

**A NEW PARASITIC COPEPOD, *TEGOMBOMOLOCHUS NASICOLA*
GEN. ET SP. NOV. (CYCLOPOIDA: BOMOLOCHIDAE),
FROM A JAPANESE GOATFISH^{1,2)}**

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With Text-figures 1-24

Two couples of large bomolochid copepods, representing a new genus and a new species, were obtained from the nasal cavities of a goatfish, *Pseudupeneus spilurus* (Bleeker), fished in Tanabe Bay, a couple from each of the cavities of a single host fish being attached to the olfactory lamellae and occupying almost the whole cavity space. This new species described here under the name of *Tegobomolochus nasicola* is deviated greatly from known bomolochids in that the ventral concavity of cephalosome, which serves as a suction cup to fasten the parasite to the host in usual bomolochids, is not formed and the first legs are functionally included in the metasomal series of legs, and further in having the metasomal segments each with an unusually expanded dorsal chitinous plate.

In addition to this copepod, the same host fish was infected by three other copepods, an unidentified taeniacanthid and chalimus larvae of a caligid, respectively in the bucco-branchial cavities and on the gill arches and *Colobomatus pupa* Izawa in the cephalic sensory canal system. The nasal cavities of other individuals of the same fish caught in the same bay were examined, but no couples of the present new bomolochid were found there, instead the cavities were occupied by the aggregation of an unidentified small taeniacanthid, while the other three copepods referred to above were generally found in their respective sites mentioned above. It is not rare that a single fish is infected at the same time by several different parasitic copepods as shown in the case of needlefishes, Belonidae (Cressey & Collette, 1971). This seems to show clearly that fishes are provided with much more niches for parasitic copepods than invertebrate.

Genus *Tegobomolochus* nov.

Diagnosis: A bomolochid. Body larger as compared with other genera of the family, with three metasomal segments each bearing a largely expanded dorsal

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shield. Cephalosome including first pedigerous segment, but the legs belonging functionally to the metasomal series of legs; cephalic appendages through maxilla found on the sternal surface somewhat elevated. Urosome 5-segmented in female but 4-segmented in male. Egg sac reniform, large.

Appendages essentially the same as in usual bomolochids. Rostrum with rounded posterior margin. First antenna 6-segmented, with a horn-like chitinous process on first segment. Second antenna 4-segmented; terminal segment ending in 6 setae inclusive of claw-like ones, separated from third segment furnished with a claw and a process. Maxillary hook absent. Labrum with 2 projections on the rounded posterior margin. Mandible with terminal and subterminal blades almost equally broad and fringed with teeth on the posterior margin. Paragnath well developed, distally forming a process armed with spinule-like teeth and bearing a hairy accessory lobe at the base. First maxilla indistinctly 2-jointed. Second maxilla strong, 2-segmented; second segment formed distally into a beak-like process, with another similar process articulated at the middle of the segment. Maxilliped posterolateral to second maxilla; 3-segmented and ending in a small unbranched claw in female, but 4-segmented in male. Four pairs of biramous legs larger posteriorly, each with 3-segmented rami exclusive of 2-segmented exopodite of first leg; setae on legs 2-4 devoid of hairs. Caudal ramus with 6 setae.

Type species: *Tegobomolochus nasicola* n. sp., parasitic in the nasal cavity of a teleost.

Tegobomolochus nasicola n. sp.

(Figs. 1-24)

