

## *Chonopeltis liversedgei* sp. n. (Crustacea: Branchiura), parasite of the Western bottlenose *Mormyrus lacerda* (Mormyridae) from the Okavango Delta, Botswana

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**Abstract.** A new species *Chonopeltis liversedgei* sp. n. of the endemic African genus *Chonopeltis* Thiele, 1900 (Crustacea: Branchiura) is described. This ectoparasite inhabits the branchial chamber of its mormyrid host *Mormyrus lacerda* Castelnau, 1861 and was collected from three localities in the Okavango River and its inland Delta in Botswana, Southern Africa.

The endemic African branchiuran genus *Chonopeltis* Thiele, 1900 comprises 13 species, each with a limited distribution and narrow host preference. They are mostly restricted to only one drainage basin. Only two species, i.e. *Chonopeltis inermis* Thiele, 1900 and *Chonopeltis brevis* Fryer, 1961 are known to have crossed a watershed and establish in an adjacent drainage system (Fryer 1968, Van As and Van As 1993).

So far, two species have been recorded from the Zambesi River System. *Chonopeltis koki* Van As, 1992 was found on the skin of *Labeo cylindricus* Peters in the Upper Zambesi River (Van As 1992). *Chonopeltis lisikili* Van As et Van As, 1996 was found on the mouth folds and at the base of the pectoral fins of *Synodontis leopardinus* Pellegrin in the Zambesi River as well as in the Okavango River and its inland Delta (Van As and Van As 1996).

During surveys carried out in different localities in the Okavango River and Delta, specimens of *Chonopeltis* were collected from the branchial chamber of the Western bottlenose *Mormyrus lacerda* Castelnau, 1861. These specimens resemble *Chonopeltis schoutedeni* Brian, 1940, so far only known from the Zaire River System (Brian 1940, Darteville 1951, Fryer 1956, 1959 and Marques 1978). Upon closer examination, it was found that these specimens differ from *C. schoutedeni* and all other species of the genus and are described as a new species below.

### MATERIALS AND METHODS

During fieldwork carried out by a team of researchers from June to August 1998, fishes were collected in different localities in the Okavango River and Delta by means of gill nets, cast nets and electro-fishing. Fish were taken live to a field laboratory, set up nearby. Here, they were anaesthetised using MS222 and examined for the presence of ecto- and endoparasites. More than 1000 specimens of 54 different fish

species were examined, including 15 specimens of *Mormyrus lacerda*, some of which hosted specimens of a *Chonopeltis* species in their branchial chamber. These were removed by using a fine brush and fixed in 70% ethanol.

Back in the laboratory in Bloemfontein, they were studied by light microscopy and measurements (in mm) were made from microscope projection drawings.

Specimens used for scanning electron microscopy (SEM) were dehydrated to absolute ethanol, critical-point dried, sputter coated with gold and studied in a JEOL WINSEM JSM 6400 at 5 kV.

A single specimen of *C. schoutedeni*, on loan from the Natural History Museum, London (661.5 1957.6.5.78-85) for a previous study was examined by light microscopy (Van As 1992).

