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INGOLFIELLA FUSCINA, NEW SPECIES (CRUSTACEA: AMPHIPODA) FROM THE GULF OF MEXICO AND THE ATLANTIC COAST OF NORTH AMERICA, AND PARTIAL REDESCRIPTION OF *I. ATLANTISI* MILLS, 1967

Masahiro Dojiri and Jürgen Sieg

Abstract.—A new species of ingolfiellid amphipod, *Ingolfiella fuscina,* is described from relatively shallow waters (17–151 m) off the Atlantic coast and in the Gulf of Mexico, United States. The species differs from its congeners by having the following combination of characters: pereonites and pleonites higher than long, trifid tip of the ungulus of pereopods 3 and 4, stout ungulus with accessory process on pereopods 5–7, 4 rows of spinules on uropod 2, acuminate pleopods 1–3, and a sexually dimorphic element (simple seta in female; pectinate spine in male) on the peduncle of uropod 1.

Ingolfiella atlantisi Mills, 1967, is partly redescribed from the holotype. It differs from the new species in the shape and armament of gnathopods 1 and 2, and in the shape of the ungulus of pereopods 3–7.

Sexual dimorphism in the Ingolfiellidea and the classification of *Ingolfiella* at the subgeneric level are discussed.

Zusammenfassung.—Eine neue Art aus der Amphipoden Unterordnung Ingolfiellidea, *Ingolfiella fuscina,* wird aus verhältnismässig geringer Tiefe (17–151 m) von den Vereinigten Staaten von der Atlantikküste und dem Golf von Mexiko beschrieben. Die Art unterscheidet sich von allen anderen Vertretern der Gattung in der Kombination der Merkmale Pereonite and Pleonite höher als lang, dreizackiger Spitze des Ungulus in den Pereopoden 3 und 4, hakenförmigem Ungulus mit zusätzlichem Vorsprung in den Pereopoden 5–7, 4 Borstenreihen auf dem Uropoden 2, zugespitzten Pleopoden 1–3 und weist am Pedunkel des Uropoden 1 ein Merkmal auf, das Sexualdimorphismus zeigt (1 einfache Borste beim Weibchen; beidseitig gefiedert beim Männchen).

Ingolfiella atlantisi Mills, 1967, wird unter Verwendung des Holotypus teilweise nachbeschrieben. Sie unterscheidet sich von der neuen Art in der Form und Bewehrung der Gnathopoden 1 und 2 sowie in der Form des Ungulus der Pereopoden 3–7.

Der Sexualdimorphismus innerhalb der Ingolfiellidea und bei *Ingolfiella* die Klassifikation auf dem Niveau der Untergattungen werden diskutiert.

The Outer Continental Shelf Environmental Studies Program under the Department of the Interior's Minerals Management Service (MMS) (formerly part of the Bureau of Land Management) conducts extensive collections of the fauna of the continental shelf and slope from Alaska and California, the Gulf of Mexico and along the east coast of the United States from George's Bank, off Massachusetts, to southern Florida, in order to provide baseline data of the organisms occurring in these

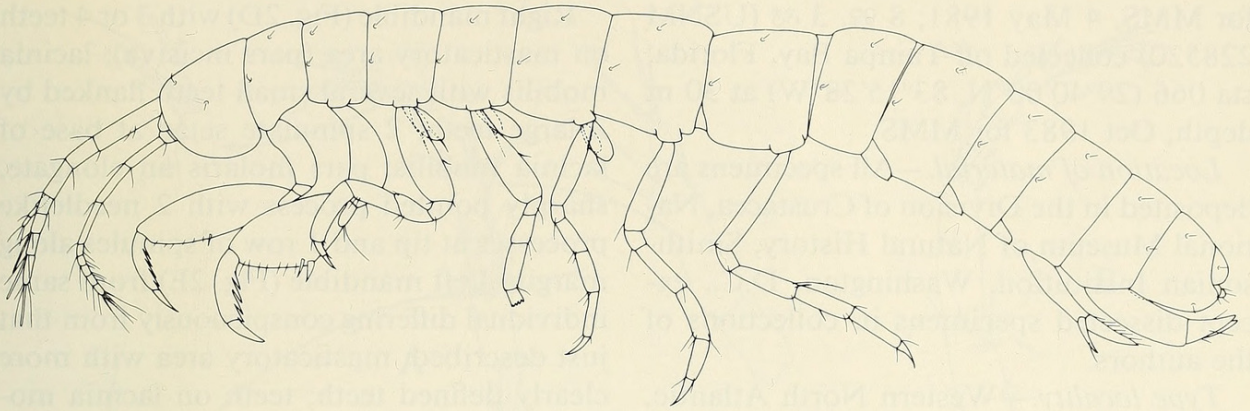


Fig. 1. *Ingolfiella fuscina,* female: body, lateral.

waters. The collected specimens, mostly identified, are maintained in the National Museum of Natural History, Smithsonian Institution, and are available for study. During a routine examination of the unidentified Crustacea from the MMS South Atlantic Benchmark Program (SABP) collection, we found specimens of a new species of *Ingolfiella* collected off the coast of South Carolina in 17 m of water. Additional material was obtained from the South Atlantic Area Living Marine Resources Study (LMRS); Mississippi, Alabama, Florida Survey (MAFLA), and from SABP samples collected off South Carolina and Florida at various depths.

