. Moreover, Townsend (1931) referred to two additional females examined by him and considered to be conspecific with *capensis*: one in NRS, which I have not seen, and one in BMNH, which is probably the female from Natal listed under 'Additional material' above. The latter specimen is probably the one examined by Emden (1947), and is a typical *C. capensis*.



***Chaulioestrus leza* sp. n.**

Figs 6, 8–10

**Etymology:** The species epithet (a noun in apposition), is a divine name used in traditional Africa from the northern Kalahari through the Congo to Tanzania (Parrinder 1971).

**Type material:** Holotype ♂: ZIMBABWE: Matopos Research Station, larva, 27.ix.1979 (emerged from puparium 7.i.1980), J. L. Bissett (BMNH) [holotype somewhat greasy; terminalia dissected and stored in glycerine in microvial pinned with specimen]. Paratypes: BOTSWANA: 1 ♀, Chobe Dist., Casane Camping, 28-29.xii.1981, U. Norling (ZMUC). NAMIBIA: 1 ♀, Kuiseb Canyon, 23°18'S:15°45'E, 22-23.i.1972, Southern African Exp. B.M. (BMNH); 4 ♀, Sesriem Canyon, 3 mls W Sesriem, 21-22.i.1972, Southern African Exp. B.M. (2 in BMNH, 2 in NMSA). ZIMBABWE: 1 ♀, Matopos Research Station, larva, 18.xi.1979 (emerged from puparium 1.xii.1979), J. L. Bissett (ZMUC); 2 ♀, Mazabuka, 18-23.xi.1931, A. M. Allson (BMNH).

**Description:** ♂: Length 4,5 mm.

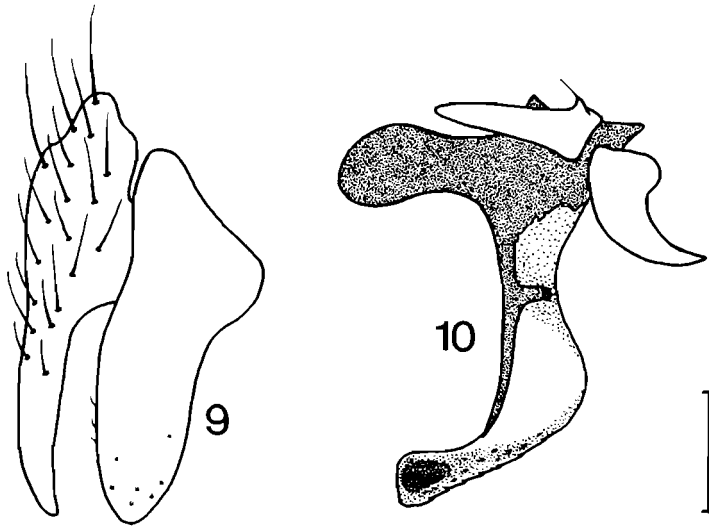
**Head:** Eye small, appearing bare but sparse, short pubescence visible at high magnification. Profrons protrudent, gena very high due to small eye and unusually large genal groove. Vibrissal angle just below level of lower eye margin. Postgena swollen and genal sulcus appearing as distinct vertical groove or fold. Fronto-orbital plate, parafacial plate, and gena with silvery grey microtomentum, frontal vitta yellowish orange and without microtomentum. Narrowest part of frons measuring  $0,35 \times$  head width, frontal vitta slightly narrower towards lunula. Frontal bristles, a pair of postocellars, a pair of proclinate ocellars, and inner and outer vertical bristles well developed; 1 proclinate and 1 reclinate orbital bristles; fronto-orbital plate otherwise bare. Parafacial plate bare. Vibrissa about as strong as strongest genal setae. Antenna short, first flagellomere  $1,3 \times$  as long as pedicel. Arista  $1,3 \times$  as long as first flagellomere, micropubescence much shorter than arista diameter. Scape and pedicel brown, first flagellomere black. Palpus and proboscis short. Palpus yellow, proboscis brown.