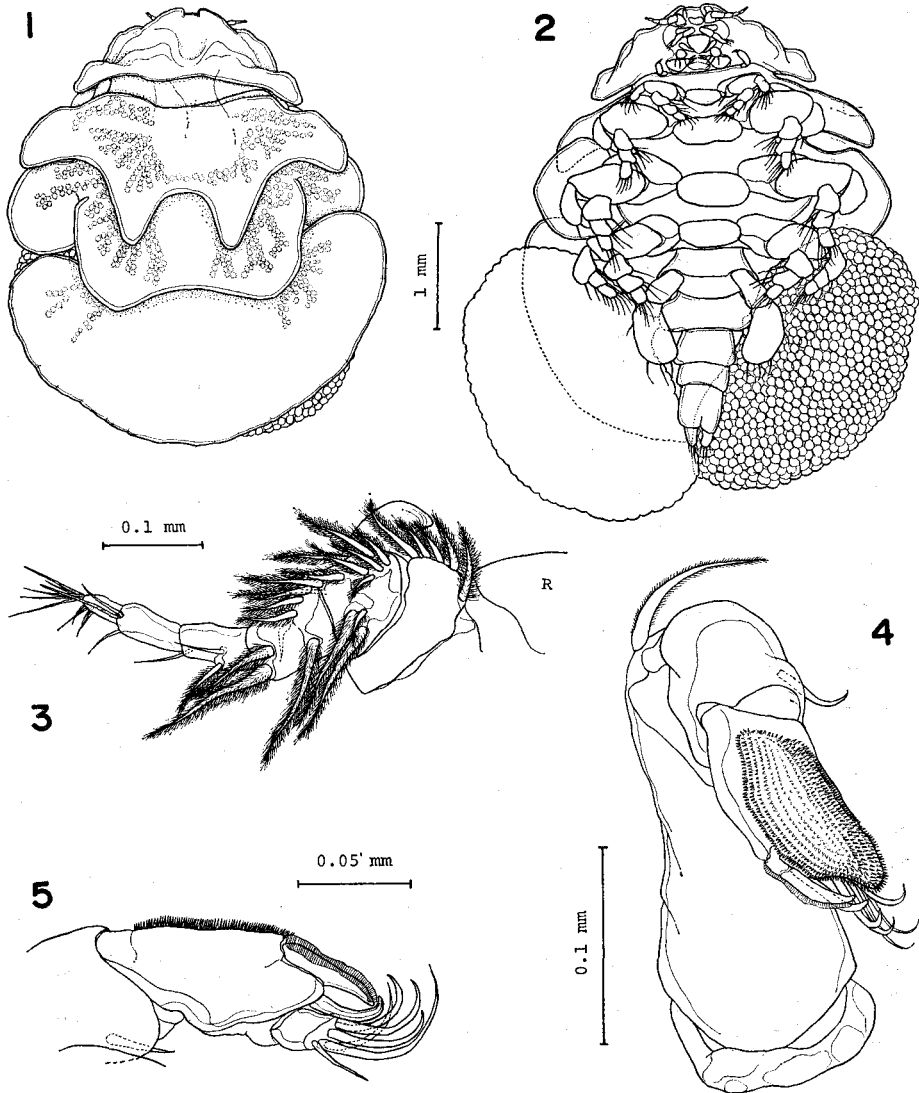
Material: 2 ovigerous females and 2 males from the nasal cavity of an individual of *Pseudupeneus spilurus* (Bleeker) fished in Tanabe Bay on January 29, 1972. Holotype (female) and 3 paratypes are deposited at the Seto Marine Biological Laboratory.

Female: Length from the anterior to the posterior end of dorsal shield 4.0 mm, greatest width including dorsal shield 3.5 mm in holotype; respectively 3.8 mm and 3.0 mm in paratype female. Body (Figs. 1 & 2) oval in dorsal view, depressed; consisting of cephalosome including first pedigerous segment, 3-segmented metasome carrying on each segment a largely expanded dorsal shield and 5-segmented urosome entirely concealed under the last shield. Cephalosome about 2 times wider than long, round anteriorly, but broadened posteriorly to form postero-lateral projections on the dorsal side; anterior two thirds of the ventral surface raised and reinforced together with the dorsal side by a common sclerotic layer; cephalic appendages through second maxilla and labium located on this elevated area. The ventral surface posterior to labium diminished sharply to form a neck; maxillipeds located at the anterior corner of this portion, first legs on the posterior margin functioning within the metasomal series of legs. Three dorsal shields larger posteriorly, overlapped partly, wider than long; the first with a median pair of posterior projections; the