### RESULTS

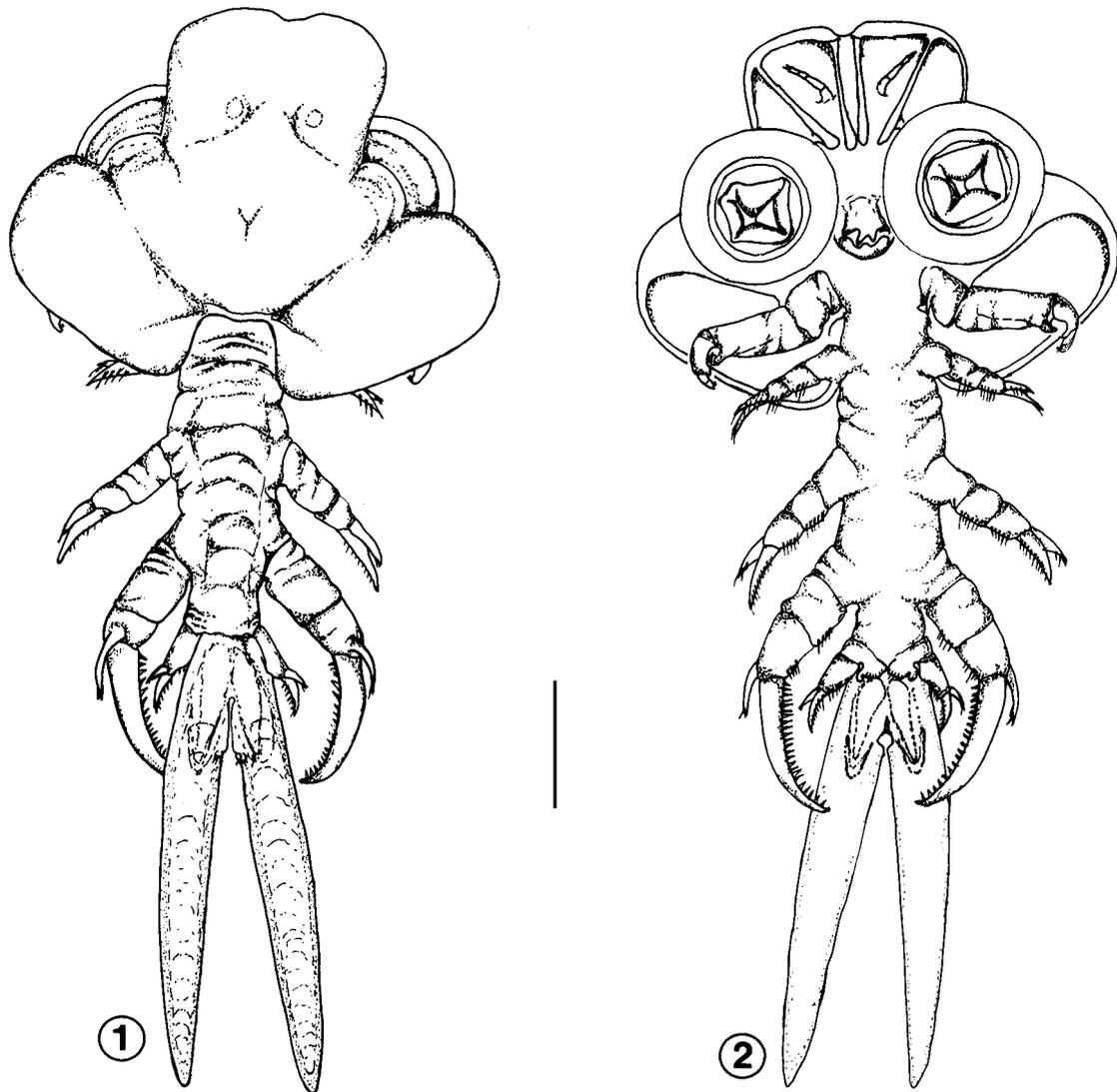
Of all the different fish species examined, only *Mormyrus lacerda* was infested with *Chonopeltis* specimens. A total of 15 specimens of *M. lacerda* from three different localities were collected and examined. Of these, 7 were infested; in all cases, the parasites were found in the branchial chamber. The description of the new *Chonopeltis* sp. below is based on 14 adult females and 5 adult and 1 young males.

#### *Chonopeltis liversedgei* sp. n.

Adult female

Figs. 1-13

**Description:** Total length of female 9 mm. General form elongated, slender body (Figs. 1, 2). Carapace trifoliate, reaching back to cover base of first pair of legs. Anterior margin of cephalic lobe thickened with deep medial indentation. Length of carapace 3.2 mm, c. 36% of total body length. Length of anterior carapace 1.6 mm, c. 50% of carapace length. Width of anterior carapace 1.7 mm, c. 40% of maximum width of carapace, 4.3 mm. Eyes and ocellus like in other *Chonopeltis* species. Four chitinous supporting rods in

