

Gnathostomulida from the Canary Islands

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Abstract.—Five species of Gnathostomulida are reported from Gran Canaria (northeastern Atlantic). One, *Paragnathiella trifoliceps* new genus, new species, represents a new genus in the family Mesognathariidae, another a new species, *Austrognathia clavigera*; one is known from the northwestern North Atlantic (*Labidognathia longicollis*), and the remaining two are cosmopolitan (*Haplognathia rosea* and *H. ruberrima*).

As part of an ongoing investigation of the taxonomy and biogeography of Gnathostomulida (Sterrer et al. 1986, Sterrer 1991a, 1991b, 1991c, 1991d, 1992, 1997), a phylum of microscopic worms inhabiting marine sand, I collected sediment samples in the Canary Islands (northeastern Atlantic) in February 1996. Of ten samples from eight localities on two islands, only one locality produced Gnathostomulida (Table 1). Samples were collected by hand, snorkeling or SCUBA, and extracted as described earlier (Sterrer 1971, 1991a). The way in which specimens and species are analyzed and described follows Sterrer (1991a). This includes the use of a relative scale of 100 units (U) for the body length, various indices for length-width ratios, and the mean (\bar{X}), standard deviation (SD), maximum (Max), minimum (Min), and number (n) of measurements.

Order Filospemoidea Sterrer, 1972

Composition.—Two families, Haplognathiidae Sterrer, 1972, and Pterognathiidae Sterrer, 1972 emend. Sterrer, 1991a.

Family Haplognathiidae Sterrer, 1972.

One genus, *Haplognathia* Sterrer, 1970.

Haplognathia rosea (Sterrer, 1969)
(Figs. 1A, 2A)

Material.—One juvenile from Gran Canaria, Playa de Las Canteras (sample C1).

Description.—The faintly reddish specimens had jaws 20 μm long, with 9 μm long rostral apophyses (apophysis index 0.45). Of the basal plate, only the rostral outline could be recorded, as well as the lack of teeth or thorns.

Discussion.—Sterrer (1997) merged *H. rosacea* Sterrer, 1970 with *H. rosea*, which is now known from the North Sea (Sterrer 1969), the northwestern Atlantic (Sterrer 1997), and the southern Pacific (Sterrer 1991a, 1991c). This species, which is difficult to distinguish from, and possibly hybridizes with *H. ruberrima*, has been redefined as having jaws with rostral apophyses less than half as long as the jaws (index 0.5 or smaller), and a basal plate that lacks thorns. In the northwestern Atlantic, jaw length ranges from 15 to 23 μm , with a mean of 18.89 μm .

Haplognathia ruberrima (Sterrer, 1966)
(Figs. 1B–G, 2B–C, Table 2)

Material.—Nine specimens, of which one adult, from Gran Canaria, Playa de Las Canteras (sample C1).

Description.—The only adult was 2150 μm long and 75 μm wide at U 41.9 (index

Table 1.—Localities and samples.

Island	Locality	Sample	Date	Depth	Substratum	Gnathostomulida spp.
Gran Canaria	Las Palmas, Playa de Las Canteras	C1	16-Feb-96	2-3 m	fine sand with sparse Cymodocea	5
	Puerto de San Nicolas	C2	17-Feb-96	2 m	fine sand with ripples	—
	Playa del Ingles	C3	18-Feb-96	4 m	very fine sand	—
	Playa de las Burras	C4	18-Feb-96	8 m	very fine sand with Cymodocea	—
	Playa Ojo de Garza	C6	18-Feb-96	intertidal	fine sand bar at river mouth	—
	Melenara	C7	18-Feb-96	intertidal	fine sand in and around beach rock	—
	Las Palmas, Playa de Las Canteras	C8	19-Feb-96	2-3 m	fine sand with sparse Cymodocea	—
	Las Palmas, Playa de Las Canteras	C9	20-Feb-96	2-3 m	fine sand with Cymodocea rhizomes	1
	Arinaga	C10	21-Feb-96	4-5 m	fine sand holes in Cymodocea bed	—
	Lanzarote	La Papagaya	L1	21-Feb-96	7 m	fine sand with Cymodocea

28.67). The smallest intact specimen measured 310 μm by 35 μm , with a rostrum 140 μm by 35 μm ; these are the dimensions of a recently hatched juvenile (Sterrerr 1997). Most of the specimens were colourless to faintly pink; only one was red. All had a basal plate in the shape of a transverse, ventrally concave buckle (length 6–9 μm , width 8–13 μm ; index 0.57), with rows of regularly spaced thorns on the dorsal surface. The jaws are 22–29 μm long (\bar{X} = 25.57 μm), with well delimited rostral apophyses whose length usually equals or exceeds the jaw length. The jaws have one strong tooth, possibly with numerous small, thorn-like bristles surrounding it. A pair of pharyngeal glands, with fine granula and large vacuoles, is typical for this species (Fig. 1G).

Discussion.—The most cosmopolitan species of the entire phylum is now known from the North Sea and Mediterranean (Sterrerr 1969), the northwestern Atlantic (Sterrerr 1997), and the Pacific islands of Hawaii (Sterrerr 1991b) and Fiji (Sterrerr 1991a). It has been redefined as having jaws with rostral apophyses at least half as long as the jaws (index 0.5 or greater), and a basal plate that always bears thorns. The Canaries specimens fall in every respect within the limits of this highly variable species.

Order Bursovaginoidea Sterrer, 1972

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

Suborder Scleroperalia Sterrer, 1972

Composition.—Eight families, Agnathiellidae Sterrer, 1972; Mesognathiidae Sterrer, 1972; Clausognathiidae Sterrer, 1992; Gnathostomariidae Sterrer, 1972; Rastrognathiidae Kristensen & Nørrevang, 1977; Probognathiidae Sterrer & Farris, 1975; Onychognathiidae Sterrer, 1972; and Gnathostomulidae Sterrer, 1972.