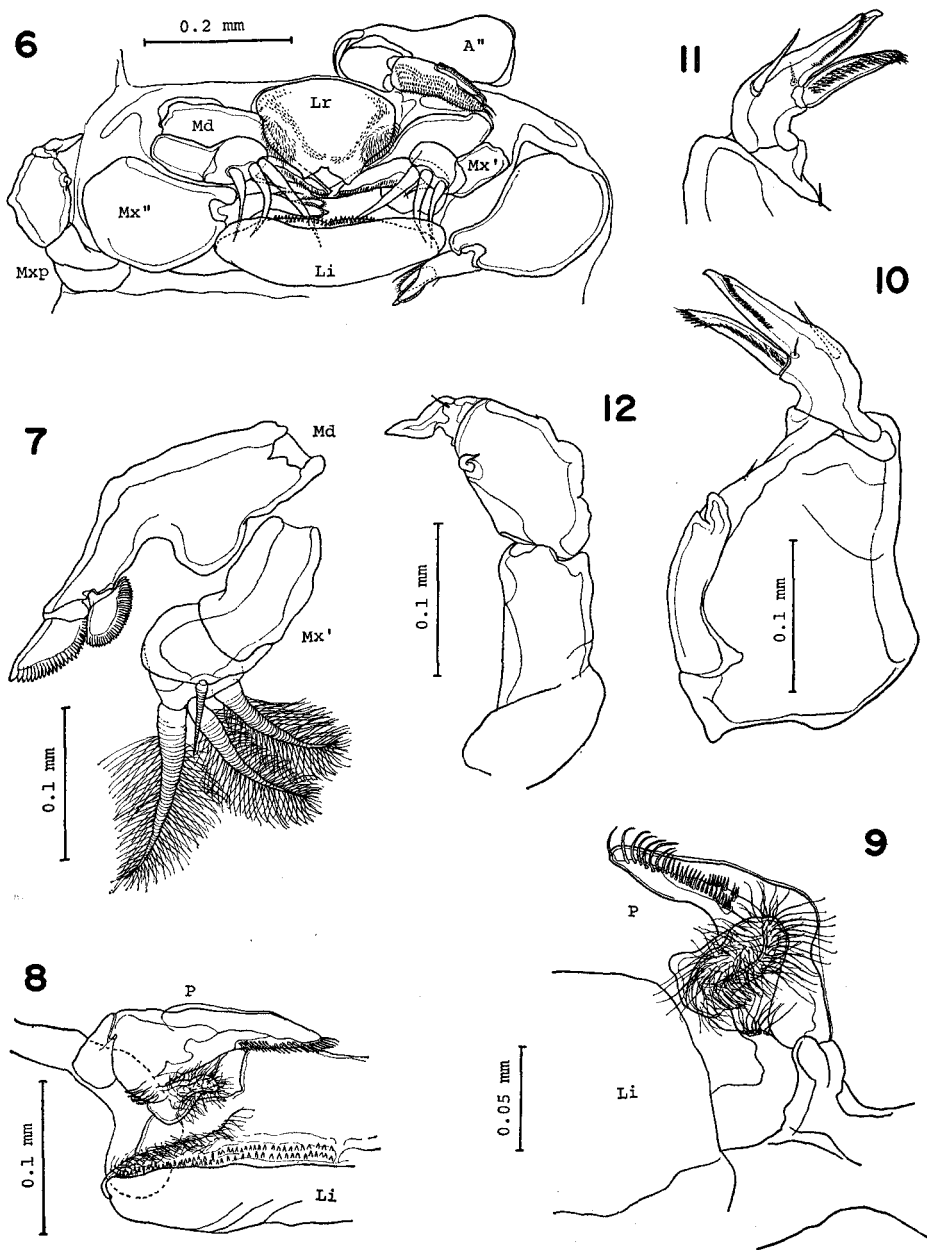
second divided into a median and lateral plates; the third hemi-circular and rounded posteriorly.

Habitus firm; milky white, but somewhat brownish at the central portion; eyes silvery red, buried under hypodermis between the bases of first antennae.

Egg sac reniform, depressed, ca. 2.8×1.6 mm; containing numerous eggs of $100\text{--}120 \mu$ in diameter.