The Ingolfiellidea is a suborder of the Amphipoda. According to Stock (1976) the group contains two families, the monotypic Metaingolfiellidae and the Ingolfiellidae. The latter family has three genera, *Troglolelеupia* Ruffo, 1974a, with three species, *Ingolfiella* Hansen, 1903, with 23 species, and *Stygobarnardia* Ruffo, 1985, containing only *S. caprellinoides* Ruffo, 1985, which was formerly identified as the male of *Ingolfiella opisthodorus* (now considered a species of *Troglolelеupia* Ruffo, 1974a) by K. H. Barnard (1966).

The members of this suborder have been reported from very diverse habitats and a wide range of depths (Spooner 1960, Stock 1976). The present discovery, however, is the first record of an ingolfiellid in relatively shallow water off the eastern coast of the United States. Although Mills (1967) described *Ingolfiella atlantisi* from the western North Atlantic, it was reported from the deep sea (4743–4892 m). *Ingolfiella atlantisi* is partly redescribed from the holotype and compared to the new species described below. A discussion of Ingolfiellidea is also presented.

Ingolfiella fuscina, new species
Figs. 1–5

Type specimens.—Holotype ♀ (USNM 224991), allotype ♂ (USNM 224992), paratypes (10 ♀♀, 1 ♂; USNM 224993) collected off South Carolina, sta 2B (32°54′06″N, 079°11′58″W) with box core at 17 m depth for Minerals Management Service (MMS), Department of Interior, 17 Nov 1977.

Additional specimens.—1 ♀ (USNM 224994) collected off Crystal River, Florida, sta III-2316 (28°42′00″N, 084°20′01″W) at 25 m depth for MMS in 1975; 1 ♀ (USNM 224995) with same collection data as preceding specimens, but collected in 1976; 1 ♀ (USNM 224996) collected off Panama City, Florida, sta V-2529 (29°55′59″N, 086°06′29″W) at 38 m depth for MMS, 7 Feb 1976; 1 ♀, 1 ♂ (USNM 224997) collected off Florida, sta 7E (29°36′00″N, 080°10′59″W) with box core at 151 m depth for MMS, 2 Sep 1977; 7 ♀♀ (2 dissected on slides) (USNM 221271) collected off South Carolina, sta 0S06 (32°29′06″N, 078°49′18″W) with Smith-MacIntyre grab at 48 m depth

for MMS, 4 May 1981; 8 ♀♀, 3 ♂♂ (USNM 228520) collected off Tampa Bay, Florida, sta 066 (29°40′00″N, 83°15′28″W) at 30 m depth, Oct 1983 for MMS.

Location of material.—All specimens are deposited in the Division of Crustacea, National Museum of Natural History, Smithsonian Institution, Washington, D.C., except dissected specimens in collections of the authors.

Type locality.—Western North Atlantic, off South Carolina, 32°54′06″N, 79°11′58″W, 17 m.

Etymology.—The specific name *fuscina,* a feminine noun (Latin for three-pronged fork or trident), alludes to the trifid tip of the ungulus of pereopods 3 and 4.

Description of female (other than holotype).—Body: Total body length (frontal margin of head to tip of telson) 1.43–1.80 mm, based on 6 specimens. Body (Fig. 1) elongate, laterally compressed; each body somite shorter than high, and bearing a few setules. Small subtriangular process, "ocular lobe," present between bases of first and second antennae; this process rounded at apex and hyaline, not extending beyond distal margin of basal segment of second antenna.

First antenna (Fig. 2A) with 3-segmented peduncle and 4-segmented flagellum; first segment of peduncle longer than segments 2 and 3 combined; armament formula for peduncle and flagellum: 16, 12, 7, 2, 4 + 1 esthete, and 7 + 2 esthetes. Accessory flagellum (Fig. 2A) 3-segmented, first segment naked; second segment with 3 setae; terminal segment with 2 setae and 1 esthete.

Second antenna (Fig. 2B) with 5-segmented peduncle and 5-segmented flagellum; "gland cone" (see Stock 1976) on second segment of peduncle digitiform; armament formula for peduncle and flagellum: 0, 1, 5, 8 (3 additional setae, indicated by arrows, present in 1 specimen), 11, 2, 5, 4, 5, 6 (1 of these somewhat esthete-like: broad with rounded tip).

Labrum (Fig. 2C) with rounded posterior margin.

Right mandible (Fig. 2D) with 3 or 4 teeth on masticatory area (pars incisiva); lacinia mobilis with several small teeth flanked by 2 large teeth; 2 spinulate setae at base of lacinia mobilis; pars molaris an elongate, sharply pointed process with 2 needlelike processes at tip and 1 row of spinules along margin. Left mandible (Fig. 2E) from same individual differing conspicuously from that just described; masticatory area with more clearly defined teeth; teeth on lacinia mobilis all similar in size; 3 spinulate setae at base of lacinia mobilis.

First maxilla (Fig. 2F) with rounded proximal endite bearing 3 setae; distal endite with 3 spinulate spines (1 spinulate only along inner margin), 1 pectinate spine, and 2 bifid spines; 2-segmented palp tipped with 3 apical setae.