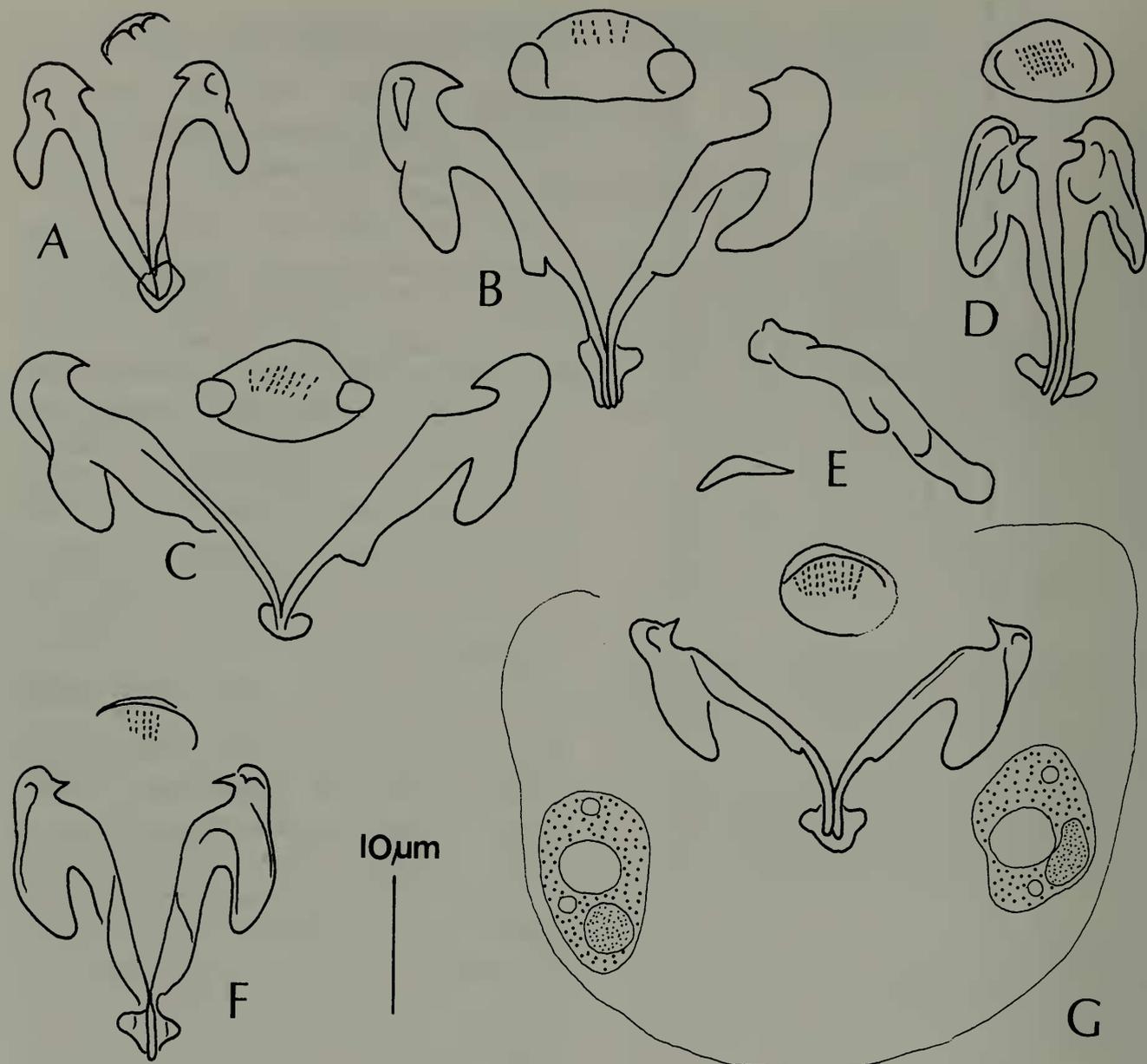


Fig. 1. *Haplognathia rosea* and *H. ruberrima*. A, *H. rosea*, jaws and rostral edge of basal plate; B-G, *H. ruberrima*, basal plate and jaws of several specimens; E shows the same specimen as D but in left lateral view. All to the same scale.

Family Agnathiellidae Sterrer, 1972

Composition.—One genus, *Agnathiella* Sterrer, 1971.

Paragnathiella, new genus

Diagnosis.—Agnathiellidae with jaws but without a basal plate. Type species: *P. trifoliceps*, new species.

Paragnathiella trifoliceps, new species (Figs. 3A-L, 4A-E, Table 3)

Synonymy.—"Genus IV" and "Genus V" in Sterrer 1972.

Etymology.—From the Greek *par* (beside), to indicate a close relationship with *Agnathiella*; and Latin *trifoli-* (three-leaved) and *-iceps* (-headed), in reference to the clover-shaped rostrum.

Material.—18 specimens, of which 2 adult, from Gran Canaria, Playa de Las Canteras (17 from sample C1; one from sample C9).

Holotype.—USNM 174368, one adult in squeeze preparation.

Type locality.—Gran Canaria, Las Palmas, Playa de Las Canteras, fine sand with sparse sea grass (*Cymodocea nodosa*) at

