

STUDIES ON MALE GENITALIA OF SARCOPHAGIDAE (DIPTERA) BASED ON SCANNING ELECTRON MICROSCOPE OBSERVATIONS

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Male genitalia of Oxyvinia excisa (Lopes), Oxysarcodexia thornax (Walker), O. fluminensis Lopes, Sarcodexia lambens (Wiedemann), Peckia chrysostoma (Wiedemann) and Liopygia ruficornis (Fabricius) were studied based on scanning electron microscope photography. Some important details were evidenced with this method.

Key words: Diptera – Sarcophagidae – male genitalia – scanning electron microscope

Male genitalia obtained from specimens reared in the Laboratory of the Department of Biology, Instituto Oswaldo Cruz, preserved in dry state, were photographed in the Department of Morphology of the Institute of Biological Sciences, Federal University, Belo Horizonte using the methods explained in previous paper (Lopes & Leite, 1987).

Some important details of male genitalia structures were observed and used in the systematic of the species studied.

Oxyvinia excisa (Lopes, 1950)
(Figs 1 to 6)

Dexosarcophaga excisa Lopes, 1950: 361, figs 19-26.

Oxyvinia excisa Lopes & Kano, 1968: 296, figs 1-4 (copulation).

This species was included in the genus *Oxyvinia* (Raviniini) mostly by the structure of the fifth sternite which shows longitudinal cleft, the internal margins, bearing closely inserted hairs and by the festoons in the pseudocephalon of the first instar larvae (Leite & Lopes, 1987: 223, figs 16-21). Copulation of

this species is very much peculiar, the large ventralia of penis dragging the region in which fall the product of the accessory gland of female, forming a cavity in which the spermatozoa should be able to attain the opening of the spermathecae conducts (Lopes & Kano, 1968: 296, fig. 4).

The scanning figures elucidated some details of the penis structure. The dorsal wall of the paraphallus shows conspicuous longitudinal striae (Figs 5, 6); the ventral membrane is covered with pale hairs (Fig. 1); a ventral elliptical pillow is present on theca (Figs 2, 3); an internal wall is easily visible between the border of apical plate and the styli (Figs 2-5); the styli shall be seen near the dorsal pair of the pillows of ventralia (Figs 3, 4). The most curious structure is the ventralia, very important part of penis, during copulation; it is composed of a large, deep concave surface ending in sharp point, having, basally, a pair of small pillows (Fig. 5). The palpi genitalium, a very important piece in copulation, is easily observed in Figs 2, 3 (Lopes & Kano, 1968, Fig. 3).

Oxysarcodexia thornax (Walker, 1849)
(Figs 7 to 12)

Sarcophaga thornax Walker, 1849: 814 (female); Lopes, 1976: 630, figs 4-12 (type examined).

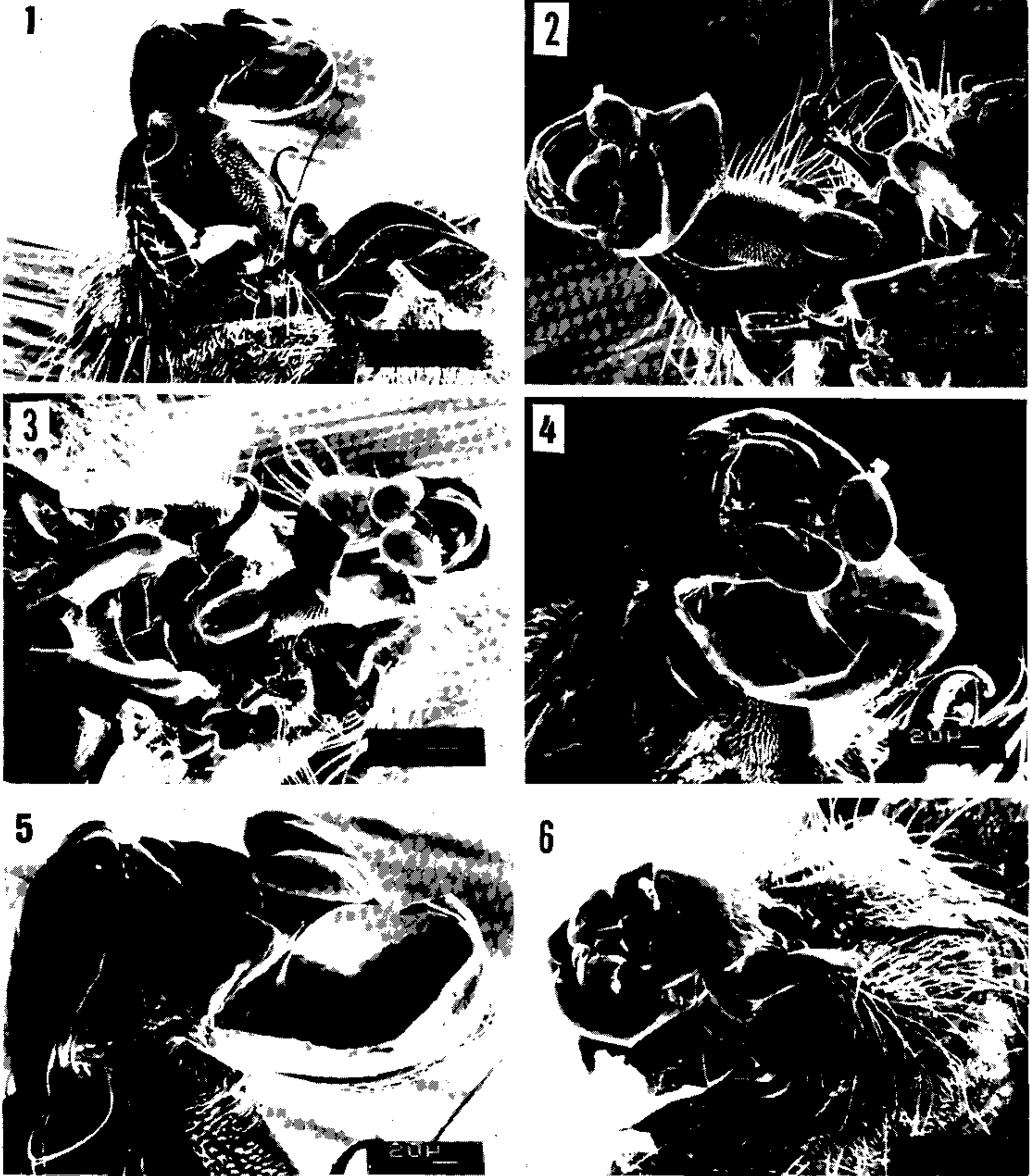
Sarcophaga pudica Rondani, 1850: 174; Lopes, 1986: 557 (type examined).