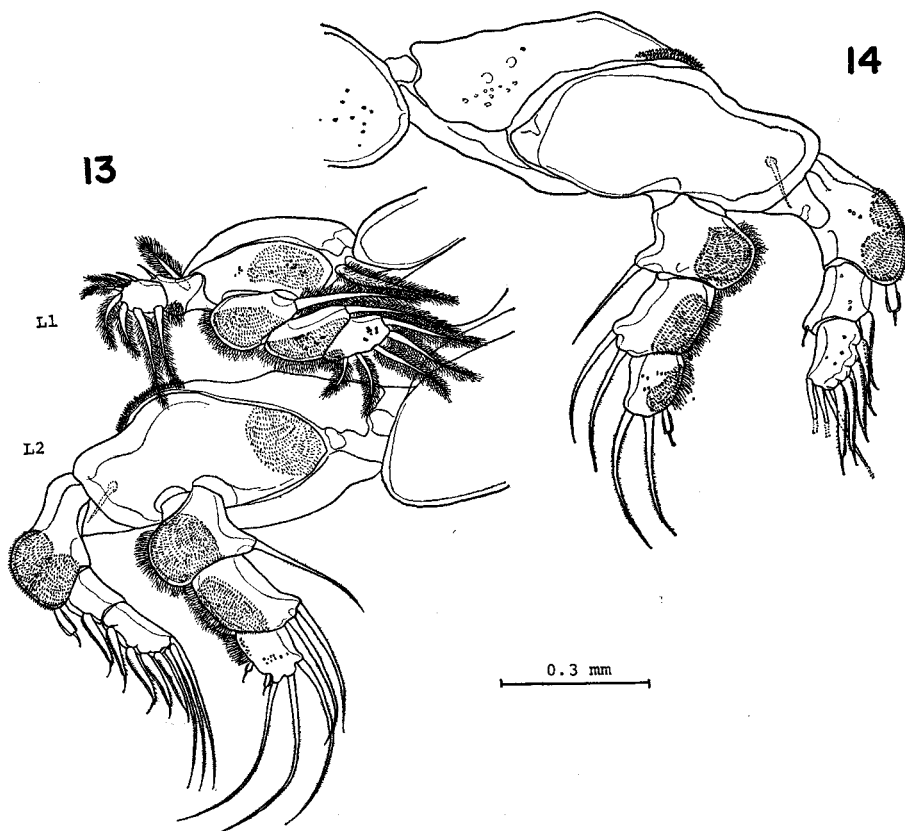


Figs. 1-5. *Tegobomolochus nasicola* gen. et sp. nov., female. 1. total animal, dorsal. 2. the same, ventral. 3. first antenna and rostrum, ventral view. 4. second antenna, ventral view. 5. distal segments of the same, front view. Abbreviation: A²-second antenna, Es-egg sac, Li-labium, Lr-labrum, Ll-5-legs 1-5, Md-mandible, Mx'-first maxilla, Mx''-second maxilla, Mxp-maxilliped, P-paragnath, R-rostrum.



Figs. 6-12. *Tegobomolochus nascicola* gen. et sp. nov., female. 6. oral appendages in situ, ventral view. 7. mandible and first maxilla in situ, dorsal view. 8. paragnath and labium in situ, ventral view. 9. the same, back view. 10. second maxilla, back view. 11. second segment of the same, front view. 12. maxilliped, back view.

Rostrum (Fig. 3, R) moderate, with rounded posterior margin. First antenna (Fig. 3) 6-segmented, with a horn-like process on the dorsal side of first segment; setal formula of segments 5, 12, 7, 3, 2+1 aesthete and 8+1 aesthete. Second antenna (Figs. 4 & 5) 4-segmented; terminal segment separated from the third. First segment with a simple seta on the anterior side. Third segment projected ventro-distally into a knob, the ventral surface covered by spinules arranged in longitudinal rows, a large claw-like process fringed with a membrane along its anterior edge at the



Figs. 13-14. *Tegobomolochus nasicola* gen. et sp. nov., female. 13. first and second legs in situ, ventral view. 14. third leg, ventral view.