Second maxilla (Fig. 2G) with 2 lobes each with 5 naked apical setae.

Maxilliped (Fig. 2H) with digitiform endite bearing 2 setae; palp 5-segmented with armament: 2, 1, 1, 1, 2 + 1 (clawlike spine).

Coxal gills present on pereopods 3 to 5 (Fig. 1).

Gnathopod 1 (Fig. 3A) with basis longer than ischium and merus combined; basis and ischium each with 1 seta; merus with 2 setae near junction with carpus; carpus relatively slender, with 1 seta on anterodistal corner; palm bearing 4 spines, 7 simple setae, and 4 Y-shaped setae (see detailed Fig. 3A); claw formed from propodus and dactylus; propodus with 2 anterior and 2 posterior setae; dactylus with 1 anterior seta and 4 elongate teeth (fourth tooth closely appressed to or fused with dactylus and bearing 1 seta at base).

Gnathopod 2 (Fig. 3B) with basis, ischium, and merus similar to those of gnathopod 1; carpus somewhat triangular, anterodistal corner bearing 1 seta, and conspicuously stouter than that of gnathopod 1; palm carrying 3 spines (1 of which large), 8 simple setae, 3 Y-shaped setae, and 2 small teeth (1 located between second and third Y-shaped setae; another immediately distal to third) (Fig. 3B); propodus and dactylus

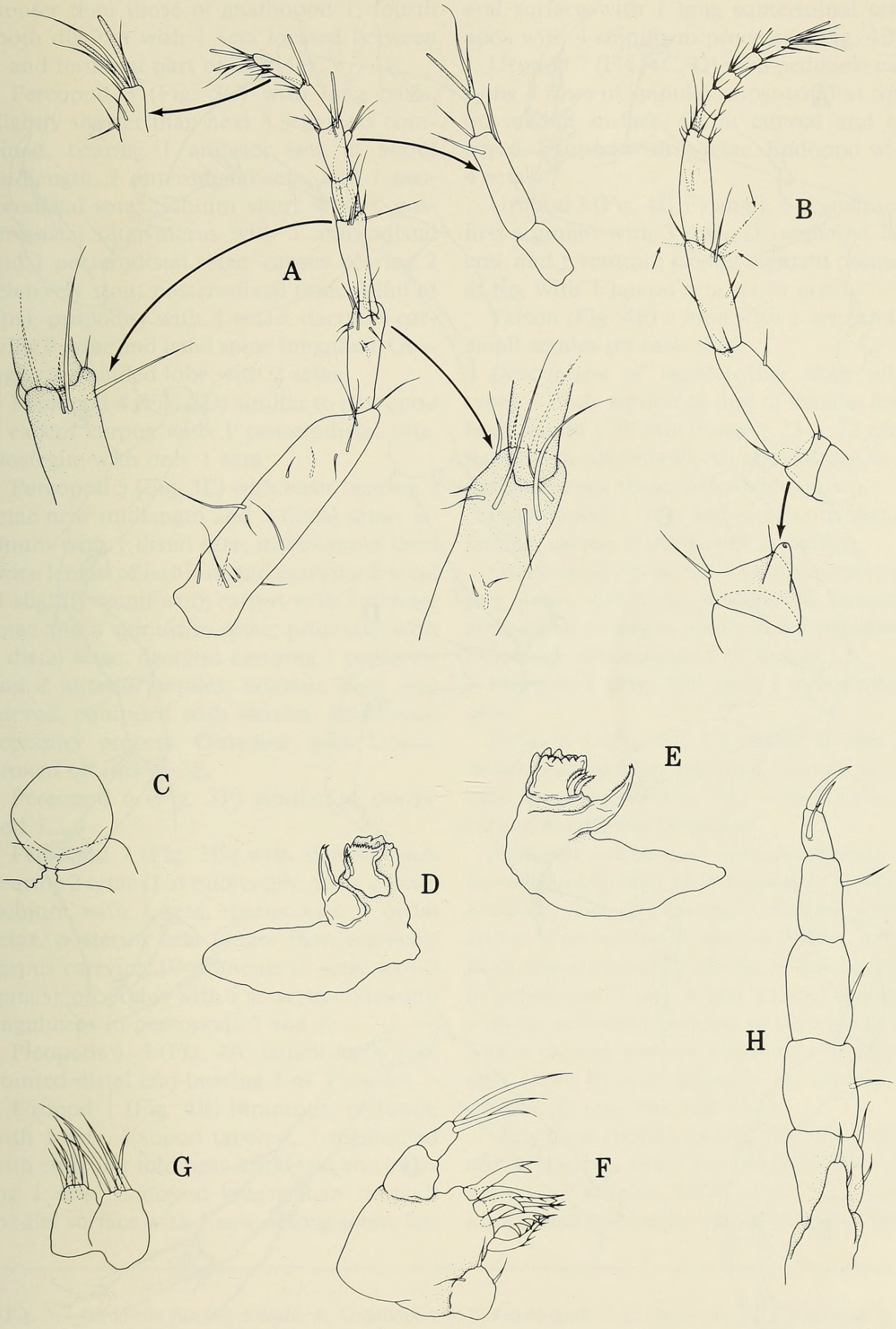
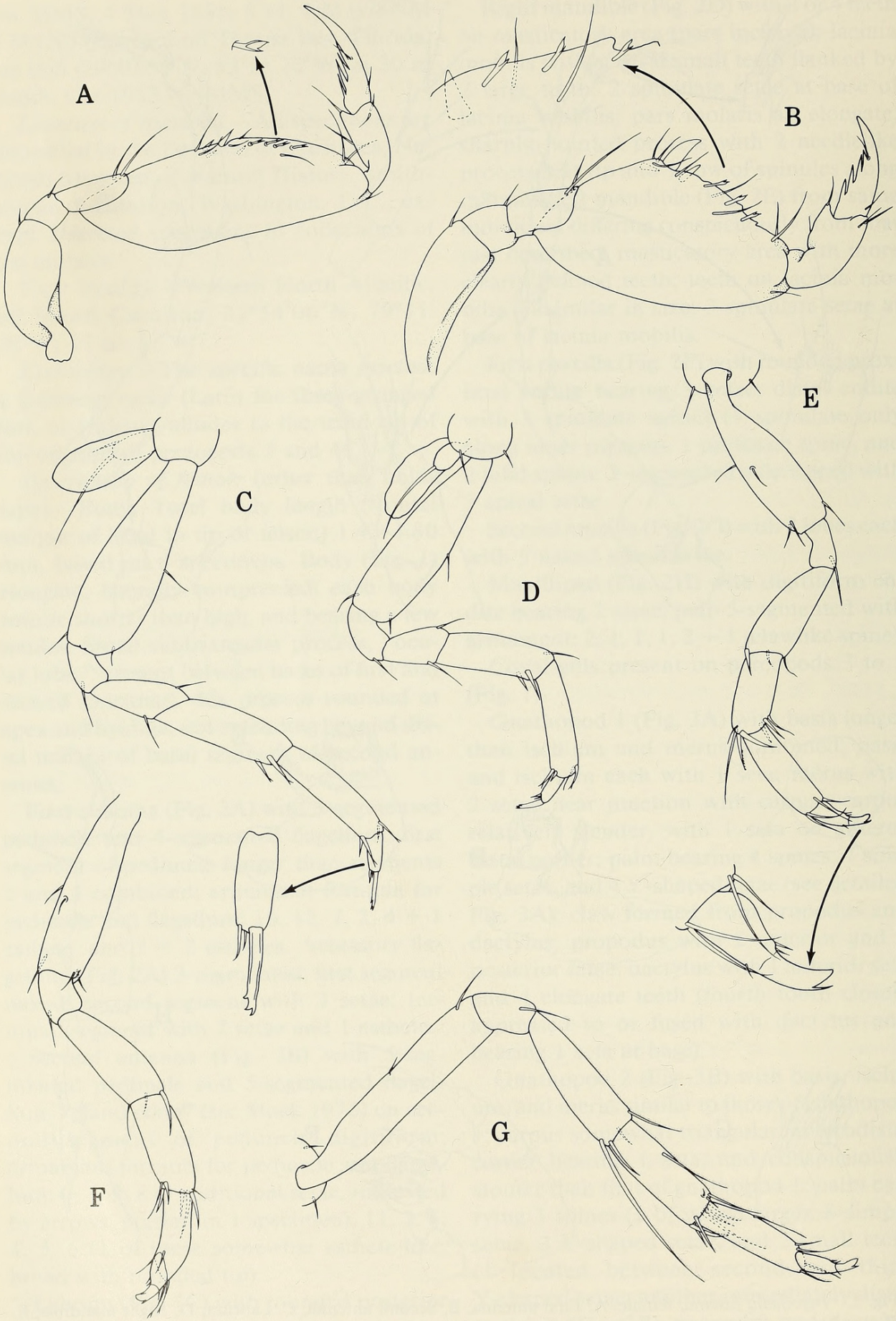