Sarcophaga aurifinis Walker, 1852: 325; Aldrich, 1930: 18, fig. 3 (type examined).

This work was undertaken in the Laboratories of the Institute of Biological Sciences, Belo Horizonte, Santa Ursula University and Oswaldo Cruz Institute, Rio de Janeiro.

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Oxyvinia excisa (Lopes), male genitalia. Fig. 1: cerci and phallic organs, lateral view. Fig. 2: penis, ventral view. Fig. 3: penis and internal forcipis, anterior view. Fig. 4: penis, anterior view. Fig. 5: apex of penis, oblique view. Fig. 6: cerci and penis, dorsal view.

Sarcophaga tessellata Fabricius of Wiedemann, 1830: 363; Townsend, 1931a: 74 (specimen examined).

Sarcophaga compta Wiedemann of Mattos, 1919: 63, pl. 3 (misident.).

Sarcophaga aurigena Townsend of Engel, 1931: 146, fig. 12 (misident.).

Oxysarcodexia neotropicals Prado & Fonseca, 1932: 36, fig. 4.

Oxysarcodexia thornax Lopes & Leite, 1986, figs 9-13 (L1).

O. thornax (Walker) is the commonest species of *Oxysarcodexia* living in southern South America being largely distributed:



Oxysarcodexia thornax (Walker), male genitalia. Fig. 7: phallic organs, lateral view. Fig. 8: penis and internal forcipules, anterior view. Fig. 9: penis anterior view. Fig. 10: idem, dorsal view. Fig. 11: apical plate of paraphallus, anterior view. Fig. 12: cerci and penis, dorsal view.

“Amazonica”, “Cerrado”, “Paranense”, “Atlantica”, “Caatinga”, “Chaqueña”, “Pampeana” Provinces (Cabrera & Willing, 1973), reaching the “Yungas” Province. It belongs to a group of species in which the ventralia is formed by a pair of conspicuous plates united proximally; the females present a very reduced syntergite VI + VII, represented by reduced plates (Lopes,

1976: figs 4-12); the signum and vaginal plate being very large. Five species belong to this group, three of them living in the “Atlantic” Province: *O. thornax* (Walker, 1849), *O. morretesi* Tibana & Mello, 1983 and *O. timida* (Aldrich, 1916); the other species: *O. conclausa* (Walker, 1861) and *O. afficta* (Wulp, 1895) are found from “Mesoamericana de Montaña” to

"Pacifica" Province, one of them reaching "Desertica" and "Subantartica" Provinces through the "Yungas" Province.

Some very interesting features are easily observed in the scanning photographs now presented: the apical plate is composed of two plates, laterally covered with short pile, having anteriorly about six pairs of flat appendages (Fig. 11); the apical plate is connected with the paraphallus by a poorly sclerotized region (Fig. 10) which presents, posteriorly, a rounded apophysis best seen in Fig. 7. The paraphallus is entirely incorporated to the theca but the limit between them shall be observed in the Figs 7, 10; anteriorly, the theca is ventrally sclerotized but the paraphallus shows a median membranous region and, on each side, an angular limit. The most complicated part of the penis is the ventralia with a rounded dentate part and a slender apophysis, anteriorly, on each flat plate (Figs 7, 9, 10); the dorsal part of the ventralia is curved inwards (Fig. 10) and the ventral margins are almost straight in lateral view (Fig. 7) but are curved outwards in dorsal view (Fig. 10). The styli of glans are internally protect by the apical plate but evidently shall be able to attain the female organs through the apical aperture seen in the Fig. 11.