**Thorax:** Black with grey microtomentum and without distinct pattern (holotype with thorax slightly greasy). Chaetotaxy:  $acr = 0 + 1$ ,  $dc = 2 + 3$ ,  $ia = 1$  (inner posthumeral)  $+ 1$ ,  $sa = 1 + 1$ ,  $h = 2$ . Scutellum with 1 pair weak discals, 2 pairs lateral marginals and 1 pair apical marginals. Katepisternal bristles 1:1, notopleuron bare except for usual 2 bristles.

**Wing:** Hyaline, basicosta light yellow, veins brown. Costal spine not differentiated, base of vein  $R_{4+5}$  with single setula dorsally and 2 setulae ventrally. Bend of vein M obtuse, beyond this straight. Cell  $r_{4+5}$  open.

**Legs:** Black with grey microtomentum. Bristles short. Fore tibia with 1 p bristle. Mid tibia with 1 av, 1 ad, and 1 pd. Hind tibia with 1 av, 2 ad, and 2 pd. Fore tarsus  $1,25 \times$  as long as fore tibia. Claws and pulvilli of all legs  $0,75 \times$  as long as fifth tarsomere.

**Abdomen:** Black with grey microtomentum. Tergites 1+2–4 each with 3 brown triangular spots coalescing at posterior margin, T5 almost entirely grey. T3



Figs 9–10. *Chauliooestrus leza* sp. n., ♂ terminalia. 9. Right cercus and surstylus, lateral view. 10. Aedeagus + right paramere and gonopod, lateral view. Scale line = 0,1 mm.

without median marginal bristles, T4–T5 each with a row of short marginal bristles.

Terminalia: Cercus and surstylus of usual miltogrammatine type. Aedeagus with broad epiphallus.

♀: Length 4,5–7,0 mm.

Very like ♂ but differing as follows: Orbital bristles vary in number from 1 proclinate and no reclinate to 3 proclinate and 1 reclinate. Parafacial plate with scattered setulae. Base of wing vein  $R_{4+5}$  with 1–3 setulae dorsally, cell  $r_{4+5}$  occasionally closed at margin. Leg bristles of normal length, hind tibia with row of ad and pd bristles. Fore tarsus 1,18 × as long as fore tibia. Claws and pulvilli 0,75 × as long as fifth tarsomere.

Puparium: Length 5,0–6,0 mm.

Of the usual barrel-shape; posterior spiracles deeply recessed.

Distribution: Botswana, Namibia, Zimbabwe.

Biology: Apparently endoparasitic in termites. The holotype and female paratype from Zimbabwe (Matopos Research Station) are both pinned with an empty puparium, and their labels read: 'Larva parasitising *Hodotermes mossambicus dealates*'. One of the paratypes from Zimbabwe (Mazabuka) was 'taken 17.xi.31 at mouth of new termite burrows', the other is labelled 'termite parasite' (two latter citations handwritten on underside of locality labels).

Remarks: A few other Afrotropical species of Miltogrammatinae have been recorded as associates of termite nests, either as parasitoids or as inquilines/kleptoparasites. A larva of *Hoplcephala schistacea* (Villeneuve) was found feeding on termites in the fungus gardens of a termite nest (Curran 1928),

and the adults are often found on flowers near the mounds (Zumpt 1961). Skaife (1954) described the association between *Termitometopia skaifei* Zumpt and the termite *Amitermes atlanticus* Fuller, where the larvae apparently are fed by the termite workers which receive some secretion in return. *Noditermitomyia arabops* seems to be a true parasitoid and has been bred from *Noditermes curvatus* (Silvestri) (Séguy 1953); females of *Senotainia grisea* (Villeneuve) have been observed larvipositing in openings in a mound of *Cubitermes pretorianus* Silvestri in the early wet season (Ferrar 1987). The termite-parasitising larvae described by Kemner (1925) were tentatively considered as Miltogrammatinae by Ferrar (1987), but the structure of the posterior spiracle of larva 3, with a diamond-shaped outline and the two outer slits pointing in opposite directions, makes this highly improbable, and strongly suggests inclusion in the Calliphoridae. The similarity to the calliphorid genus *Termitocalliphora* Bauristhene, for example, is striking (Ferrar 1987: Figs 12.256 & 92.17).

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