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# *TRIPLIGNATHIA ADRIATICA,* NEW GENUS AND SPECIES, AND A TYPOLOGY OF MOUTH PARTS IN AUSTROGNATHIIDAE (GNATHOSTOMULIDA)

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*Abstract.–Triplignathia adriatica,* a new genus and species of Gnathostomulida in the family Austrognathiidae, is described from two localities in the Adriatic (Mediterranean). Owing to the possession of three rows of jaw teeth the new genus occupies one end of a morphological cline along which the species of Austrognathiidae can be arranged; the other end is occupied by species of *Austrognatharia* with two rows of teeth one of which has only one tooth. Species of the third genus in the family, *Austrognathia,* with two full rows of teeth, lie between these extremes.

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Shortly after my first encounters with the phylum Gnathostomulida (Sterrer 1965, 1966), now considered one of the most primitive living Bilateria (Ax 1986, Sterrer et al. 1986), I kept finding isolated specimens in the Adriatic of what appeared to be a species representing a new genus. I deferred describing it in the hope of collecting additional specimens or even species at other localities. Now, some 25 years later, while the number of described species of Gnathostomulida has grown to 77 in 19 genera, including 23 new species collected recently in the Pacific Ocean (Sterrer 1991a, 1991b, 1991c), no additional material pertaining to these original finds has appeared. Since the genus was mentioned in earlier systematic considerations (Sterrer 1972; "Genus XVI") it seems appropriate to name and discuss it in the context of the family.

Sediment samples were collected by diving, with a hand net or a bucket, and treated as described in detail (Sterrer 1971). A camera lucida was not used, hence specimens were not documented in as much detail as would be desirable. Furthermore, at a time when finding a single gnathostomulid specimen was considered a lucky break, I did not expect to collect several species per sample. This led me to conflate data pertaining to three species (including the one described here) into the description of the first representative of the suborder Conophoralia, *Austrognathia riedli* Sterrer, 1965. In all other respects the methods of analyzing and describing specimens and species, including measurements and indices used, are as detailed in Sterrer 1991a.

## Order Bursovaginoidea Sterrer, 1972

*Composition.*—Two suborders, Scleroperalia Sterrer, 1972, and Conophoralia Sterrer, 1972.

## Suborder Conophoralia Sterrer, 1972

*Composition.*—Only one family, Austrognathiidae Sterrer, 1971.

## Austrognathiidae Sterrer, 1971

*Composition.*—Two genera, *Austrognathia* Sterrer, 1965 emend. Sterrer, 1991a; and *Austrognatharia* Sterrer, 1971 emend. Sterrer, 1991a.

## *Triplignathia,* new genus

*Diagnosis.*—Austrognathiidae with three rows of jaw teeth. Basal plate with three