Oxysarcodexia fluminensis Lopes, 1946
(Figs 13 to 18)

Oxysarcodexia fluminensis Lopes, 1946: 104, figs 103-105.

This species belongs to the paulistanensis group, the ventralia is spinous, having a pair of lateral rounded apophysis dorsally on the base of the median stalk. The females present a large syntergite VI + VII which became membranous longitudinally on middle. The pair of the apical plates of the paraphallus bears abundant pile, laterally; the poorly sclerotized region connecting with paraphallus is reduced and the membranous apophysis is small (Fig. 18). Anteriorly the apical plates are curved forwards and present a pair of flat median apophyses and a pair of large proximal lobes, all covered with pile (Figs 16, 17). The ventralia is more complicated than that of *thornax*: there are a median stalk bearing a pair of basal rounded lobes (Figs 14, 16, 17) and anteriorly, two pairs of curved spinous apophyses, both with convergent apices (Fig. 15). The limit between theca and paraphallus is easily seen in Figs 13, 15 and 16.

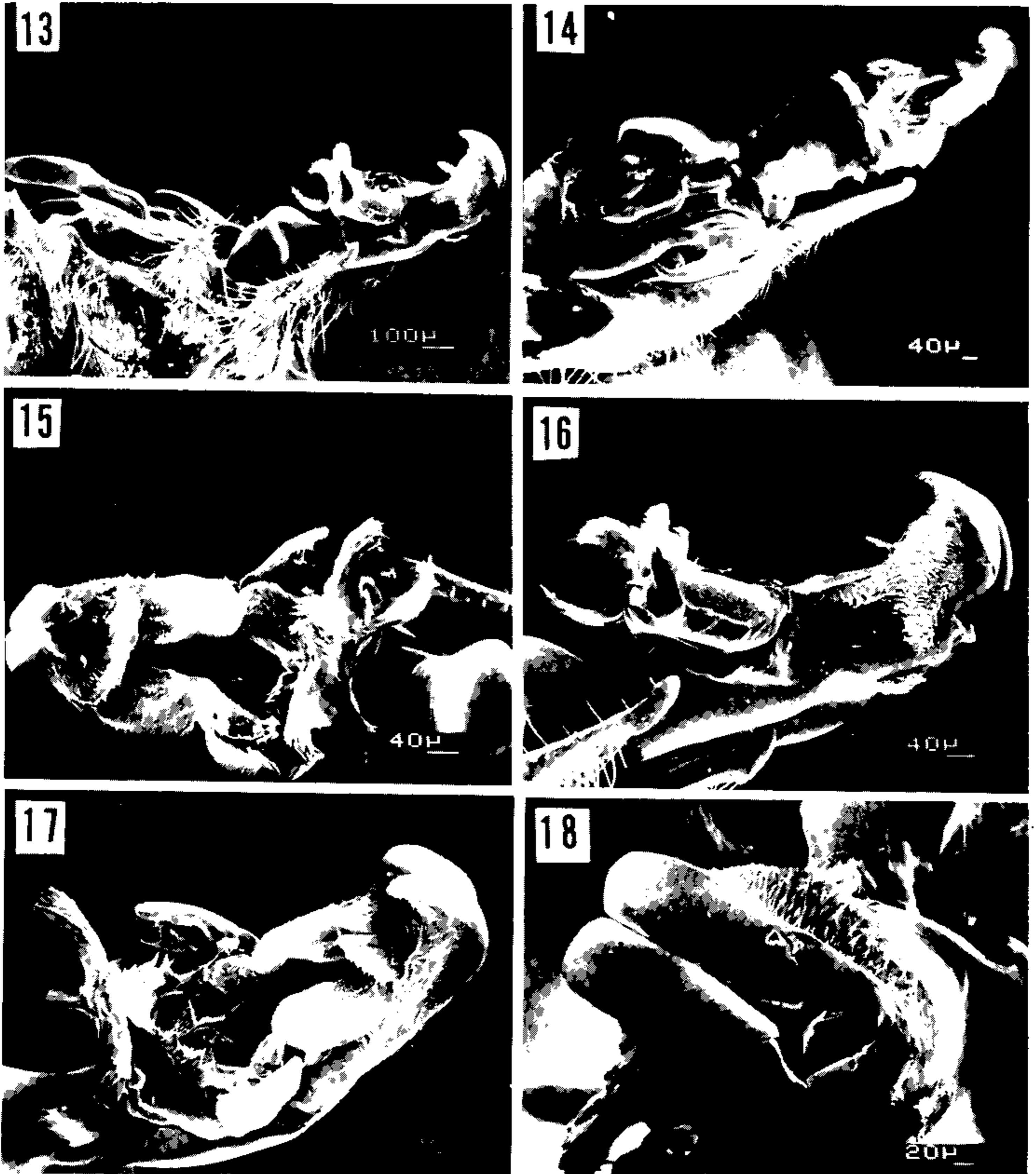
Genus *Sarcodexia* Townsend, 1892

Sarcodexia Townsend, 1892: 105. Type-species: *S. sternodontes* Townsend, 1892 (orig. desig.) = *Sarcophaga lambens* Wiedemann, 1830.