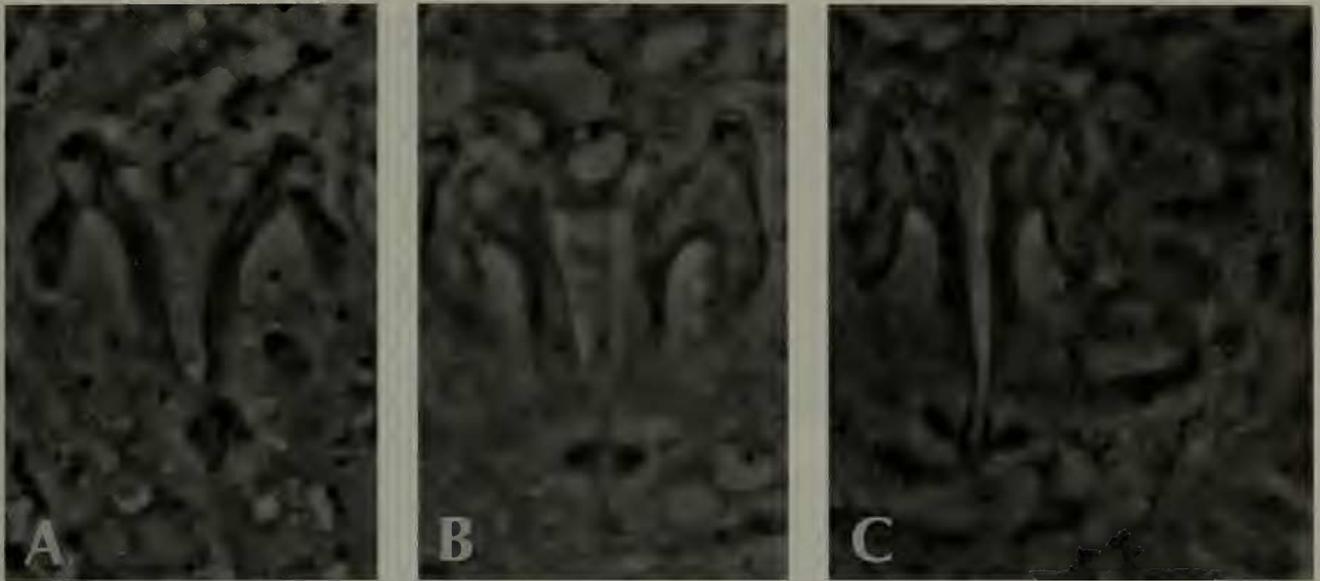


Fig. 2. *Haplognathia rosea* and *H. ruberrima*, phase contrast micrographs. A, *H. rosea*, jaws and rostral edge of basal plate (cf. Fig. 1A); B, *H. ruberrima*, jaws; C, *H. ruberrima*, jaws, and basal plate with thorns (upper right).

2–3 m depth; sample collected 16 Feb 1996.

Diagnosis.—About 1500 μm long *Paragnathiella* (body index 13.42) with clover-shaped rostrum (rostrum index 2.40). Jaws 14–17 μm long bearing 14–20 delicate teeth. Male stylet to 70 μm long.

Description.—Organization and behavior: Colourless and very opaque due to many round, greenish epidermal inclusions. Animals move rather swiftly, often carrying the posterior third of the body curled up, and are able to swim backward. Adults are to 1500 μm long and 120 μm wide at U 49.84 (index 13.42); the posterior end tapers into a short tail region. The rostrum of the only adult measured was 120 μm long

and 50 μm wide at U 8.0 (index 2.40). The rostrum is somewhat clove-shaped, with a 25 μm long frontal lobe separated from lateral lobes by conspicuous ciliary pits. It seems that there is one pair of apicalia (to 16 μm long). Sensory cirri are difficult to analyze since they are poorly defined and usually join the ciliary beat. There is one pair each of frontalia (42 μm), ventralia (30 μm), dorsalia (23 μm), lateralia (40 μm), and postlateralia (35 μm). Sensory bristles originate well apart from each other, and do not coincide in dorsal view.

Digestive tract: The transversely oval mouth extends from U 7.3 to U 8.0. A basal plate is lacking. The prefrontal epidermis is thickened, and contains many round inclu-

Table 2.—*Haplognathia ruberrima*. Measurements and statistics.

	\bar{x}	<i>SD</i>	Max	Min	<i>n</i>
Body length of adults	2150.00		2150	2150	1
Body width of adults	75.00		75	75	1
Body index of adults	28.67		28.67	28.67	1
Rostrum index of adults	4.33		4.33	4.33	1
Jaw length	25.57	3.15	29	22	7
Apophysis index	0.52	0.03	0.56	0.48	7
Basal plate length	6.33	0.52	7	6	6
Basal plate width	11.50	2.35	13	8	6
Basal plate index	0.57	0.12	0.75	0.46	6