distal one-third of the antero-ventral margin and a claw at the dorso-distal corner of the segment. Terminal segment very small, with 6 apical setae inclusive of 3 claw-like ones. Maxillary hook absent. Labrum (Fig. 6, Lr) wider than long, with two projections on the rounded posterior margin, furnished on each lateral side of the ventral surface with a hairy area and with a spinulose band running a little apart from the whole lateral to posterior margin. Mandible (Figs. 6 & 7; Md) structured as in usual bomolochids; terminal and subterminal blades nearly equal in size, broad,

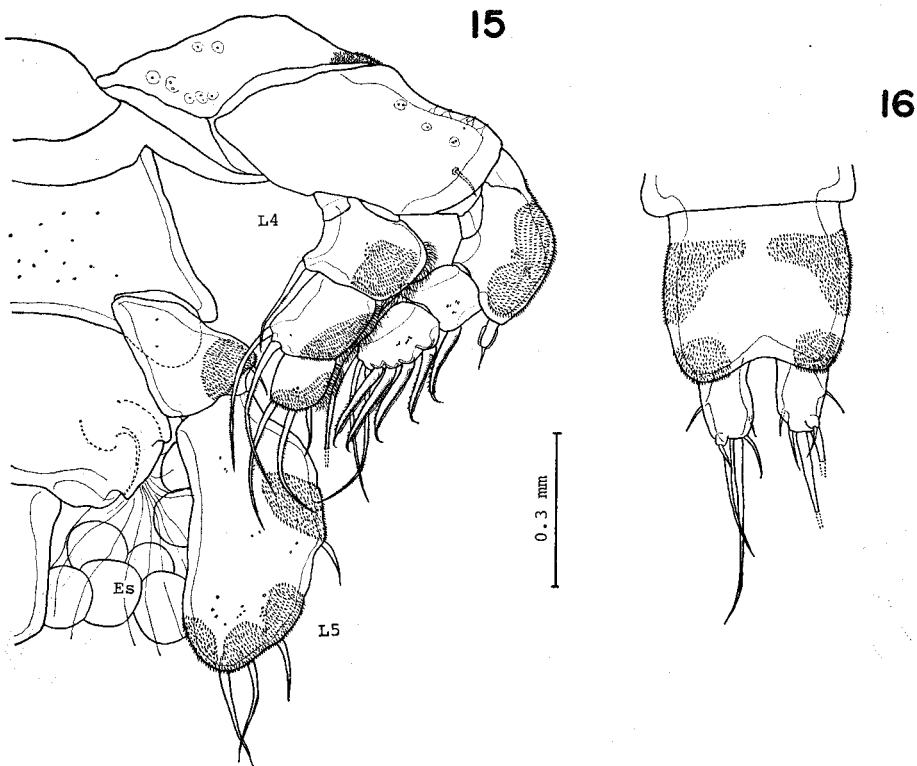
fringed along the posterior margin with ca. 26 and ca. 35 teeth respectively. First maxilla (Figs. 6 & 7; Mx') indistinctly divided into 2 joints; proximal joint laid along the sternal surface, unarmed; distal joint perpendicular to sternum, with 3 stout and long hairy setae at the tip and a naked seta on the posterior side. Paragnath (Figs. 8 & 9; P) unusually developed, originating from the sternal reinforcement connecting labrum and labium along either side of mouth; the proximal half thickened and furnished with a hairy accessory lobe on the posterior side, the other half distal to the median bent narrowed into a process armed with a row of spinule-like teeth along the posterior margin. Second maxilla (Figs. 6, Mx"; 10 & 11) strong, 2-segmented. First segment massive, with a process at the middle and a spinule near the distal end on the median side. Second segment tapering distally into a process fringed with a continuous row of spinules along both anterior and posterior edges but the apex, with a similar additional process jointed to the segment near the middle on the dorsal side and fringed along the anterior edge with 3 rows and along the posterior edge with a row of spinules, and further armed with a seta near the base on the anterior side and a spinule on the posterior side between the bases of distal and additional processes. Maxilliped (Figs. 6, Mxp; 12) posterolateral to second maxilla, slender, 3-segmented; first segment elongate, depressed antero-posteriorly; second segment slightly expanded and with a curved spine on the median side at the middle; terminal segment in the form of small ungiform process, with a spinule on the posterior side at the base. Labium (Figs. 6, 8 & 9; Li) wider than labrum, compressed antero-posteriorly, bearing on the anterior surface a hairy area along each lateral side and a spinulose band along the distal margin.