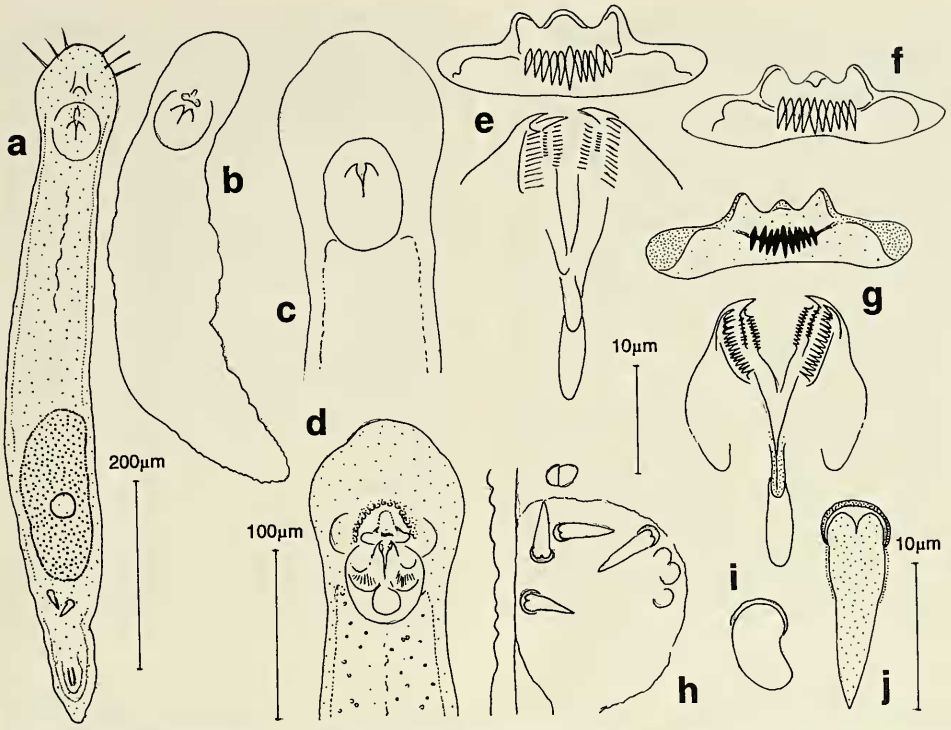


Fig. 1. *Triplignathia adriatica.* a, Adult specimen, free swimming, dorsal view; b, Juvenile specimen, slightly contracted; c and d, Rostra of two specimens; e, Basal plate and jaws, strongly squeezed; f, Basal plate of holotype; g, Basal plate and jaws, somewhat reconstructed; h, Testis; i, Bursa conulus (?); j, Conulus. Scales apply to a–b, c–d, e–g and i–j, respectively.

rostral lobes; teeth entirely contained within its outline.

Type species: *T. adriatica,* new species.

*Triplignathia adriatica,* new species
Figs. 1–3, Table 1

*Austrognathia riedli.*—Sterrer, 1965:786, fig. 3 only.

*Etymology.*—From the Latin *triplex* (threefold) in reference to the three rows of jaw teeth, and the type locality.

*Holotype.*—USNM 136897, one specimen in squeeze preparation.

*Type locality.*—Dubrovnik (Adriatic Sea), near Lapad, sand between Zostera at 5 m depth, 15 m from the shore; sample collected 20 Jul 1969.

*Other localities.*—Rovinj (Adriatic Sea), off the railway station, heterogeneous coarse sand with detritus at 3–4 m depth, April 1965 (cf. Sterrer 1965), 1 specimen; Val di Lone, fine sand at 2–3 m depth, 28 Aug 1967, 3 specimens; Isola Rossa, seaward of a shallow Posidonia patch, fine sand with detritus, 8–10 m, August 1968, 2 specimens.

*Diagnosis.*—Plump *Triplignathia* (index 8.13) with broad rostrum (index 0.81). Basal plate 7.83 μm long, 24.20 μm wide (index 0.33), with median lobe usually slightly smaller than lateral lobes. Jaws 21.50 μm long; dorsal row with 9.25 teeth, median row with 7.67 and ventral row with 13.00 teeth. Conuli delicate, with rounded hat, to 14 μm long and 9 μm wide (index 2.90).

*Description.*—Organization and behavior: Colorless-opaque. Mature specimens (Fig. 1a, b) ranged from 315 μm to 650 μm in length; the larger measured 80 μm in width at U 69.2 (body index 8.13). Rostrum broad