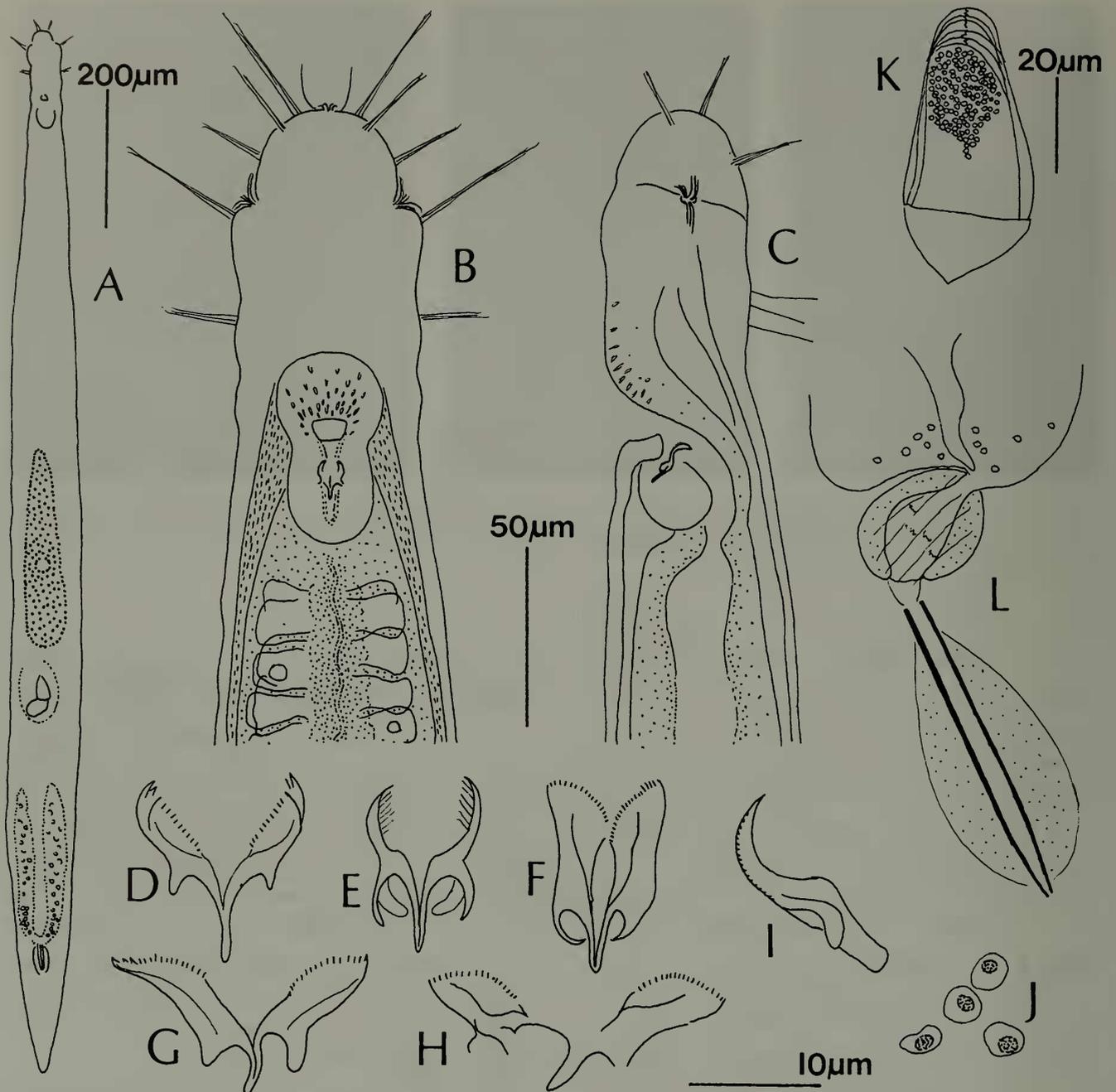


Fig. 3. *Paragnathiella trifoliceps*. A, habitus of adult; B, rostrum of adult, ventral view; C, rostrum of adult, left lateral view; D-I, jaws of several specimens; F-H, strongly squeezed, I, left lateral view; J, bursa; K, male copulatory organ; L, sperm. Scales apply to A, B-C, D-J, and K-L, respectively.

sions. The jaws are 14–17 μm long (\bar{X} = 15.31 μm), delicate, forceps-shaped and lamellar. In resting position the jaws point dorsorostrally at a 50° angle from the horizontal (Fig. 3i). The symphysis is narrow, and there is a pair of rostral apophyses that converge ventro-medio-caudally. Under low squeezing the jaws appear to have only one strongly curved terminal tooth. Stronger squeezing reveals that what appears as a terminal tooth is only the dorsal endpoint

of a delicate, caudo-ventrally descending lamella set with 14–20 (\bar{X} = 18.00) teeth, of which all except the 2 or 3 dorsal-most are very short. The pharynx bulb is 12–17 μm (\bar{X} = 14.40 μm) long behind the symphysis. The gut cells appear strongly vacuolized. There is a “lateral system” of unknown function, i.e., tissue strands between gut and epidermis which originate on either side of the pharynx and continue into the tail region.

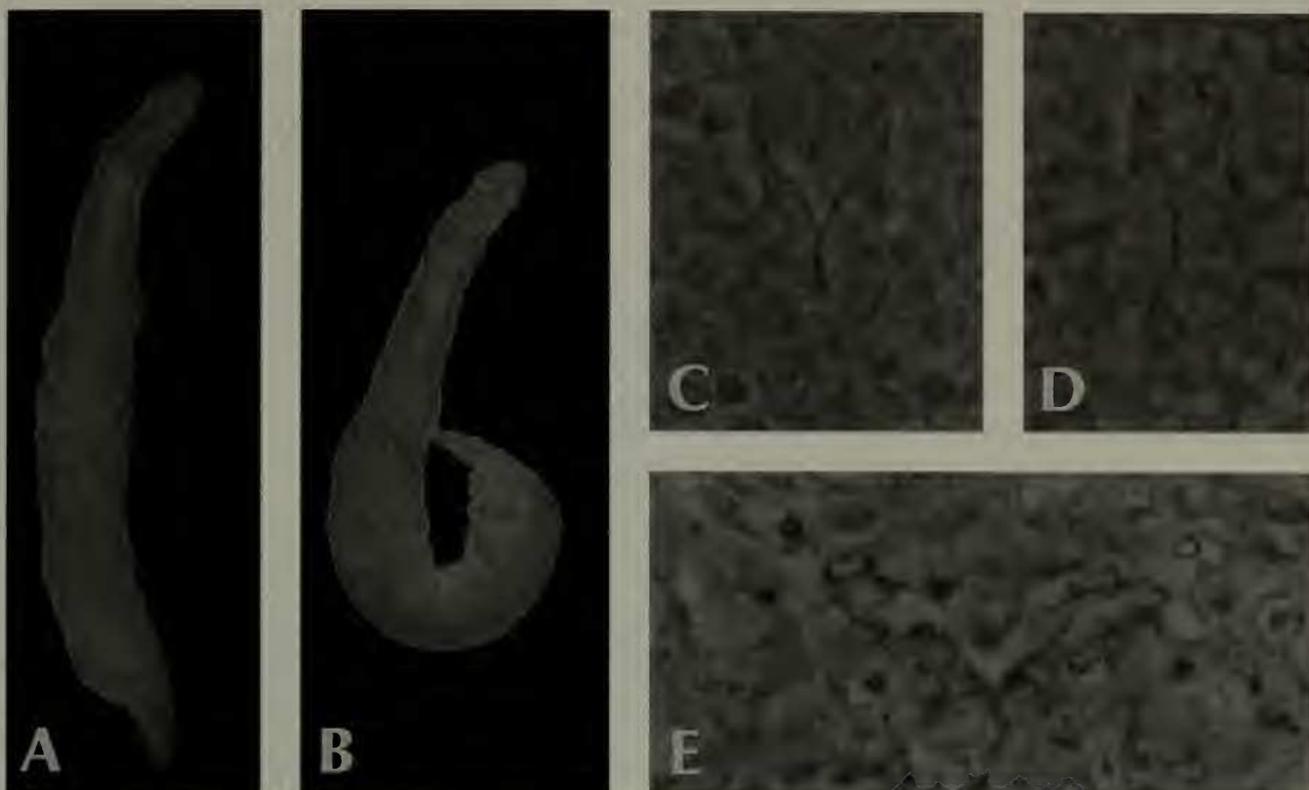


Fig. 4. *Paragnathiella trifoliceps*, phase contrast micrographs. A–B, habitus of free-swimming specimen; C–E, jaws of three specimens, E strongly squeezed to show teeth (cf. Fig. 3H).

Male system: The paired, tubular testes are 200 μm long, extending from U 73.3 to U 86.7. They empty into a muscular, ovoid vesicula seminalis 28 μm long and 22 μm wide, which in turn connects with the penis (Fig. 3L). Located between U 87.35 and U 91.48, the male stylet, made up of concentrically arranged rods, is 69–70 μm long and 5 μm wide. Sperm is irregularly round to oval, 2–3 μm in diameter, with no discernible filaments (Fig. 3J).