Anterior four pairs of legs (Figs. 13-15) biramous, the third pair largest; each leg supported on an elliptical sternal plate and consisting of 2-segmented protopodite and 3-segmented rami exclusive of 2-segmented exopodite of first leg. Setal formula of these legs as follows (number of spines in Roman and that of setae in Arabic numerals):

| | Protopodite | Exopodite | Endopodite |
|-------|-------------|----------------|----------------|
| Leg 1 | 0-1; 1-0 | I-0; III-6 | 0-1; 0-1; 0-5 |
| Leg 2 | 0-0; 1-0 | I-0; I-0; IV-3 | 0-1; 0-2; II-3 |
| Leg 3 | 0-0; 1-0 | I-0; I-1; IV-3 | 0-1; 0-2; I-2 |
| Leg 4 | 0-0; 1-0 | I-0; I-1; IV-3 | 0-1; 0-2; 0-3 |

Abnormal setation, 0-1, observed in second endopodite segment of left third leg in paratype female. Three sorts of spines noted in these legs; 4 small and naked spines on exopodite of first leg; 1 or 2 spines, stumpy and ornamented with membrane on either side and with a fine blade distally, on first exopodite segment of legs 2-4 and on third endopodite segment of legs 2-3; and the other spines, long and armed with membranous pectination and spinules on the outside and inside respectively and with a fine blade, on second and third exopodite segments of legs 2-4. Setae on first leg with plumes, but those on legs 2-4 almost completely naked, though minute traces of hairs remain on each side of them. In addition to the above-mentioned

spines and setae shown in the formulae, the legs are furnished on the ventral surface with patches of spinules and on the dorsal surface with patches of hairs as seen in figures. Fifth leg (Fig. 15, L5) relatively large, 2-segmented; first segment separated from somite, short, with a seta at the outer-distal corner and a patch of spinules on the ventral side around the same corner; second segment flattened, about 2 times as long as wide, with an outer seta at the middle and distally 3 setae respectively accompanied with a patch of spinules on the ventral side near the base. Caudal ramus (Fig. 16) slightly longer than wide, with 6 simple setae inclusive of 2 long apical ones.