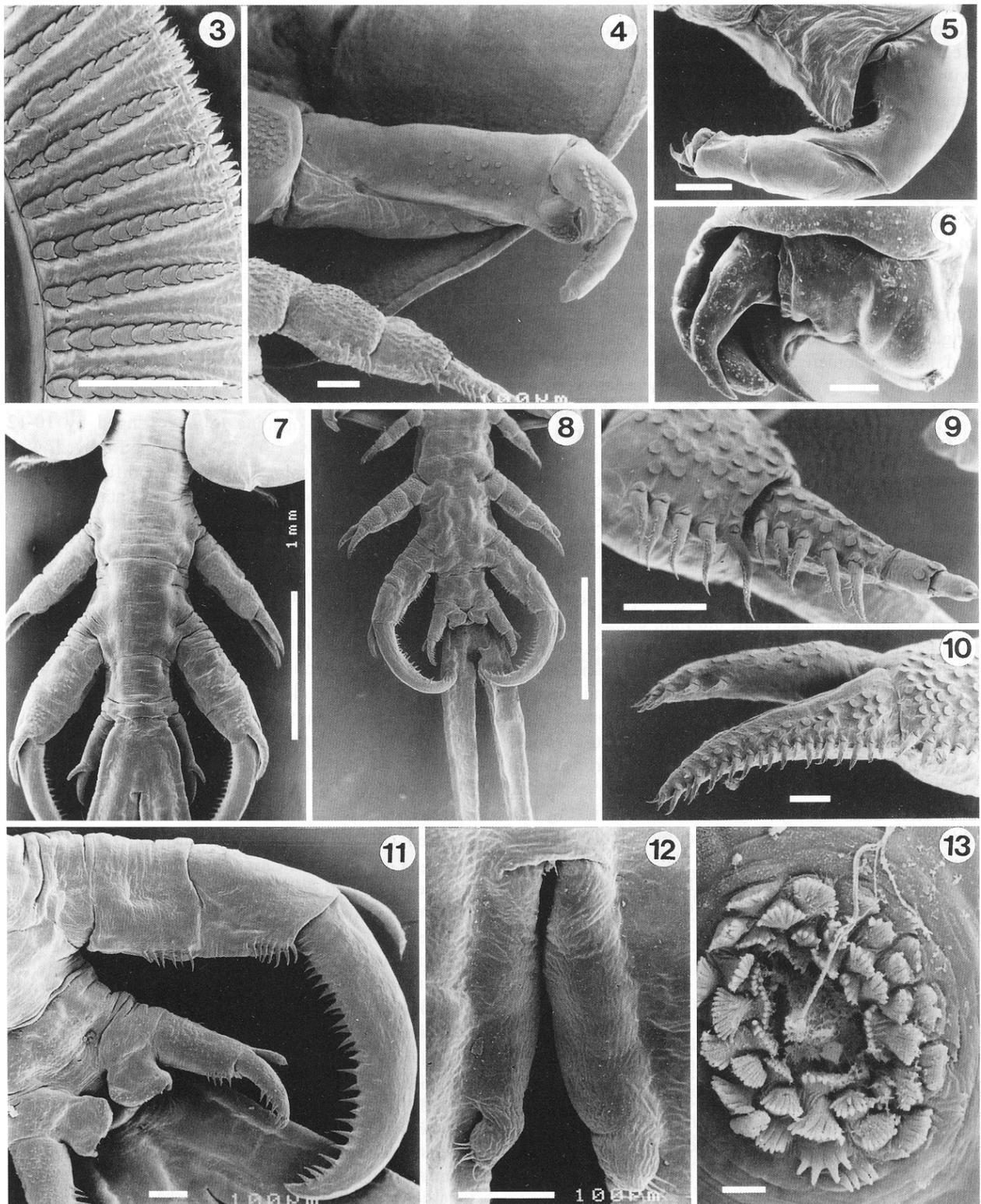


**Figs. 1, 2.** Microscope projection drawings of *Chonopeltis liversedgei* sp. n., holotype female. **Fig. 1.** Dorsal view. **Fig. 2.** Ventral view. Scale bar = 1 mm.