Female system: The only adult measured had an egg 280 μm long which extended from U 40.0 to J 58.7. The bursa system lies immediately posteriorly, extending from U 60.38 to U 64.71. It consists of an anterior bell-shaped bursa, 34–60 μm long (\bar{X} = 44.00 μm) and 27–28 μm wide (\bar{X} = 27.75 μm), and an unstructured, globular prebursa about 50 μm in diameter. The bursa is made up of stacked, layered cells as is usual for the suborder Scleroperalia, but cristae are lacking, and a bursa mouthpiece, although probably present, is not obvious (Fig. 3K). The bursa is usually tightly

packed with sperm. A vagina was not observed.

Discussion.—This species has been known to me since 1966 when I found one specimen at Banyuls-sur-Mer (southern France). Another specimen encountered in Rovinj (Adriatic) in 1967 suggested at first that I was dealing with two separate species or even genera, to which I referred as “Genus IV” and “Genus V” (Sterrer 1972). Further material from Tunis in 1971, Rovinj and Crete in 1991, and now Gran Canaria, have convinced me that we are dealing with a single species. The possession of a cuticular bursa and stylet assigns it to Bursovaginoidea-Scleroperalia, and the lack of a basal plate, lamellar forceps structure of jaws, and loose arrangement of the sensorium place it at the lower end of the suborder. The jaws most resemble those of lower Scleroperalia, i.e., *Clausognathia* Sterrer, *Gnathostomaria* Ax, *Mesognatharia* Sterrer, *Labidognathia* Riedl, and *Tenuignathia* Sterrer. With the two latter genera, *Paragnathiella* also shares the possession of an

Table 3.—*Paragnathiella trifoliceps*. Measurements and statistics.

	\bar{X}	SD	Max	Min	n
Body length of adults	1460.00	56.57	1500	1420	2
Body width of adults	110.00	14.14	120	100	2
Body index of adults	13.42	2.24	15.00	11.83	2
Rostrum index of adults	2.40		2.40	2.40	1
Jaw length	15.31	0.85	17	14	13
Penis stylet length	69.50	0.71	70	69	2
Sperm length	3.00	0.00	3	3	8
Sperm width	2.38	0.52	3	2	8
Sperm index	1.31	0.26	1.50	1.00	8

unpaired apical ciliary pit; with *Clausognathia*, *Tenuignathia*, *Rastrognathia* Kristensen & Nørrevang and *Agnathiella* Sterrer, it shares the lack of a basal plate. In terms of its habitus, the clover-shape of the rostrum, and the unique possession of an extra pair of sensory cirri (postlateralia), the new genus is nearly identical with the jawless *Agnathiella*. Since the loss of basal plate and/or jaws may have occurred several times independently in lower Scleroperalia, I propose that the new genus be united with *Agnathiella* in the family Agnathiellidae.

Family Mesognathariidae Sterrer, 1972

Composition.—The 3 genera *Mesognatharia* Sterrer, 1966, *Labidognathia* Riedl, 1970, and *Tenuignathia* Sterrer, 1976.

Labidognathia longicollis Riedl, 1970 (Figs. 5A–E, 6A–B, Table 4)

Material.—Nine specimens, of which 3 are adults, from Gran Canaria, Playa de Las Canteras (sample C1).

Description.—Colorless. One adult measured 700 μm by 65 μm at U 42.9 (index 10.77). The basal plate is shield-shaped, 14–18 μm long and 10–13 μm wide (index 1.31), with a rostral concavity and an oval knob at the caudal end. In most specimens the rostral concavity clearly showed 8–12 longitudinal striations, whereas each of the lateral wings was set with 9–12 shorter teeth. Jaws are lamellar, 20–23 μm long (\bar{X}

= 21.00 μm), and provided with a somewhat coarser dorsal row of 13–15 teeth, and a finer ventral row of 10–15 teeth. Both rows are composed in such a way that a robust tooth always alternates with two delicate teeth (Fig. 5F). The male stylet was 35–48 μm long (\bar{X} = 43.00 μm).

Discussion.—This is the first record of the species outside the northwest Atlantic, where it has been reported from North Carolina (Riedl 1970), and from Florida, Belize, Puerto Rico and Panama (Sterrer in press). The Canaries specimens differ from their western Atlantic counterparts in the longer male stylet (35–48 μm vs. 23–35 μm), but especially in the dentition of the basal plate. Riedl (1970) described “a row of short ridges or projections, perhaps 6 to 8 in number,” on the central part of the rostral contour, and Sterrer (1997) recorded specimens from Puerto Rico with nine teeth on each of the lateral lobes. Yet nowhere have I seen specimens in which both the central ridges (or striations) and the lateral teeth were so consistently conspicuous.

Suborder Conophoralia Sterrer, 1972

Composition.—One family, *Austrognathiidae* Sterrer, 1971.