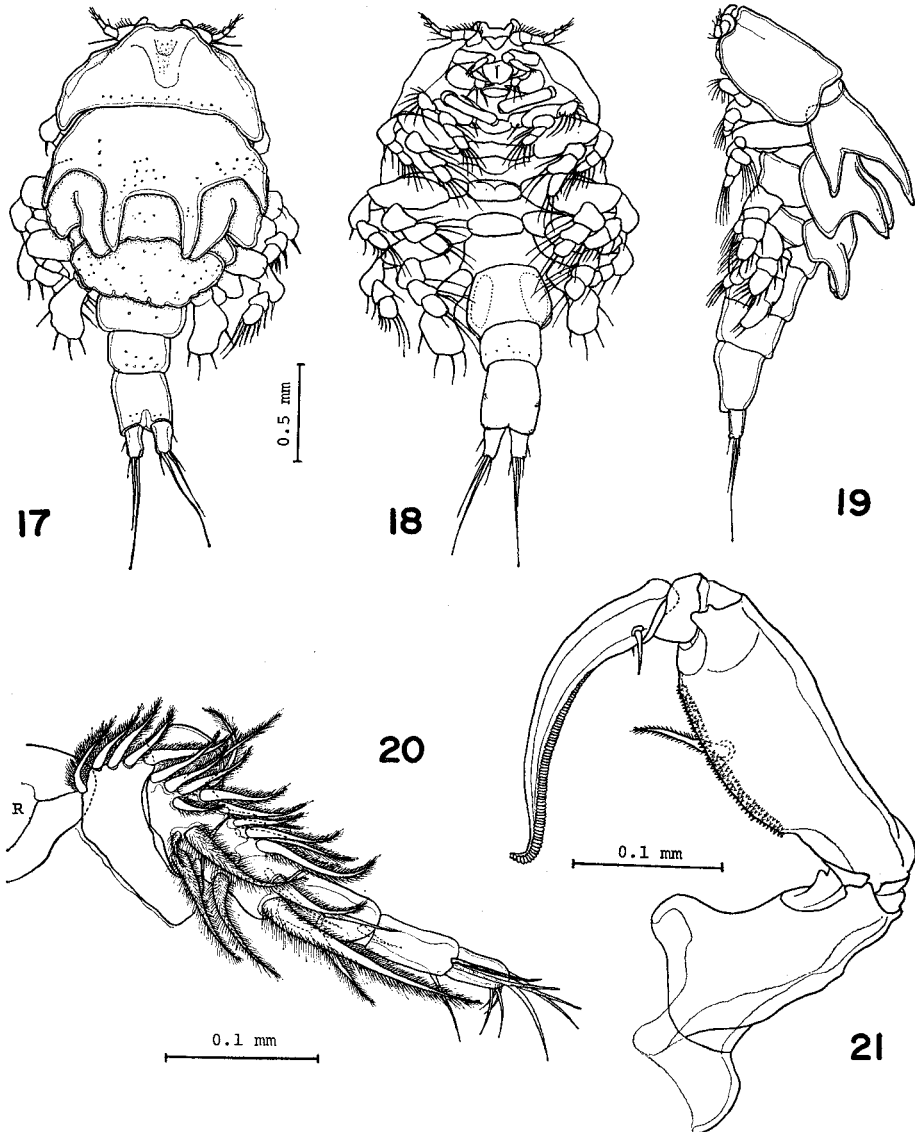


Figs. 15–16. *Tegobomolochus nasicola* gen. et sp. nov., female. 15. fourth and fifth legs in situ, ventral view. 16. anal segment and caudal rami in situ, ventral view.

Male: Length excluding caudal ramus 1.8–2.0 mm; greatest width 1.8 mm on an average of 2 specimens. Body (Figs. 17–19) structured as in female except 4-segmented urosome (Fig. 24). Dorsal shields less developed, but similar to those of female and smaller posteriorly; the last covering only fifth pedigerous segment and the anterior part of the genital.

Cephalic appendages as in female except developed maxilliped. Maxilliped (Fig. 21) largest of all cephalic appendages, elongated and 4-segmented; first segment thickened at the base, unarmed; second segment longer than the first, somewhat

expanded and with hairy seta around the middle on the median side furnished with several longitudinal rows of spinules; third segment very short, unarmed; terminal segment almost as long as the second, in the form of a slender claw gently bent inwards,