Cricobrachia Enderlein, 1928: 19. Type-species: *C. anitsiana* Enderlein, 1928 (orig. desig.) = *Sarcophaga lambens* Wiedemann, 1830.

In addition to the type species, largely distributed in the Americas, from the southern United States to Argentina and Paraguay, also introduced on Cook and Samoa Islands, *Sarcodexia notata* Lopes, 1953 was described from Venezuela and recorded from Ecuador. Both species were found on dead Arthropods. Roback (1954) proposed the subtribe Sarcodexiina in which he included *Paraphrissopoda* Townsend and *Euboettcheria* Townsend. Roback characterized the subtribe by having "median filaments formed by the antero-ventral prolongation of the median edges of the ventral sclerotization (p. 16, chart 3). It is easily observed that the median process of glans (median filaments of Roback), commonly found between the styli, is absent. However in some species, the median process is visible. Lopes (1983) based mostly in larval characters, considered only the genus *Sarcodexia* in the subtribe Sarcodexiina, the other two genera were included in the subtribe Paraphrissopodiina, the other two genera were included in the subtribe Paraphrissopodiina (now Peckiina because *Paraphrissopoda* = *Peckia*). The first instar larvae of the species of both subtribes share a conspicuous synapomorphy: the elongate clypeal arch reaching the clypeal phragma; the spherical spermatheca of the species of both subtribes is also found in the Adiscochaetina. However Sarcodexiina present large, hairy anal tergite not found in the species of the other subtribes (Lopes, 1975: 543, fig. 30). Another important character found in *S. lambens* is the largely divergent styli which correspond to very peculiar features in the female genitalia: the openings of the spermathecae ducts are situated on the sides of the vagina (Lopes, 1941: 218, figs 8-10).

The structure of the penis in the second species of the genus (*S. notata*) is similar to the type species (Lopes, 1953: 230, figs 16-19); the female syntergite VI + VII however, is composed of two plates, not entire as in *S. lambens*. Some



Oxysarcodexia fluminensis Lopes, male genitalia. Fig. 13: cerci and phallic organs, lateral view. Fig. 14: idem, anterior view. Fig. 15: penis, anterior view. Fig. 16: idem, lateral view. Fig. 17: idem, oblique view. Fig. 18: apical plate of paraphallus, posterior view.

other external characters of *notata* are also very different from *S. lambens*: there are three (not four) post-dorsocentral bristles, spaced for three, middle femur presents ctenideum and R1 is hairy on center. One of us (H. S. L.) has two males and one female of *S. notata* from Ecuador (Zamora); the holotype was collected near Caracas from borer of *Doratopeas* sp. (Lepidoptera). However, the cerci and penis of

S. lambens and *S. notata* are very similar. There are three species of *Euboettcheria* with divergent styli: *E. aequata* (Wulp, 1895); *E. dominicana* Lopes, 1982 and *E. alvarengai* Lopes & Tibana, 1983; the females of this species are unknown. All known species of *Euboettcheria* show a peculiar feature in the vaginal wall in which the openings of the spermathecae ducts are reaching (Lopes, 1958: 226, fig. 103).

Some structures of the male genitalia of *S. lambens* became well elucidated after the scanning photographs now presented. The extremity of the cercus shows a posterior point (Figs 19, 20, 24) and there is very conspicuous internal crest (Figs 20, 21); in posterior view the extremity presents two points (Fig. 21). Surstylus elongated, with conspicuous long hairs on distal half and numerous small, closely inserted hairs on base (Fig. 19). The penis shows divergent arms, the apical plate (juxta of Roback, 1954, fig. 302) is curled, protecting each stylus and showing a conspicuous curved point (Figs 19, 23). The extremity of the styli is expanded showing internally a small tubercle; these structures are detailed in Fig. 22. A rounded ventralia is also seen in Figs 21, 23. After the photographs now published it is easy to understand the mechanism of transferring the semen through the styli, protected by the curled apical plate, to the openings of the spermathecae which are situated on the pigmented plates of the vaginal wall (Lopes, 1941: 218, figs 8-10).

Genus *Peckia* Robineau-Desvoidy, 1830

Peckia Robineau-Desvoidy, 1830: 335 (type-species, *P. imperialis* Robineau-Desvoidy (desig. Coquillett, 1910: 585) = *Sarcophaga praeceps* Wiedemann, 1830.

Paraphrissopodia Macquart, 1835: 222 (type-species, *Sarcophaga praeceps* Wiedemann, 1830 (orig. design.).

Paraphrissopoda Townsend, 1915: 118 (type-species, *Peckia lamanensis* Robineau-Desvoidy (orig. design.) = *Musca gulo* Fabricius.

Chrysostomyia Townsend, 1931b: 315 (type-species, *Sarcophaga chrysostoma* Wiedemann, 1830. (orig. desig.).