Family Austrognathiidae Sterrer, 1971

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

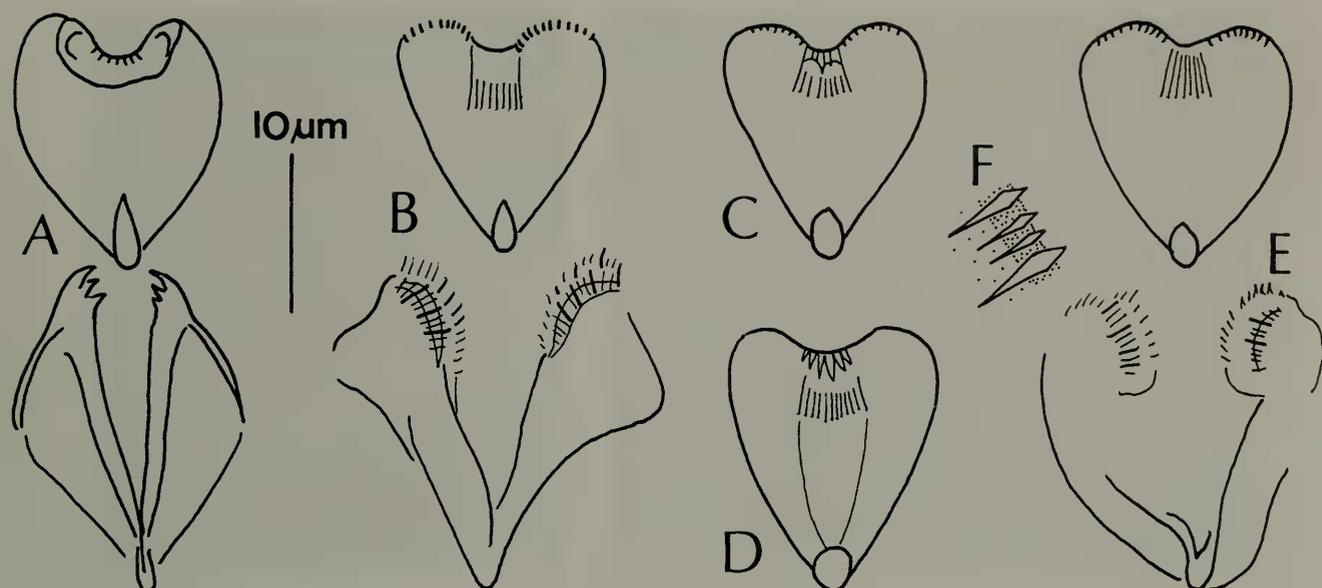


Fig. 5. *Labidognathia longicollis*. A-E, jaws and basal plates of several specimens, strongly squeezed; F, detail of jaw teeth in dorsal row. A-E to the same scale; F not to scale.

Austrognathia clavigera, new species
(Figs. 7A-O, 8A-C, Table 5)

Etymology.—From the Latin *clavus* (nail), and *gerere* (to carry), in reference to the sperm (conuli) which give the appearance of nails or thumbtacks.

Material.—Twenty-eight more specimens, of which 7 adults, from sample C1.

Holotype.—USNM 174367, one adult in squeeze preparation.

Type locality.—Gran Canaria Las Pal-

mas, Playa de Las Canteras, fine sand with sparse sea grass (*Cymodocea nodosa*) at 2–3m depth; sample collected 16 Feb 1996.

Diagnosis.—Stout *Austrognathia* (body index 7.63) with squarish rostrum (rostrum index 0.81) and many bundles of spindle-shaped epidermal rhabdoids. Basal plate 6.30 μm long, 20.09 μm wide (index 0.32), with inconspicuous median and flat lateral lobes. Jaws 20.24 μm long, with 4.78 teeth in dorsal and 8.14 teeth in ventral row; pos-

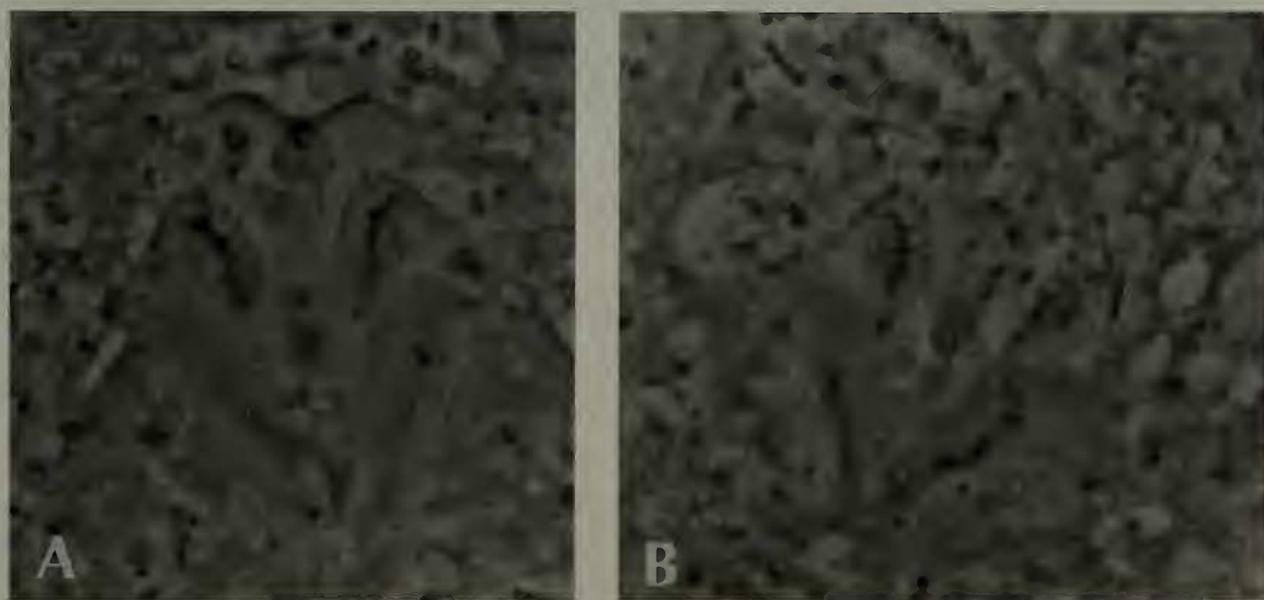


Fig. 6. *Labidognathia longicollis*, phase contrast micrographs. A-B, basal plate and jaws of two specimens, strongly squeezed.