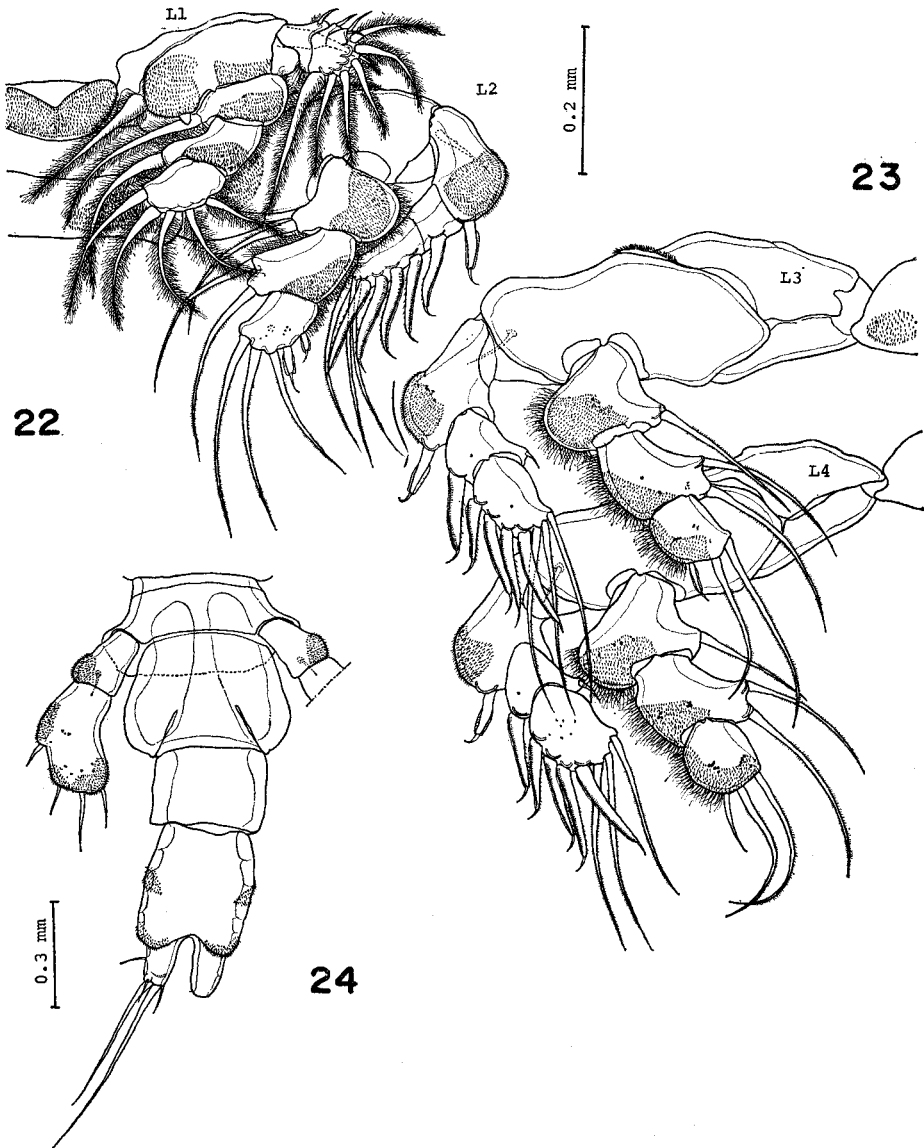
Figs. 17-21. *Tegobomolochus nasicola* gen. et sp. nov., male. 17. total animal, dorsal. 18. the same, ventral. 19. the same, lateral view. 20. first antenna, ventral view. 21. maxilliped, back view.

recurved at the tip and edged with serial notches on the concave margin except the basal portion armed with 2 setules.

Four pairs of biramous legs (Figs. 22 & 23; L1-4) larger posteriorly, quite the

same as in female in structure and armature; sternal plates supporting these legs covered with spinules. Fifth leg and caudal ramus (Fig. 24) as in female.

Remarks: In addition to the outstanding features referred to already in the introductory note, the present new genus *Tegobomolochus* is distinct from any known genera of the family Bomolochidae in having unusually developed paragnath in both sexes and slender maxilliped with a small unbranched claw in the female.



Figs. 22-24. *Tegobomolochus nasicola* gen. et sp. nov., male. 22. first and second legs in situ, ventral view. 23. third and fourth legs in situ, ventral view, magnified as in Fig. 22. 24. urosome, ventral view.

As *T. nasicola* gen et sp. nov. is devoid of the ventral concavity which is acting as the main adhesive organ in usual bomolochids, seemingly it is unable to adhere to the even wall surface of such wide spaces as the buccal or branchial cavities. Of course, either of usual bomolochids or taeniacanthids, both closely related to each other in structure and behaviour, are found from the nasal cavity of fishes, but this cavity should be a wide space for these smaller copepods, though there the water current must be much less. Further, *Tegobomolochus* differs from usual bomolochids in that it lives in a couple instead of in aggregation. This is plainly due to its isolated mode of life as seen commonly in fixed parasitic copepods such as chondracanthids, lernaeopodoids or in gall-forming genera such as *Sarcotaces* or *Ive*.

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