Fig. 2. *Ingolfiella fuscina,* female: A, First antenna; B, Second antenna; C, Labrum; D, Right mandible; E, Left mandible; F, First maxilla; G, Second maxilla; H, Maxilliped.


A
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stouter than those of gnathopod 1; fourth tooth distinct with 1 seta located between it and terminal part of dactylus.

Pereopod 3 (Fig. 3C) with long basis, slightly shorter than next 3 segments combined, bearing 1 anterior seta at about midlength, 1 anterodistal seta, and 1 posterodistal seta; ischium short with 1 posterodistal seta; merus with 1 anterodistal and 1 posterodistal setae; carpus bearing 2 relatively stout posterodistal setae (bifid at tips); propodus with 4 setae; dactylus carrying 2 setae and trifid spine (ungulus). Oostegite a rounded lobe with 2 setae.

Pereopod 4 (Fig. 3D) similar to pereopod 3 except carpus with 1 posterodistal seta. Oostegite with only 1 seta.

Pereopod 5 (Fig. 3E) with basis bearing 2 setae near midlength and 3 distal setae; ischium with 1 distal seta; merus more than twice length of ischium and carrying 3 setae (1 slightly spiniform); carpus with 3 slender setae and 4 spiniform setae; propodus with 4 distal setae; dactylus carrying 1 posterior and 2 anterior setules; ungulus stout and curved, equipped with slender, spiniform, accessory process. Oostegite with 1 seta, broken off in Fig. 3E.