anterior carapace, proximal rods close together, almost parallel. Lateral rods v-shaped. Posterior parts of rods not connected (Fig. 2). Single large elongated oval-shaped respiration area situated in lateral carapace lobes. Antenna 4-segmented; proximal segment short, broader than other three segments, second segment longest, distal segment terminating in four spines. Cluster of 12 to 18 setae situated at base of antenna. Suckers (maxillulae) large, diameter 1.4 mm, c. 16% of total body length, with 72-80 rows of chitinous supporting rods, each consisting of between 10-16 inter-linking sclerites (Fig. 3). Margin of sucker fringed by single row of short tapering setae each with apical brush of fine setules. Mandibles curved with single row of sharply pointed teeth on concave side. Three rows of crenulated scales on ventral lip of mouth. Maxilla robust, strongly prehensile, larger than first pair of legs

(Fig. 4), more or less of similar size as legs 2. Proximal part of maxilla consists of 2 well developed elongated segments. Distal part of maxilla consists of 3 short segments (Fig. 5). Last podomere minute, terminating with a pair of retractable claws (Fig. 6). Proximal and distal part connected by hinged cubital joint. This appendage adapted to perform holding function. To further facilitate this function, distal extremity of second podomere and posterior part of third podomere, studded with scales (Fig. 5).

Thorax extended, section from maxilla up to leg 3 of equal thickness. Thorax section between legs 3 and 4 reduced to almost half the width of preceding section. Dorsal side of thorax without scales, ventral side of thorax with scabrous areas. Legs unevenly spaced, but well separated. Space between legs 1 and 2 larger than space between legs 2 and 3 and legs 3 and 4. Legs 1



**Figs. 3-13.** Scanning electron micrographs of *Chonopeltis liversedgei* sp. n., female. **Fig. 3.** Section of sucker margin. **Fig. 4.** Maxilla and leg 1. **Fig. 5.** Last three podomeres of maxillae. **Fig. 6.** Retractable claws of maxilla. **Fig. 7.** Legs 2, 3 and 4, dorsal view. **Fig. 8.** Legs 1, 2, 3 and 4, ventral view. **Fig. 9.** Endopod of leg 1. **Fig. 10.** Exo- and endopod of leg 2. **Fig. 11.** Legs 3, 4 and natatory lobes, ventral view. **Fig. 12.** Furcal rami. **Fig. 13.** Spermatheca opening. Scale bars: Figs. 3, 4, 11, 12 = 100 µm; Figs. 5, 9, 10 = 50 µm; Fig. 6 = 10 µm; Figs. 7, 8 = 1 mm; Fig. 13 = 5 µm.

small, legs 2 slightly larger, with legs 3 very large, almost of same diameter as posterior part of abdomen. Legs 4 small (Figs. 7, 8). First podomere of leg 1 without setae, but heavily scaled, second podomere with single row of 6-8 stout setae and scabrous areas on ventral side, third podomere with 5-7 similar setae and scabrous areas (Fig. 4). Exopod of leg 1 unsegmented, longer than 3-segmented endopod (Fig. 9), both with setae similar to those on podomeres. Arrangement of setae and scales on podomeres of legs 2 similar to those of legs 1. Both exo- and endopods consist of only single segment, endopod slightly longer than exopod. Endopod with single row of 14-18 stout setae, distal end of exopod with only 4-6 setae (Fig. 10). All setae bear single row of setules as in legs 1. Legs 3 huge, second and third podomeres with single row of stout sharp spines. Exopod greatly reduced, bearing setae only on distal end, endopod massive, scimitar-shaped with single row of 24-30 stout, sharply pointed spines (Fig. 11). None of the spines on legs 3 bear any setules. Exopod of leg 4 greatly reduced in size, endopod large. Leg 4 bearing similar spines to those of legs 3. Natatory lobe of leg 4 broad, with curved caudal protrusion (Fig. 11). Posterior margin of natatory lobe with short, stout spines, without setules.

Abdomen long, length 3.7 mm, c. 41% of total body length. Length of fused part, 0.8 mm, c. 22% of abdomen length. Length of cleft 2.9 mm, c. 78% of abdomen length. Width of abdomen 0.9 mm. Abdomen lobes straight, elongated, oval-shaped. Furcal rami situated some distance posterior to base of abdomen cleft, slightly curved, terminating in cluster of 6-8 simple setae (Fig. 12). Furcal rami only visible from dorsal side. Spermathecae elongated pear-shaped, extending past cleft and slightly beyond furcal rami (Fig. 2). Opening of spermathecae fringed by circular row of specialised scales (Fig. 13).