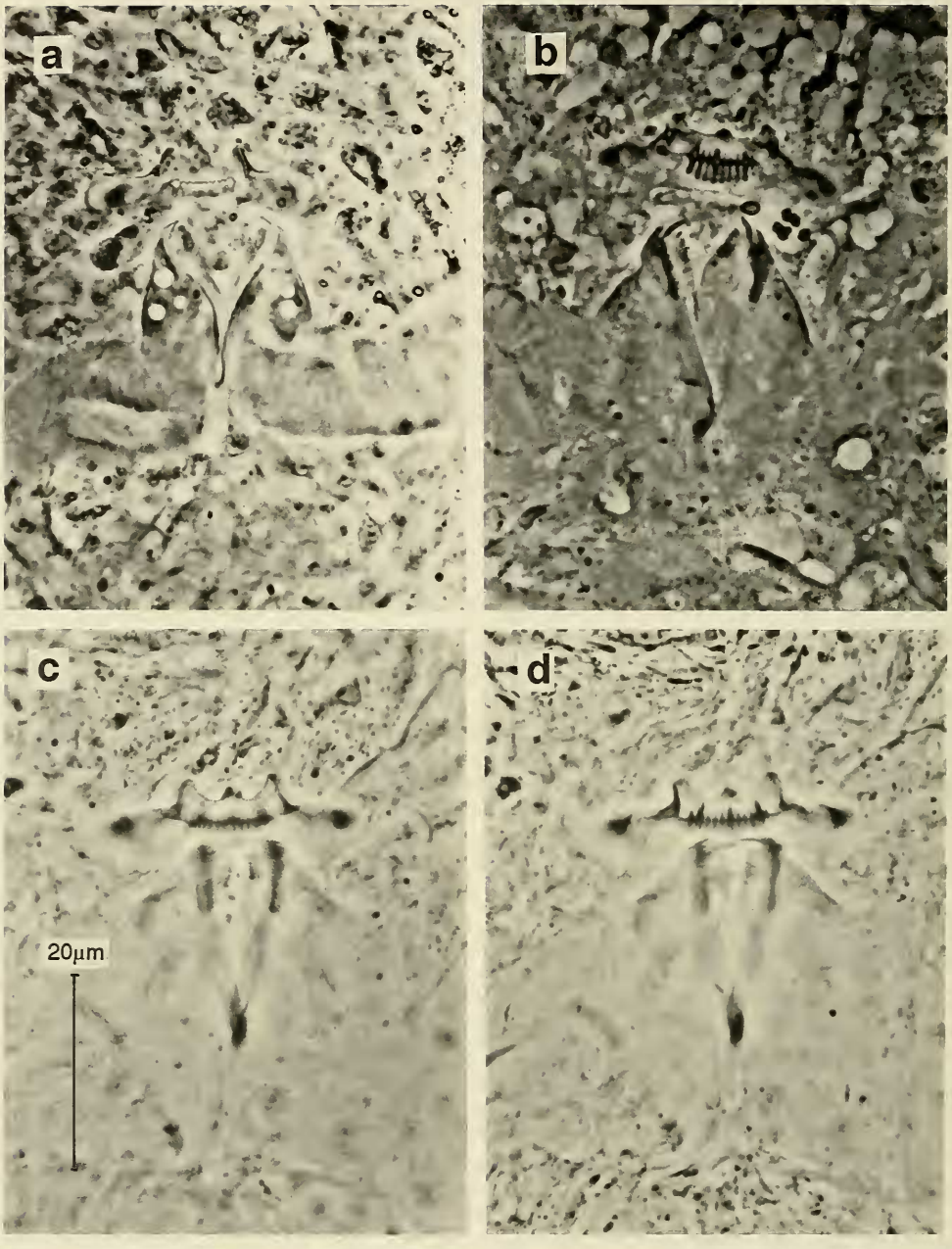


Fig. 2. *Triplignathia adriatica.* Photomicrographs of the pharynx of live specimens from Rovinj (phase contrast). a, moderately squeezed, with the median row of jaw teeth in focus; b, a more strongly squeezed specimen, with the ventral and median rows of jaw teeth in focus; c and d, a third specimen, very strongly squeezed; in c the ventral and median rows of jaw teeth are in focus, in d the dorsal row. All to the same scale.