Pereopod 6 (Fig. 3F) similar to pereopod 5.

Pereopod 7 (Fig. 3G) with slender basis bearing 2 setae (1 at midlength; other distal); ischium with 1 seta; merus with 4 distal setae, posterior seta longer than segment; carpus carrying 10 elements (7 setae and 3 spines); propodus with 5 setae; dactylus and ungulus as in pereopods 5 and 6.

Pleopods 1–3 (Fig. 4A) lamelliform with pointed distal end bearing 1 or 2 setules.

Uropod 1 (Fig. 4B) biramous; peduncle with 1 seta. Exopod tapered, 1-segmented with cuticular fold near distal end and bearing 1 seta. Endopod longer than exopod; medial surface with 1 row of long setae; lateral surface with 1 long subterminal seta; apex with 4 spiniform processes (Fig. 4B).

Uropod 2 (Fig. 4C, D) with peduncle carrying 4 rows of spinules, most trifid at tips, on medial surface. Rami curved and tapered. Exopod with 2 setae. Endopod with 4 setae.

Uropod 3 (Fig. 4E, F) small, 2-segmented; first segment with 3 setae (1 medial, 1 lateral, and 1 ventral); second segment pointed at tip, with 1 lateral seta set in notch.

Telson (Fig. 4E) a lobe with 1 seta and 2 small setules on each side.

Description of male (other than allotype).—Body similar to that of female; total body length 1.30 mm (range 1.25–1.33 mm) based on 4 specimens. All appendages as in female except those described below.

Gnathopod 1 (Fig. 5A) similar to that of female; carpus more ovoid in outline.

Gnathopod 2 (Fig. 5B, C) with robust carpus; palm with large indentation immediately distal to largest spine, and 3 triangular processes; armament as in female.

Pleopod 1 (Fig. 5D) with 1 subterminal seta.

Uropod 1 (Fig. 5E, F) similar to that of female except with terminal, dorsal, pectinate spine; spine (Fig. 5F) with 2 rows of curved needlelike processes.

Remarks.—The new species appears to be morphologically most similar to *I.* (*Hansenliella*) *kapuri* Coineau and Rao, 1972, and *I.* (*Hansenliella*) *xarifae* Ruffo, 1966. Both species have a trifid tip of the ungulus in pereopods 3 and 4 and a stout ungulus with an accessory process in pereopods 5–7 as in the new species. However, they have only three rows of spinules on uropod 2, while *I. fuscina* has four rows.

Only three species, *Ingolfiella* (*Ingolfiella*) *abyssi* Hansen, 1903, *I.* (*Trianguliella*) *macedonica* Karaman, 1959, and *I.* (*Balcanella*) *uspallatae* Noodt, 1965, have a uropod

←

Fig. 3. *Ingolfiella fuscina*, female: A, Gnathopod 1; B, Gnathopod 2; C, Pereopod 3; D, Pereopod 4; E, Pereopod 5; F, Pereopod 6; G, Pereopod 7.