Colour of live specimens off-white, no pigment bands overlaying uteri, no other distinct body pigmentation.

#### Adult male

Figs. 14-21

**Description:** Total length male 6.7 mm. General form elongated, slender (Figs. 14, 15). Carapace reaching back to cover base of first pair of legs. Length of carapace 2.7 mm, c. 40% of total body length. Length of anterior carapace 1.3 mm, c. 48% of carapace length. Width of anterior carapace 1.5 mm, c. 43% of maximum width, 3.5 mm, of carapace. Sucker diameter 1.2 mm, c. 18% of total body length. Rest of cephalon and cephalic appendages as in female.

Leg 1 as in female. Leg 2 of same basic construction (Fig. 16), but much larger and with two bulbous posterior projections, covered by bristle-like scales, on first two podomeres (Fig. 17). Configuration of setae in

leg 2 (Fig. 18) similar to those of female. Legs 3 and 4 with copulatory structures. Second podomere of leg 3 adapted as socked structure. On ventral side this podomere appears large, sac-like without setae (Fig. 16). Dorsally this sac has an elongated arched opening (Fig. 19). Third podomere with indentation on anterior side, corresponding to posterior projections of legs 2. Posterior side of third podomere with 3 stout spines, without setules. Endopod greatly enlarged with single row of about 20 spines, exopod without spines (Fig. 19). Leg 4 on ventral side partially obscured by sac of leg 3 (Fig. 16). On dorsal side, second podomere extends in anterior direction to form prominent peg structure (Fig. 20). Base of peg forms bulbous extension, tapering towards straight hollow tip. Prominent process studded with specialised scales, situated on ventral side of peg (Fig. 20). Rim of peg opening on ventral side forming extended lip, inner opening of peg fringed by 10-12 finger-like protrusions (Fig. 21). Endopod curved, with single row of 5-7 spines. Exopod modified, forming groove with scale-studded margin. Natatory lobes undivided, short cylindrical with a single spine (Fig. 16).

Abdomen long, v-shaped, length 2.6 mm, c. 39% of total body length. Length of fused part 0.7 mm, c. 27% of abdomen length. Length of cleft 1.9 mm, c. 73% of abdomen length. Width of abdomen 0.8 mm. Shape of abdominal lobes, elongated oval. Testis elongated oval-shaped, extend past cleft for almost half its length (Fig. 14). Furcal rami as in female.

No dorsal band of pigmentation. Body colour similar to female, but with specks of pigmentation on abdomen.