(Fig. 1c, d), somewhat clover-shaped, 65 μm long and 80 μm wide at U 6.2 (index 0.81). Sensorium insufficiently known; consisting of at least 3 pairs of compound cilia and a pair of ciliary pits; in addition, there are long single cilia in the posterior part of the body. The tail region is also beset with rhabdoid bundles that may function as adhesive or-

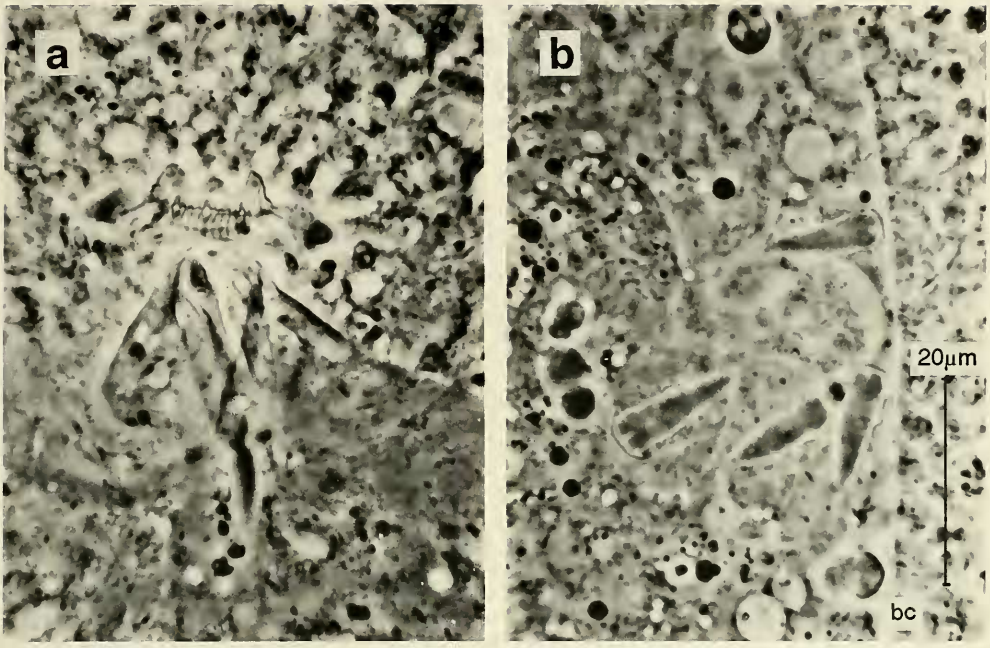


Fig. 3. *Triplignathia adriatica.* Photomicrographs of live specimens (phase contrast). a, Pharynx region of a specimen from Dubrovnik (Holotype), strongly squeezed; b, Testis with conuli, and a possible bursa conulus (bc), of a specimen from Rovinj. Both to the same scale.

gans. The animal may swim slowly but prefers to climb sluggishly over detritus particles.

Digestive tract: The oval mouth opening (Fig. 1d) leads into a spacious oral cavity which is rostrally lined by granular buccal glands, and laterally flanked by a pair of bulging prepharyngeal glands. The basal plate (Figs. 1e, f, g; 2; 3a) is 7–9 ($\bar{X}$ = 7.83) μm long and 23–26 ($\bar{X}$ = 24.20) μm wide (index 0.33). The median portion of its rostral contour is three-lobed, with the central lobe usually lower than the lateral lobes. The lateral contours of the lateral lobes form dorsally erect ridges. The caudal outline of the basal plate, probably depending on the degree of squeezing, varies from gently convex to concave. Dorsocaudally the basal plate bears 9–16 ($\bar{X}$ = 11.50) teeth of which the median tooth is longest, the rest being more or less equal. No matter how much the basal plate is squeezed, these teeth never protrude beyond the caudal outline of the basal plate. Jaws are 19–24 ($\bar{X}$ = 21.50) μm long to the symphysis, and there is a 7 μm long cauda. In addition to a strong, curved terminal tooth there are 3 rows of teeth. The ventral row, 7–8 μm long, consists of 10–18 ($\bar{X}$ = 13.00) very fine, long teeth. The median row is shorter (3 μm), and bears 7–9 ($\bar{X}$ = 7.67) short, somewhat blunter teeth. The dorsal row, about 6 μm long, bears 7–10 ($\bar{X}$ = 9.25) fairly delicate teeth.