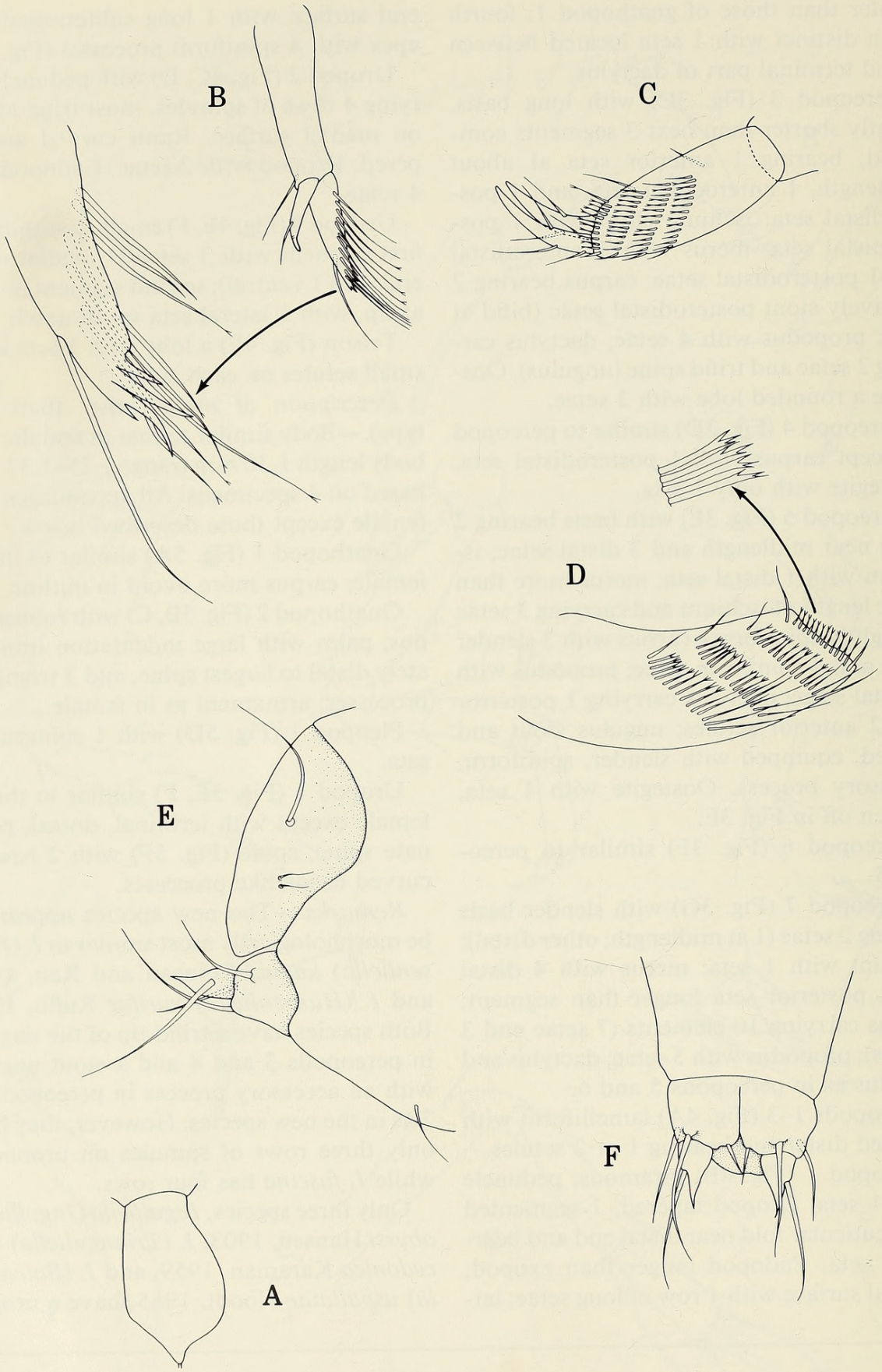

Fig. 4. *Ingolfiella fuscina*, female: A, Pleopod 1, anterior; B, Uropod 1; C, Uropod 2; D, Peduncle of uropod 2; E, Uropod 3 and telson, lateral; F, Last pleonite and uropod 3, ventral.