**Type host:** *Mormyrus lacerda* Castelnau, 1861 (Mormyridae).

**Site of infection:** Branchial chamber.

**Type locality:** Channels in the permanent swamps close to the Boro River in the Okavango Delta (19°26'S, 22°49'E).

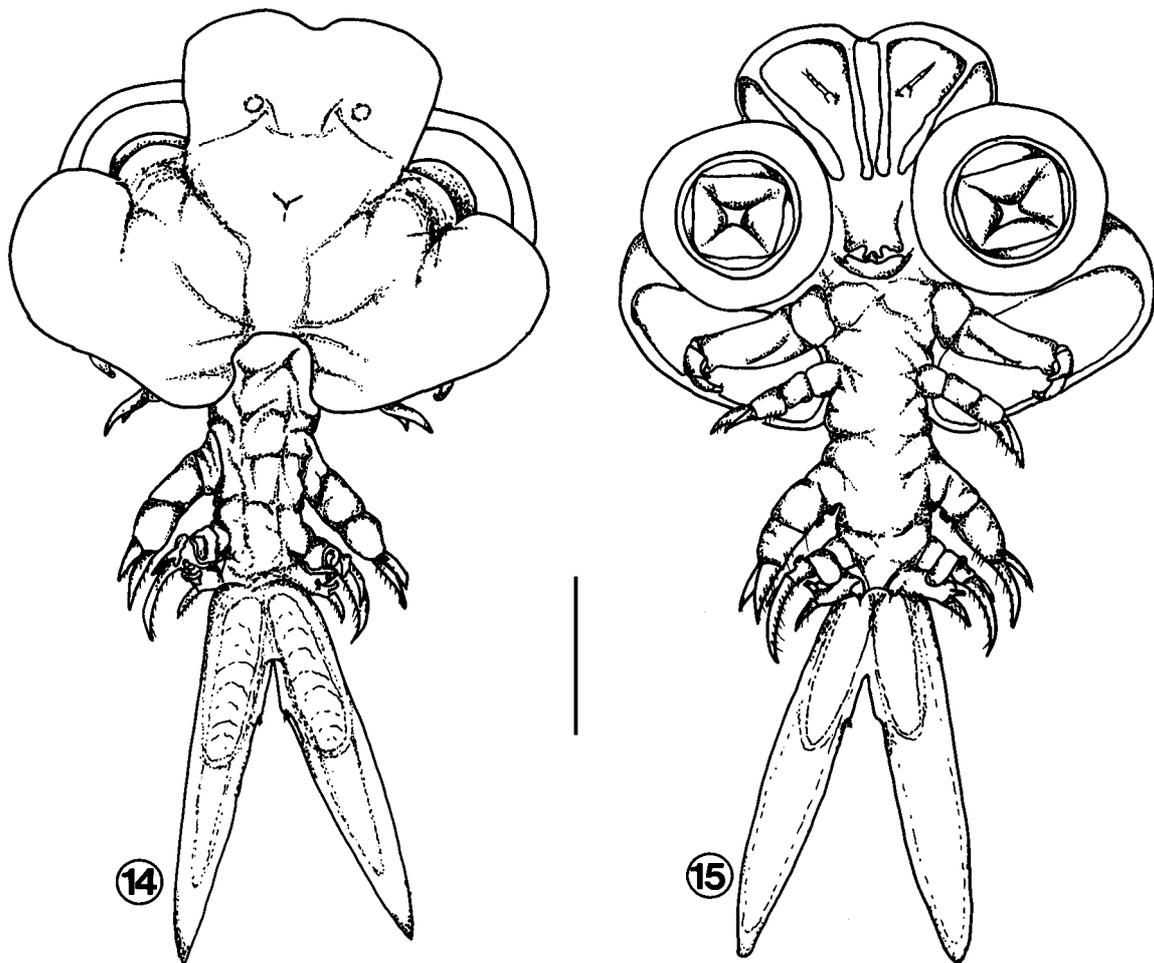
**Other localities:** Lagoon off Okavango River mainstream in Panhandle (18°23'S, 21°51'E) and in lagoons in the Kalatog Channel (18°25'S, 21°56'E).

**Prevalence:** 7/15 (47%) of examined hosts were infested.

**Intensity:** 1-4 parasites per infested host with a mean of 3.

**Deposition of types:** Holotype, female 98/7/20-2 [NMBP 214], allotype, male 98/7/20-1 [NMBP 215] in the collection of the National Museum, Bloemfontein, South Africa. A female 98/07/19-2 and a male 98/07/19-9 paratypes [No. PaÚ AV ČR 1975] in the collection of the Institute of Parasitology, ASCR, České Budějovice, Czech Republic. Other paratypes in the collection of the authors.

**Ety m o l o g y:** Named after Tim and June Liversedge of Maun, Botswana in recognition of their commitment to environmental conservation.



**Figs. 14, 15.** Microscope projection drawings of *Chonopeltis liversedgei* sp. n., allotype male. **Fig. 14.** Dorsal view. **Fig. 15.** Ventral view. Scale bar = 1 mm.