Male system: One dorso-caudal testis, which empties into a delicate, tubular penis that lacks a tripartition. The testis contained 6 conuli in one, and 4 conuli in another specimen. Conuli (Figs. 1j; 3b) slender, 9–14 ($\bar{X}$ = 11.50) μm long and 3–5 ($\bar{X}$ = 4.00) μm wide (index 2.90), with a constriction at the rim of the hat, and another constriction further down. A faint cingulum may skirt the cone between the two constrictions. The hat is rounded but takes up only 20% of the length. The blunt end of the conulus, under the hat, appears cleft.

Female system: A mature egg may be 90 μm long. One specimen had what might be

Table 1.—*Triplignathia adriatica*: Measurements and statistics.

| | Mean | *SD* | Max | Min | *n* |
|---|---|---|---|---|---|
| Body length of adults | 482.50 | | 650 | 315 | 2 |
| Body width of adults | 80.00 | | | | 1 |
| Body index of adults | 8.13 | | | | 1 |
| Rostrum index of adults | 0.81 | | | | 1 |
| Jaw length | 21.50 | 2.17 | 24 | 19 | 6 |
| Basal plate length | 7.83 | 0.75 | 9 | 7 | 6 |
| Basal plate width | 24.20 | 1.30 | 26 | 23 | 5 |
| Basal plate index | 0.33 | 0.04 | 0.36 | 0.27 | 5 |
| Sperm length | 11.50 | | 14 | 9 | 2 |
| Sperm width | 4.00 | | 5 | 3 | 2 |
| Sperm index | 2.90 | | 3.00 | 2.80 | 2 |

a bursa conulus (Figs. 1i; 3b) wedged between mature egg and testis: with a strong hat yet a somewhat disintegrated cone. A vagina was not observed.

*Discussion.*—The possession of conuli and the general organization of pharynx parts clearly identify the new species as belonging to the suborder Conophoralia. However, neither of the two existing genera can accommodate the three rows of jaw teeth, *Austrognathia* having two complete rows, and *Austrognatharia* having two rows of which the dorsal one contains only one or two teeth. In addition, the basal plate in the new species entirely surrounds its teeth, whereas in the two known genera the teeth protrude caudally beyond its contour.

## A Typology of the Mouth Parts in Austrognathiidae (Fig. 4)

In an earlier paper (Sterrer 1972) I gave a preliminary definition of the genera of Austrognathiidae on the basis of mouth part anatomy. Now that we know of 3 genera (*Triplignathia, Austrognathia* and *Austrognatharia*), with a total of 17 described species (including 7 new species from the Pacific; Sterrer 1991a, 1991b, 1991c) the picture has become somewhat more complicated, making it necessary to emend (Sterrer 1991a) the diagnoses of *Austrognathia* and *Austrognatharia.* Nevertheless, the main character associations and their

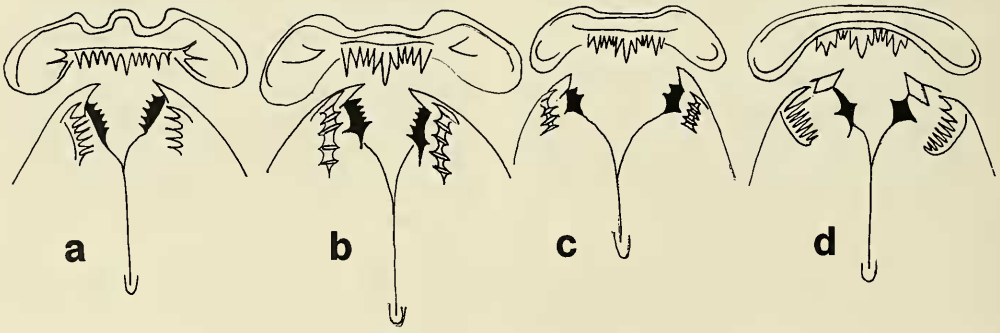


Fig. 4. Mouth part types of Austrognathiidae. a, *Austrognathia singatokae*; b, *Austrognathia novaezelandiae*; c, *Austrognatharia mooreensis*; d, *Austrognatharia pecten.* The dorsal jaw tooth row is emphasized for comparison.

sequence remain intact and emerge strengthened, if anything, by the discovery of intermediates. The known species of Austrognathiidae can thus be grouped as follows:

1. "*Adriatica* Group" (Fig. 1g) typified by *Triplignathia adriatica* new genus and species: Basal plate with prominent central and lateral lobes; basal plate teeth rather uniform in size and arrangement. Jaws with 3 rows of teeth; the dorsal row with more than 3 teeth of which none is rooted.