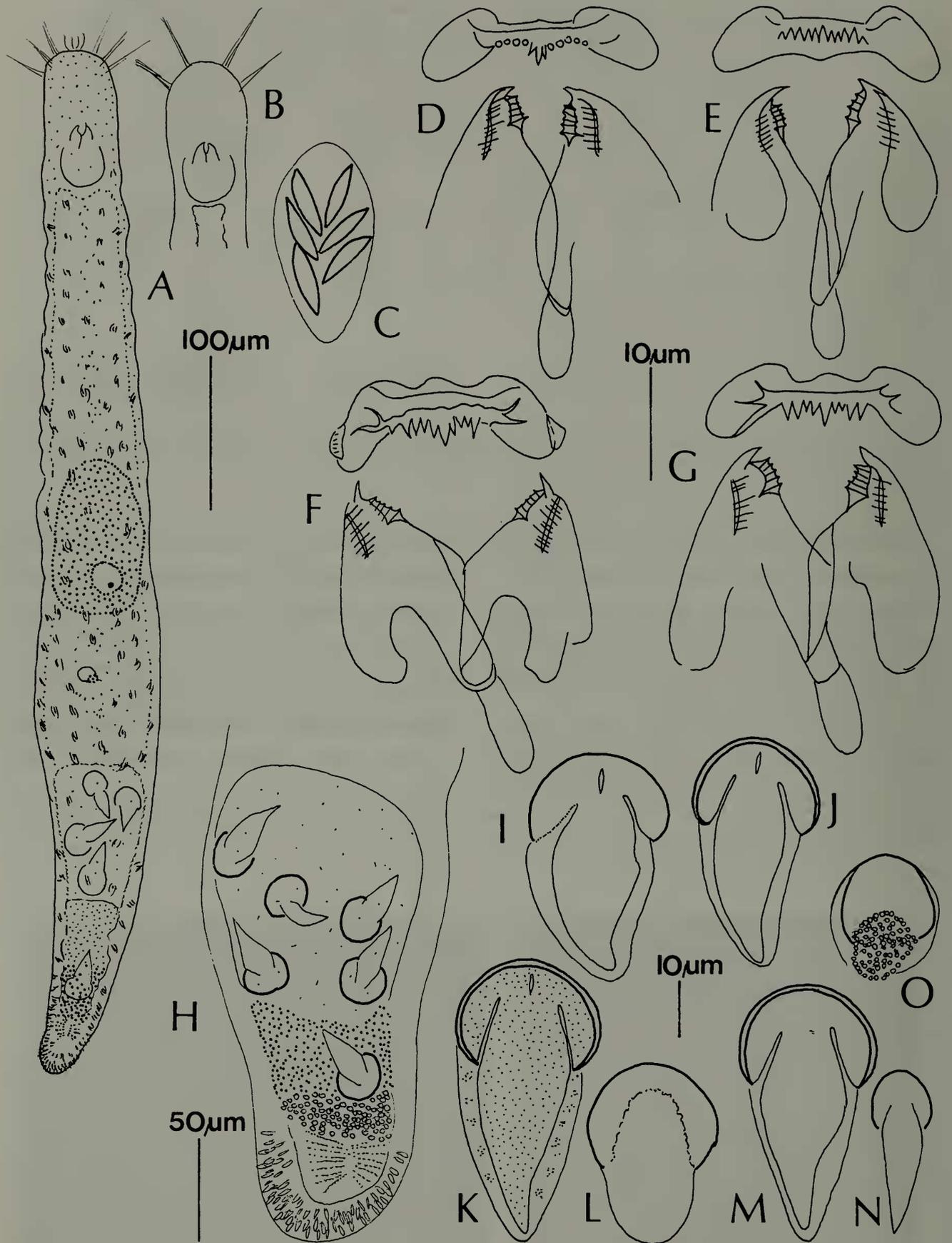


Fig. 7. *Austrognathia clavigera*. A, habitus of adult; B, rostrum of another specimen; C, rhabdoid bundle; D-G, basal plate and jaws of four specimens, strongly squeezed; H, posterior part of body showing male reproductive system; I-M, mature conuli; N, immature conulus; O, bursa conulus. Conuli in K and L, M and N, and J and O, respectively, are from the same specimen. Scales apply to A-B, C-G, H, and I-O, respectively.

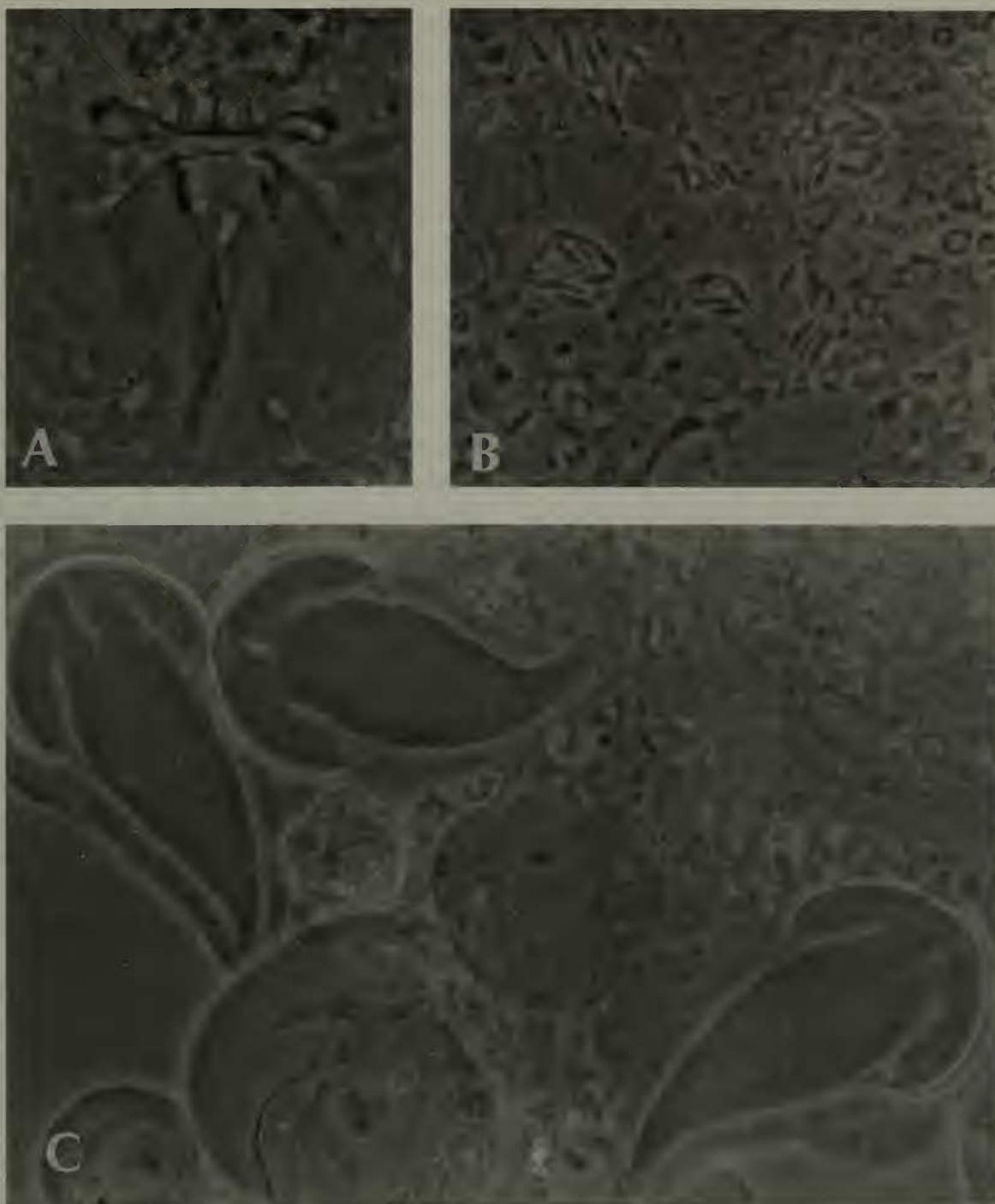


Fig. 8. *Austrognathia clavigera*, phase contrast micrographs. A, basal plate and jaws, strongly squeezed, so that the anterior edge of the basal plate is facing posteriorly; B, rhabdoid bundles; C, terminal conuli.

terior-most dorsal tooth usually rooted. Conuli to 52 μm long and 24 μm wide (index 1.96), without cingulum; hat much wider than cone and circumscribing 250°.