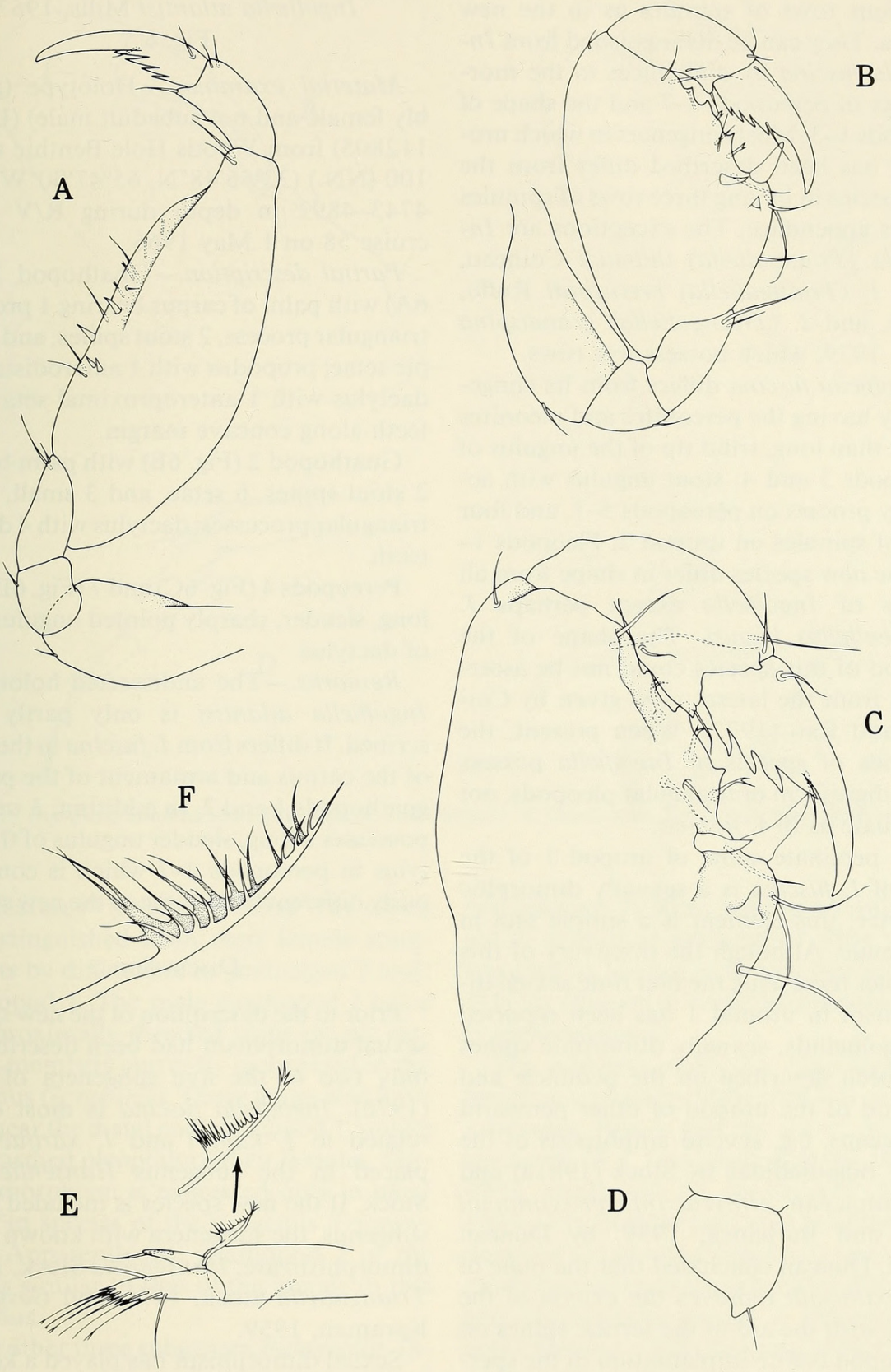

Fig. 5. *Ingolfiella fuscina,* male: A, Gnathopod 1; B, Gnathopod 2; C, Gnathopod 2, enlarged view; D, Pleopod 1; E, Uropod 1; F, Spine of uropod 1 peduncle, slightly dorsal view.

with four rows of spinules as in the new species. They can be distinguished from *Ingolfiella fuscina* by differences in the morphology of pereopods 5–7 and the shape of pleopods 1–3. Most congeners in which uropod 2 has been described differ from the new species in having three rows of spinules on this appendage. The exceptions are *Ingolfiella* (*Trianguliella*) *thibaudi* Coineau, 1968, *I.* (*Trianguliella*) *berrisfordi* Ruffo, 1974b, and *I.* (*Trianguliella*) *grandispina* Stock, 1979, which possess five rows.

Ingolfiella fuscina differs from its congeners by having the pereonites and pleonites higher than long, trifid tip of the ungulus of pereopods 3 and 4, stout ungulus with accessory process on pereopods 5–7, and four rows of spinules on uropod 2. Pleopods 1–3 of the new species differ in shape from all species of *Ingolfiella* except perhaps *I.* (*Hansenliella*) *kapuri.* The shape of the pleopod of this species could not be ascertained from the lateral view given by Coineau and Rao (1972). When present, the pleopods of species of *Ingolfiella* possess either digitiform or triangular pleopods, not acuminate as in *I. fuscina.*

The pectinate spine of uropod 1 of the male of *I. fuscina* is a sexually dimorphic character; this element is a simple seta in the female. Although the discovery of this character represents the first time sexual dimorphism in uropod 1 has been reported for ingolfiellids, sexually dimorphic spines have been described on the peduncle and endopod of the uropod of other peracarid crustaceans, e.g. several amphipods of the family Bogidiellidae by Stock (1981a) and the cumacean *Almyracuma proximoculi* Jones and Burbanck, 1959, by Duncan (1983). Duncan concluded that the male of *A. proximoculi* removes the exuvia of the female with the aid of the serrate spines on the uropod before implantation of the spermatophore on the ventrum of the female. It is not known if the pectinate spine of uropod 1 of *I. fuscina* functions in a similar way; however, its position makes it plausible.

Ingolfiella atlantisi Mills, 1967
Fig. 6

Material examined.—Holotype (probably female and not subadult male) (USNM 112805) from Woods Hole Benthic station 100 (NN.) (33°56′48″N, 65°47′00″W) from 4743–4892 m depth during R/V *Chain* cruise 58 on 1 May 1966.

Partial description.—Gnathopod 1 (Fig. 6A) with palm of carpus bearing 1 proximal triangular process, 2 stout spines, and 8 simple setae; propodus with 1 anterodistal seta; dactylus with 1 anteroproximal seta and 4 teeth along concave margin.

Gnathopod 2 (Fig. 6B) with palm bearing 2 stout spines, 6 setae, and 3 small, distal, triangular processes; dactylus with 4 distinct teeth.

Pereopods 4 (Fig. 6C) and 7 (Fig. 6D) with long, slender, sharply pointed ungulus at tip of dactylus.

Remarks.—The undissected holotype of *Ingolfiella atlantisi* is only partly redescribed. It differs from *I. fuscina* in the shape of the carpus and armament of the palm of gnathopods 1 and 2. In addition, *I. atlantisi* possesses a long, slender ungulus of the dactylus in pereopods 3–7 which is conspicuously different from those of the new species.

Discussion

Prior to the description of the new species, sexual dimorphism had been described for only two of the five subgenera of Stock (1976). *Ingolfiella fuscina* is most closely related to *I. kapuri* and *I. xarifae,* both placed in the subgenus *Hansenliella* by Stock. If the new species is included in this subgenus, the subgenera with known sexual dimorphism are: *Hanseniella* Stock, 1981b; *Trianguliella* Stock, 1976; and *Gevgeliella* Karaman, 1959.