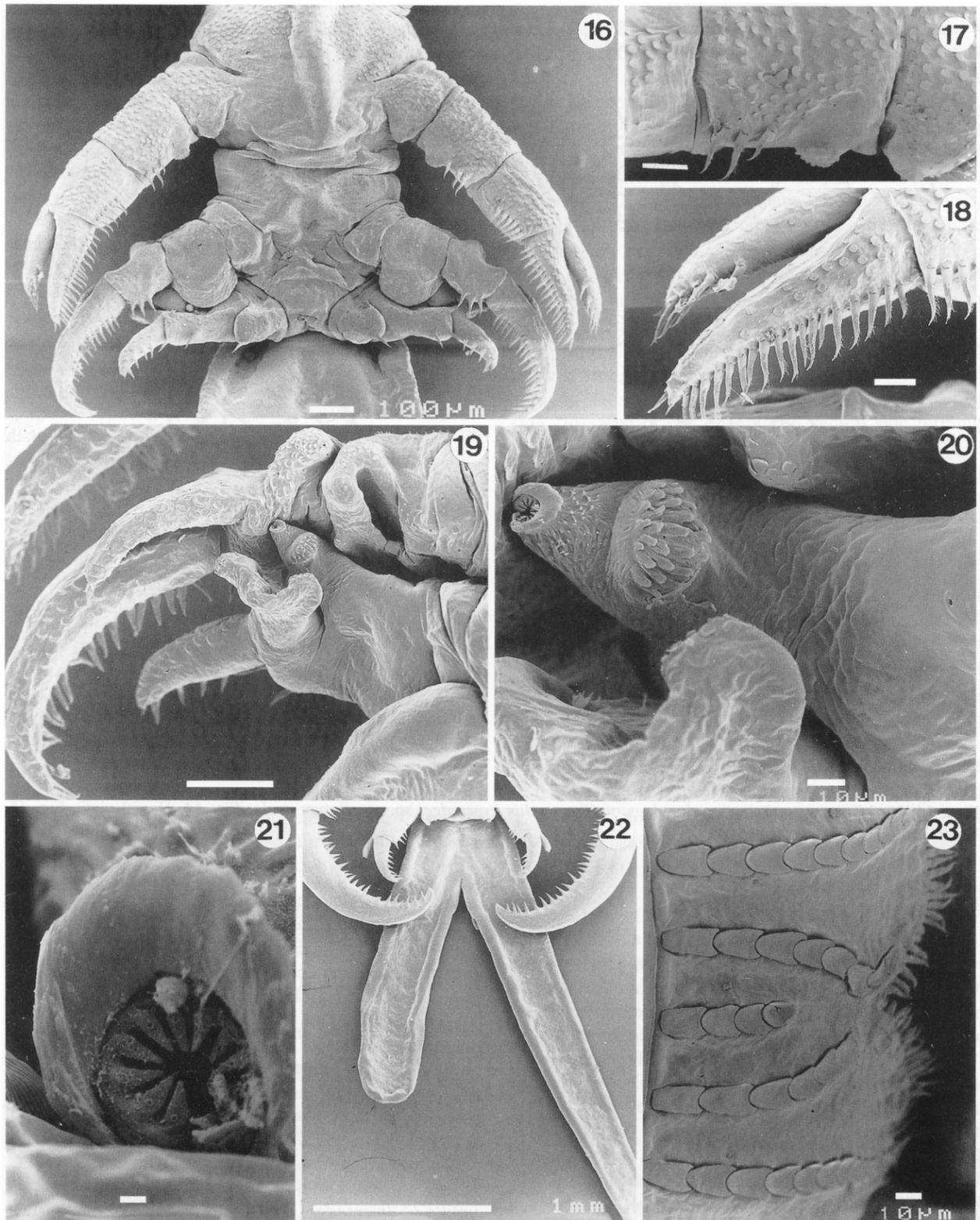
## DISCUSSION

*Chonopeltis liversedgei* sp. n. has a slender body with a short carapace and long abdomen. Other species with a short carapace and long abdomen are *Chonopeltis inermis* Thiele, 1900, *Chonopeltis congicus* Fryer, 1959, *Chonopeltis elongatus* Fryer, 1974, *Chonopeltis fryeri* Van As, 1986, *Chonopeltis flaccifrons* Fryer, 1960 and *Chonopeltis schoutedeni* Brian, 1940. The morphology of the thoracic appendages and copulatory structures of these species differ significantly from *C. liversedgei*.