Paradisochaeta Blanchard, 1939: 834 (type-species, *Adisochaeta enderleini* Engel, 1931 (orig. desc.).

The type species of *Peckia*, *P. praeceps* (Wiedemann, 1830) is morphologically very similar to the type species of the junior synonyms, including the female genitalia. Dodge always adopted this synonym. Some genera, in the family, present the differences showing by *P. praeceps* when it is compared with the other species considered now in the genus *Peckia*,

especially the entirely and shining black abdomen, not tessellated. The neotropical genus *Austrohartigia* and the oriental genus *Sarcorohdendorfia* present black abdomen in some species (*Austrohartigia nigriventris* Lopes and *Sarcorohdendorfia nigriventris* (Lopes); in spite, most of the species show tessellated abdomen, the pollinosity lacking in the referred species. The nearest genus of *Peckia* is *Euboettcheria* Townsend, 1927, type-species *E. australis* Townsend, 1927, from southern South America which differs from *Peckia* especially by the absence of the ventralia, the penis being elongated, causing important modifications in the vagina, in the region of the openings of the ducts of spermathecae are situated (Lopes, 1958: 226, fig. 103).

The genus belongs to the subtribe Peckiina (= Paraphrissopodina Rohdendorf, 1967: 59) which differs from Sarcodexiina mostly by the reduction of the post-dorsocentral bristles, by the presence of a vestigial hairy sixth abdominal tergite of males (Lopes, 1958: 218, figs 38-40) and by the enlarged distal section of the ducts of spermathecae.

Peckia chrysostoma (Wiedemann, 1830) (Figs 25 to 30)

Sarcophaga chrysostoma Wiedemann, 1830: 356; Aldrich, 1924: 210 (type examined). Type locality: St. Thomas.

Chrysostomyia townsendi Prado & Fonseca, 1932: 37, fig. 5. Type locality: S. Paulo, Brazil.

Sarcophaga clotho Curran & Walley, 1934: 482, fig 41 not Brethes, 1920. Type locality: Kartabo, Guyana.

Sarcophaga clotho impura Curran & Walley, 1934: 493. Type locality: Kartabo, Guyana.

Chrysostomyia bergi Blanchard, 1939: 831, fig 11. Type locality: Misiones, Argentina.