No other species in this group.

2. "*Singatokae* Group" (Fig. 4a) typified by *Austrognathia singatokae* Sterrer, 1991a. Basal plate with prominent, often square central lobe, and fairly prominent lateral lobes; basal plate teeth rather uniform in size and arrangement. Jaws with 2 rows of teeth; the dorsal row with 3 or more teeth none of which is rooted.

Other species in this group: *A. riedli* Sterrer, 1965; *A. hymanae* Kirsteuer, 1970; *A. microconulifera* Farris, 1977; *A. christianae* Farris, 1977.

3. "*Novaezelandiae* Group" (Fig. 4b) typified by *Austrognathia novaezelandiae* Sterrer, 1991a. Basal plate with flattened or absent central lobe, and rounded lateral lobes; basal plate teeth not uniform in size, with the central and the next-to-lateral-most stronger than the rest. Jaws with 2 rows of teeth; the dorsal row with 3 or more teeth of which the caudal-most tooth is usually rooted.

Other species in this group: *A. macroconifera* Sterrer, 1991a; *A. nannulifera* Sterrer, 1991a.

4. "*Mooreensis* Group" (Fig. 4c) typified by *Austrognatharia mooreensis* Sterrer, 1991a. Basal plate with very flattened or absent central lobe, and flattened lateral lobes; basal plate teeth regionated, with one central and two lateral groups of 3 strong teeth each, separated by 2–3 weak teeth. Jaws with 2 rows of teeth; the dorsal row with 2 (rarely 1) teeth of which the caudal-most is rooted.

Other species in this group: *A. homunculus* Sterrer, 1991a.

5. "*Pecten* Group" (Fig. 4d) typified by *Austrognatharia pecten* Sterrer, 1991a. Basal plate without a central lobe; lateral lobes very flattened or absent; basal plate teeth regionated. Jaws with 2 rows of teeth; the dorsal row with one, always rooted tooth.

Other species in this group: *A. boadeni* Sterrer, 1971; *A. kirsteueri* Sterrer, 1970; *A. strunki* Farris, 1973.

Two further species of *Austrognatharia, A. sterreri* (Kirsteuer, 1969) and *A. atraclava* Ehlers & Ehlers, 1973, cannot be assigned to any group owing to insufficient data on their cuticular mouth parts.

When the groups are considered from 1 to 5, the species of Austrognathiidae represent a morphological cline of reduction, from a condition characterized by a basal plate with 3 lobes and uniform teeth, and jaws with 3 rows of uniform teeth, to a condition characterized by a basal plate without frontal lobes and with non-uniform teeth, and jaws with 2 tooth rows of which one consists of only one tooth. Three rows of jaw teeth as well as a basal plate with prominent lateral lobes can be assumed to be the plesiomorphic condition in higher Bursovaginoidea, as is evidenced by its occurrence, as a rule, in the family's outgroup, Gnathostomulidae (with the possible exception of the insufficiently known *Corculognathia* Ehlers & Ehlers, 1973).

A preliminary analysis of conulus (sperm) morphology indicates there is no matching pattern; conulus size, shape and proportions seem uncorrelated with mouth part type. In terms of biogeography it is interesting to note that the majority of species in groups 1, 2 and 5 (the "end points" of the series) have been reported from the Atlantic Ocean and Mediterranean (the exceptions being *Austrognathia singatokae* and *Austrognatharia pecten,* both from the Pacific), whereas nearly all of the species in groups 3 and 4 (the "intermediates") come from the Pa-

cific Ocean (one exception being an undescribed species from the Mediterranean). It remains to be seen whether these morphological and global distribution patterns will hold for species yet to be discovered.

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