Description.—Organization and behavior: Colorless, and rather opaque from large numbers of epidermal rhabdite bundles. Animals glide slowly, but prefer to attach themselves to detritus particles to which they may cling with tenacity. Adults are

420–900 μm long and 80–90 μm wide at U 47.26 (index 7.63). The rostrum is 45–50 μm long and 50–70 μm wide at U 6.57; it is typically rather square, with nearly parallel lateral contours. The sensorium—difficult to ascertain since the cirri join the ciliary beat almost continuously—consists of two pairs of single apicalia (to 20 μm long), and the compound frontalia (48 μm), ventralia (50 μm), dorsalia (38 μm), and later-

Table 4.—*Labidognathia longicollis*. Measurements and statistics.

	\bar{X}	<i>SD</i>	Max	Min	<i>n</i>
Body length of adults	700.00		700	700	1
Body width of adults	65.00		65	65	1
Body index of adults	10.77		10.77	10.77	1
Rostrum index of adults	1.88		1.88	1.88	1
Jaw length	21.00	1.15	23	20	7
Basal plate length	15.43	1.40	18	14	7
Basal plate width	11.86	1.07	13	10	7
Basal plate index	1.31	0.11	1.45	1.17	7
Penis stylet length	43.00	7.00	48	35	3

alia (40 μm). Occipitalia and a pair of ciliary pits are probably present. Throughout the body, but especially in the tail region, the epidermis contains ovoid bundles of spindle-shaped rhabdoids (Fig. 7C) 6 μm long and 2 μm wide which presumably serve an adhesive function.

Digestive tract: The basal plate measures 5–8 μm in length and 18–22 μm in width (index 0.32). Its rostro-lateral lobes are fairly low, and a median lobe is inconspicuous or lacking. Caudally the basal plate is set with 8–13 (\bar{X} = 10.18) rather uniform teeth. Jaws are 18–22 μm long (\bar{X} = 20.24), and have a 7 μm long pear-shaped cauda. In addition to a strong terminal tooth there are two rows of teeth: a longer ventral row of 5–12 (\bar{X} = 8.14) long teeth, and a shorter dorsal row of 4–7 (\bar{X} = 4.78) short teeth. In the ventral row, a stronger tooth usually alternates with two weaker teeth. In the dorsal row, the caudal-most tooth is always rooted.

Male system: The single testis is 50–120 μm long, extending dorso-caudally from *U* 71.73 to *U* 83.98. The penis, from *U* 84.62 to 94.58, has three regions characterized by medium, coarse, and fine granula, respectively, with the finely-granular part surrounding the male pore (Fig. 7H). The testis contains up to 11 conuli which come in at least two size classes. Of a total of 46 conuli encountered in 7 specimens, 41 were what I call "terminal" conuli (Fig. 7I–M): to 52 μm long and 24 μm wide (index 1.98), with a towering hat that describes up to 250° of a circle, and whose width significantly exceeds that of the cone. A cin-gulum is lacking. Only five conuli, seen in three specimens in addition to terminal conuli, were smaller and more slender (30 μm by 10 μm), and endowed with a less prominent hat (Fig. 7N).

Female system: Located between *U* 39.75 and *U* 54.38, a mature egg may be 85–110 μm long. A bursa conulus, 22 μm

Table 5.—*Austrognathia clavigera*. Measurements and statistics.

	\bar{X}	<i>SD</i>	Max	Min	<i>n</i>
Body length of adults	645.00	155.15	900	420	6
Body width of adults	85.00	5.48	90	80	6
Body index of adults	7.63	2.06	11.25	5.25	6
Rostrum index of adults	0.81	0.08	0.90	0.71	4
Jaw length	20.24	1.05	22	18	25
Basal plate length	6.30	0.70	8	5	23
Basal plate width	20.09	1.38	22	18	23
Basal plate index	0.32	0.05	0.40	0.25	23
Sperm length	43.63	3.56	52	38	16
Sperm width	22.31	1.01	24	21	16
Sperm index	1.96	0.14	2.26	1.67	16

by 17 μm , was seen in one specimen (Fig. 7O).

Discussion.—The genus *Austrognathia* Sterrer, 1965 currently comprises 8 valid species: *A. hymanae* Kirsteuer, 1970; *A. microconulifera* Farris, 1977; *A. nannulifera* Sterrer, 1991a; *A. novaezelandiae* Sterrer, 1991a; *A. riedli* Sterrer, 1965; *A. christiana* Farris, 1977; *A. singatokae* Sterrer, 1991a; and *A. macroconifera* Sterrer, 1991c. A comparison with *A. clavigera* sets the first four species apart as having conuli with a maximum length of only 9–20 μm . Of the remaining species, *A. macroconifera* and *A. singatokae* have conuli quite different from those of *A. clavigera*. The conuli of *A. christiana* and *A. riedli* are similar to those of *A. clavigera* except that in the former two species the hat circumscribes no more than 180°, and does not significantly exceed the width of the cone. According to a recently proposed typology of austrognathian mouth parts, the new species belongs in the “novaezelandiae” group characterized by “a basal plate with a flattened or absent central lobe and rounded lateral lobes ... and jaws in which the dorsal row has 3 or more teeth of which the caudal-most is usually rooted” (Sterrer 1991d). In aspects such as the shape of rostrum and conuli, as well as the possession of many adhesive papillae, *A. clavigera* most closely resembles the species reported by Riedl (1966) from the Red Sea and provisionally named *A. riedli* forma *maris-rubri* of which, however, neither the structure nor the dimensions of jaws and basal plate are known.

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