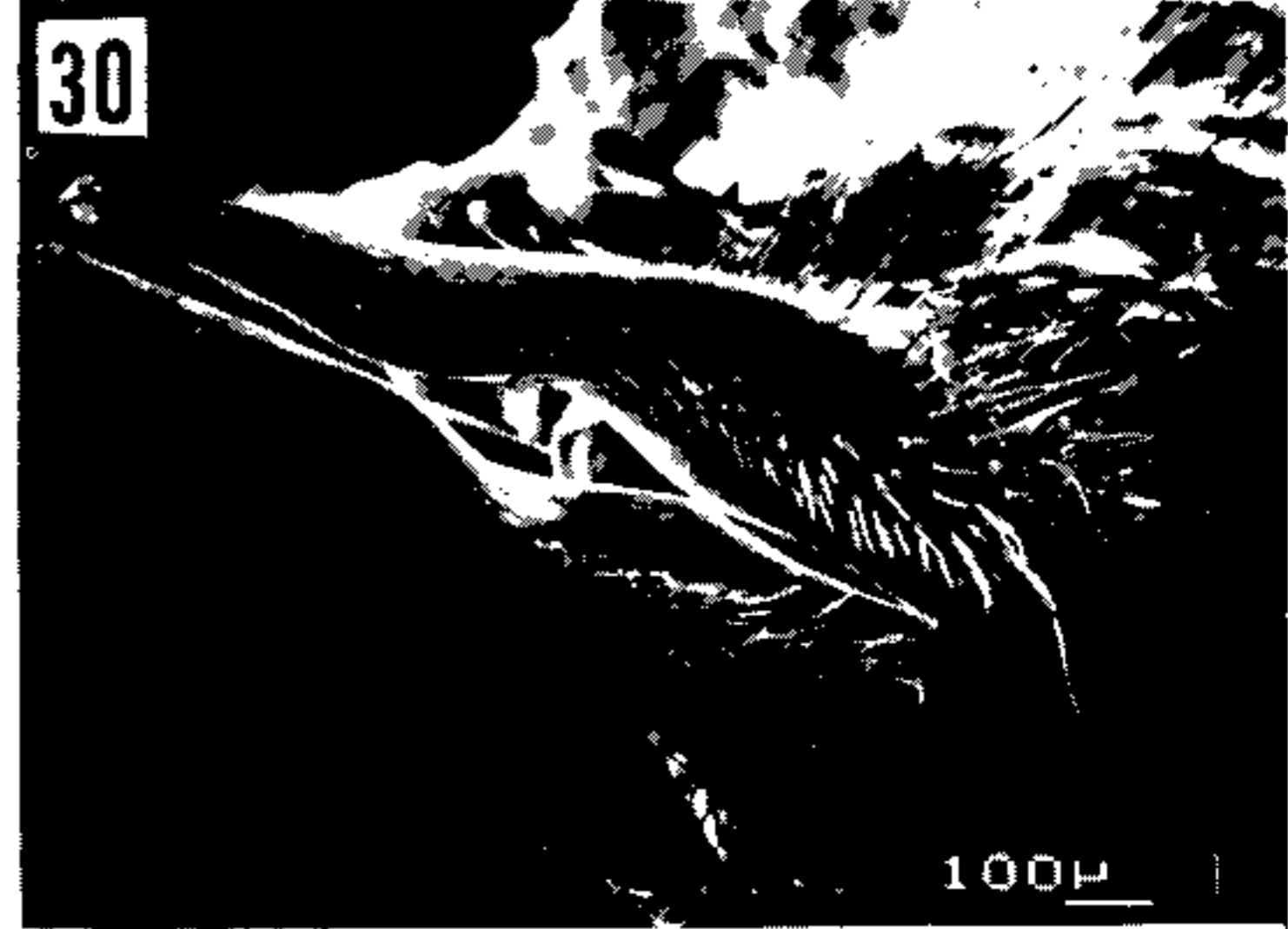
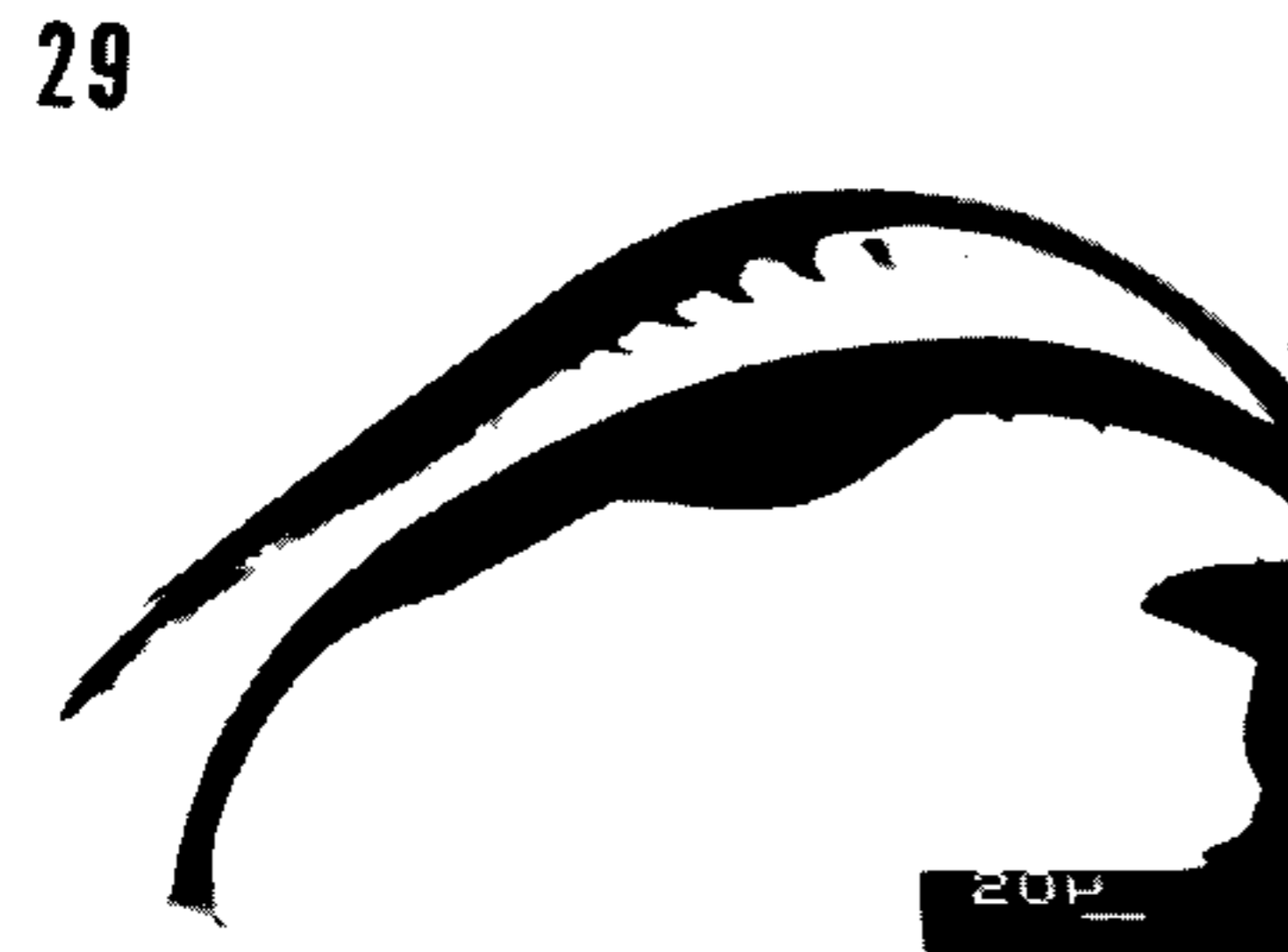
This species is the commonest large species of Sarcophagidae in Brazil, the species was found on sea beach with about 22% of specimens collected; with 5.46% of the specimens attracted to human faeces and 1.98% attracted to rotten bananas, near a secondary forest in Angra dos Reis, State of Rio de Janeiro; the species is easily reared on dead fish in the Laboratory of the Institute Oswaldo Cruz and