*Chonopeltis schoutedeni* show some resemblance to *C. liversedgei*, but can be distinguished as follows: The anterior carapace lobe of *C. liversedgei* is large and almost rectangular in shape, whilst in *C. schoutedeni* the anterior margin is shorter than the base. This is evident in the drawings presented by Brian (1940), Darteville (1951), Fryer (1959) and Marques (1978) as well as in the single specimen which we examined from the Natural History Museum, London (Fig. 24). In both sexes, but in particular in female, leg 3 of *C. liversedgei*

is more robust than in *C. schoutedeni* (cf. Figs. 7, 8 with 24). The exopod of leg 4 of female in *C. liversedgei* is shorter than in *C. schoutedeni*. The latter species lack the prominent reduction in size of the thorax from behind leg 3 in female, which is a consistent feature in all the specimens of *C. liversedgei* we examined. The spermathecae of *C. schoutedeni* are oval-shaped and shorter than the elongated pear-shaped spermathecae of *C. liversedgei*. In the latter, the abdominal lobes are oval-shaped in contrast to the narrow tapering lobes of *C. schoutedeni* (Fig. 24).

*Chonopeltis liversedgei* co-exists with *C. koki* and *C. lisikili* in the Zambesi System. Both these species, unlike *C. liversedgei*, are found on the external surface of their host and have dark pigment bands overlaying the uteri. Both *C. koki* and *C. lisikili* are also darkly pigmented whereas *C. liversedgei* is without pigmentation patterns. *Chonopeltis liversedgei* can clearly be distinguished from these two species based on the morphology of the carapace, thoracic appendages and abdomen.



**Figs. 16-23.** Scanning electron micrographs of *Chonopeltis liversedgei* sp. n. **Figs. 16-21.** Male. **Figs. 22, 23.** Female. **Fig. 16.** Legs 2, 3 and 4, ventral view. **Fig. 17.** Bulbous protrusions on leg 2. **Fig. 18.** Exo- and endopods of leg 2. **Fig. 19.** Legs 3 and 4, dorsal view. **Fig. 20.** Peg, dorsal view. **Fig. 21.** Peg opening. **Fig. 22.** Healed abdominal lobe. **Fig. 23.** Healed injury on sucker margin. Scale bars: Figs. 16, 19 = 100 µm; Figs. 17, 18 = 50 µm; Figs. 20, 23 = 10 µm; Fig. 21 = 1 µm; Fig. 22 = 1 mm.

*Chonopeltis liversedgei* displays the same degree of host specificity as has been observed in other species. Despite the fact that we examined more than 1000 specimens of 54 fish species, including many specimens of other mormyrid fishes occurring in the Okavango Delta, we only found *C. liversedgei* associated with *Mormyrus lacerda*. In all cases they were found inside the branchial chamber and never more than two specimens in a single chamber. This host is endemic to the western part of the Zambesi River System and restricted to the Cunene, Okavango, Upper Zambesi and Kafue Rivers (Skelton 1993). *Chonopeltis schoutedeni* has been recorded from different mormyrid species from the Zaire River System. We believe that it is closely related to *C. liversedgei* and probably radiated from a common ancestor.

*Chonopeltis liversedgei* displays some interesting morphological features uncommon in most of the other species. The general pattern, in most species, is that the first leg of females is normally the largest, with a progressive decline in size to leg 4. In this case, however, leg 3 is very large. The exo- and endopods, on the legs of females of the other species, are mostly similar in length and size. In *C. liversedgei*, however, the endopod of leg 3 is greatly enlarged and the exopod vestigial. On this leg as well as on leg 4, the setae, which normally have a single row of setules, are stout sharp spines, without setules. The maxilla of *C. liversedgei* is strongly prehensile, more so than in any of the other *Chonopeltis* species, except *C. schoutedeni*.

When we removed live specimens from their hosts, we made the mistake of placing three females together in the same container in river water. A few minutes later they were entangled in what appeared to be mortal combat, striking with their large third legs and pinching, very effectively, with the maxillae. It was impossible to separate them and in order to prevent damage to the



Fig. 24. Light micrograph of *Chonopeltis schoutedeni*; female, ventral view. Scale bar = 1 mm.

specimens, it required fixing them in ethanol. In some of the specimens we found scared appendages, such as the specimen in Fig. 22 where part of the abdomen is missing and in Fig. 23 showing a scar of a healed injury on the sucker rim. The morphology of the maxilla and leg 3 as well as our observation of the aggressive behaviour suggest that *C. liversedgei* may defend its territory against intruders.

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