Sarcodexia lambens (Wiedemann), male genitalia. Fig. 19: cerci and phallic organs, lateral view. Fig. 20: apex of penis and cerci, lateral view. Fig. 21: idem, anterior view. Fig. 22: right stylus of glans. Fig. 23: apex of cerci and penis. Fig. 24: cerci, posterior view.

abundantly reared in Angra dos Reis on fish viscera (Lopes, 1973: 287). Third instar larvae were studied (Lopes, 1943: 134, figs 8-16), the dentate is separated from the base of maxilla, the hypostomal touching the clypeal phragma and a ventral ring is present on mouth aperture (figs 12, 13, m); the vestige of mandible is found, forming a bridge between bases of maxillae (fig. 11, c).

Female genitalia (Lopes, 1941) composed of a vaginal plate, the signum presenting some pigmented spots and a large concavity in which the ducts of spermathecae fall into a single tube; the spherical spermathecae show a fusiform peduncle which extends to a narrow duct prolonged in a distal wide duct; the ducts are involved by cells bearing small nucleus; the spermathecae is connected with the outer wall



Peckia chrysostoma (Wiedemann), male genitalia. Fig. 25: cerci and phallic organs, anterior view. Fig. 26: idem, posterior view. Fig. 27: apex of penis, anterior view. Fig. 28: idem, lateral view. Fig. 29: styli. Fig. 30: cerci, posterior view.

of the oviduct by large cells (Lopes, 1941: 219, fig. 15).

Male genitalia somewhat variable; Roback, 1954 (figs 290-292) published good figures; Blanchard, 1939 (figs 11 a-f), under the name of *C. bergi* figured male and female genitalia; Lopes, 1976 (figs 69-76) gave figures of the commonest variations of the male genitalia, especially those of cerci which present some-

times a conspicuous dorsal process like that found in the specimens of *hilifera* group (fig. 69); variations were observed including in specimens reared from the same female and nourished with different amount of feed.

Some important additions to the male genitalia morphology were observed in the scanning photographs now published. The most interesting one is the structure of the styli of

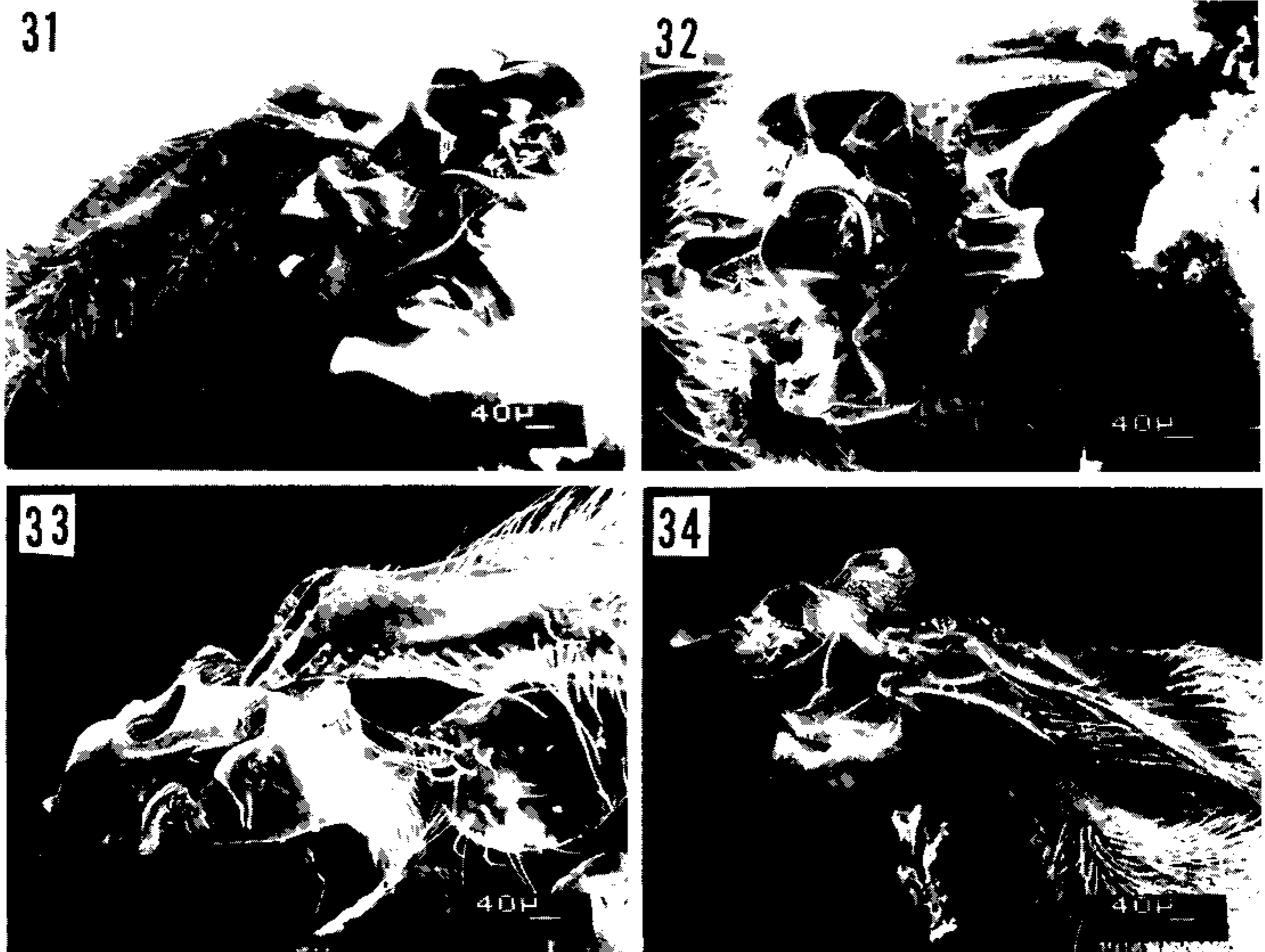
glans which are represented in the previous drawings as a pointed extremity being a recurrent teeth (Prado & Fonseca, 1932, fig. 5; Hall, 1933, fig. 14; Curran & Walley, 1934, fig. 41; Blanchard, 1939, fig. 11e; Roback, 1954, fig. 290; Lopes, 1958, figs 70-76; Lopes & Kano, 1968, fig. 7); two styli penetrate the conducts of the spermathecae. In the scanning figures it is easily observed that the extremities of the styli are expanded (Fig. 29) and there is a crest covering part of the spines (Figs 27-29). These crest are hyaline like part of the extremity and these structures are invisible by optical microscopy. The species of cerci are longitudinally striated (Figs 25, 30); the internal margins of the apical plate of paraphallus show a reticulated region (Fig. 27); the lateral plates of paraphallus have distal part largely flattened, the internal margins touching (Fig. 27); palpi genitalium apically bearing numerous small hairs (Fig. 26); median process of glans projecting forwards (Fig. 28).

Liopygia ruficornis (Fabricius, 1794)
(Figs 31 to 34)

Musca ruficornis Fabricius, 1794: 314.

This species and two other introduced species: *Thomsonia argyrostoma* (Robineau-Desvoidy, 1830), and *Jantia crassipalpis* (Macquart, 1839), were considered belonging to subgenera of the large genus *Parasarcophaga* Johnson & Tieggs, 1921. The type species of *Parasarcophaga*, *P. sericea* (Walker, 1853) share with *Sarcophaga*, *Liosarcophaga* and some others genera of Sarcophagidae a peculiar structure of spermathecae which is formed by a large terminal region and some proximal large rings (Lopes, 1959: 57, figs 54, 56). *L. ruficornis* (Fabr.) *T. argyrostoma* (R. -D.) and *J. crassipalpis* (Macq.) present elongate, finely striated spermathecae (Lopes, 1945: 401, fig 8) and cannot belong to the Sarcophagini. The other palearctic species introduced in Brazil, *Bercaea cruentata* (Meigen) show different spermatheca which shows numerous transverse striae.

Some interesting characters of male genitalia are seen in the scanning photographs: the apices of cerci present a furrow from the posterior



Liopygia ruficornis (Fabricius), male genitalia. Fig. 31: cerci and penis, lateral view. Fig. 32: apex of penis, anterior view. Fig. 33: apex of penis and cerci, lateral view. Fig. 34: idem, posterior view.

part to almost the point (Fig. 31); the apical plate is composed of two arms, the right arm was broken (Figs 31, 34), in the left arm bifid apophysis, directed backwards, is observed; the membranous connection between apical plate and paraphallus is a deep region (Fig. 33); paraphallus heavy sclerotized, on each side, a very much curved pilose lateral plate (Figs 31, 33); ventralia composed of a median curved, parallel side plate and, on each side, a flat rounded apophysis (Figs 31, 32); the styli of glans (Figs 31, 32) are a pair of broad tubes, internally supported by dentate arms (Lopes, 1945: 401, fig. 5).

This species was introduced in Brazil about 1945, probably by aircraft, from the Oriental Region. Sinton (1921: 132) refers to this species causing myiasis in dogs.

RESUMO

Estudos sobre a genitália masculina de Sarcophagidae (Diptera) baseados em observações de microscópio de varredura – As genitálias dos machos de *Oxyvinia excisa* (Lopes), *Oxysarcodexia thornax* (Walker), *O. fluminensis* Lopes, *Sarcodexia lambens* (Wiedemann), *Peckia chrysostoma* (Wiedemann) e *Liopygia ruficornis* (Fabricius) foram estudadas com base em fotografias de microscópio de varredura. Alguns detalhes importantes foram evidenciados por este método.

Palavras-chave: Diptera – Sarcophagidae – genitália do macho – microscópio de varredura

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