Sexual dimorphism has played a key role in the classification of the genus (Stock 1976). In the absence of the male it is not possible to attribute most species with certainty to a particular subgenus, since three of the five "subgenera are characterized by

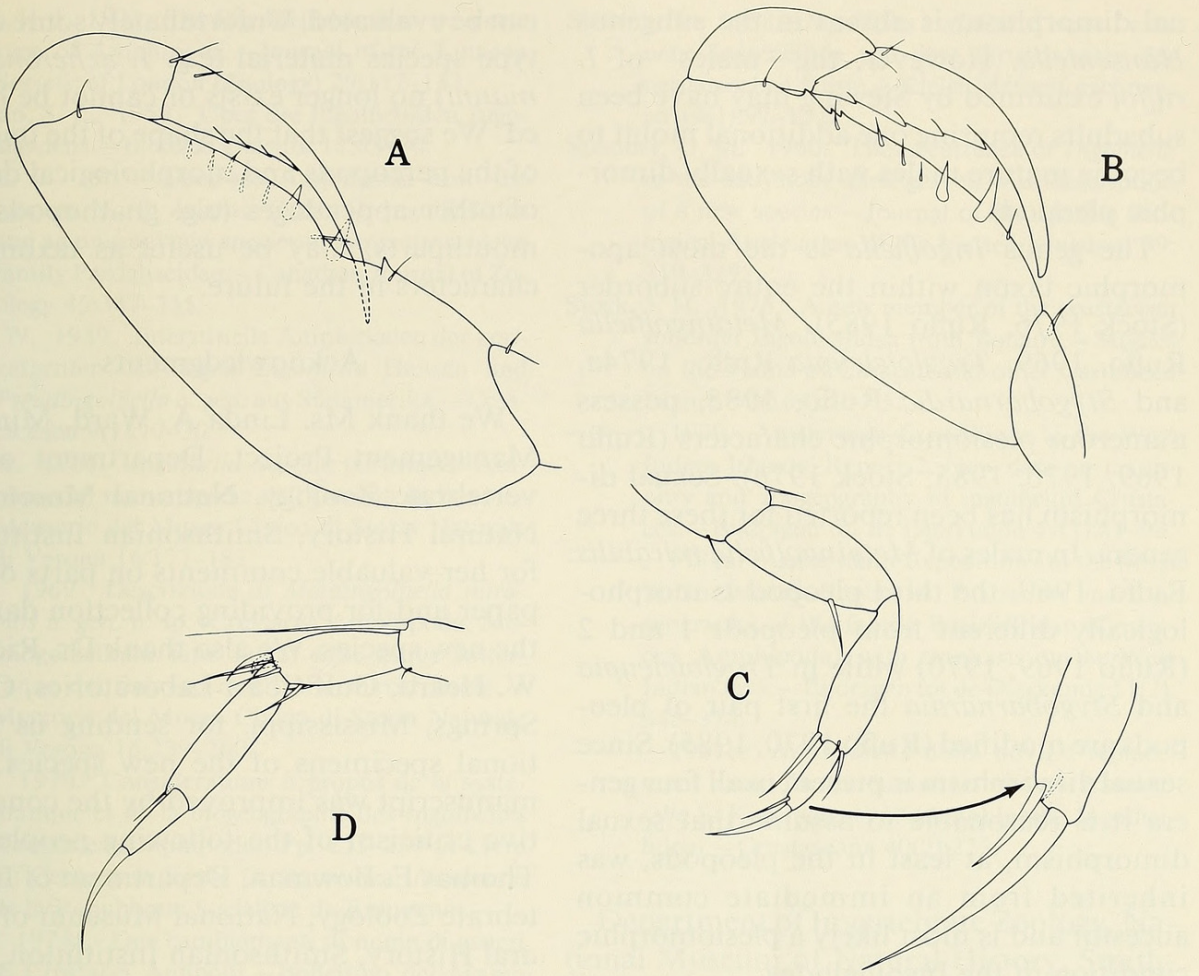

Fig. 6. *Ingolfiella atlantisi* Mills, holotype: A, Gnathopod 1; B, Gnathopod 2; C, Pereopod 4; D, Pereopod 7.

male features" (Stock 1979:95). The males are distinguished from their female counterparts by differences in gnathopod 2 and/or pleopod 1. The male gnathopod 2 has a large proximally-directed spine on the carpus in members currently recognized in the subgenus *Gevgeliella*. These males also have setae near the distal end of pleopod 1, unlike the unarmed pleopods of their females. Sexual dimorphism is expressed only in pleopod 1 in species of the subgenus *Triangu-liella*. Apparently the gnathopod 2 of the male is similar to that of the female in this subgenus.

The other three subgenera *Balcanella, Ingolfiella,* and *Hansenliella* are considered plesiomorphic by Stock (1976:63) because "neither the gnathopods nor the pleopods show secondary sexual differences" (1976: 59). This statement may be questioned for two reasons: 1) Were both sexes truly present in examined material of other species reported as having no sexual dimorphism? 2) Is the absence of sexual dimorphism really plesiomorphic?

The subadult male of *I.* (*Ingolfiella*) *atlantisi* described by Mills (1967) is probably a subadult female and the sex of the single specimen of *I.* (*Ingolfiella*) *abyssi* Hansen, 1903, could not be determined (Hansen 1903:124). Similar available information is doubtful for all other *Ingolfiella* species currently belonging to the subgenera *Balcanella* and *Hansenliella* except *I.* (*Hansenliella*) *ruffoi* Siewing, 1958. Siewing (1958:99) stated that although the specimens of *I. ruffoi* had identically developed pleopods, both sexes, determined by examination of gonad cross-sections, were present. On the basis of this report, Stock (1976) concluded that sex-

ual dimorphism is absent in the subgenus *Hanseniella*. However, the "males" of *I. ruffoi* examined by Siewing may have been subadults requiring one additional moult to become mature males with sexually dimorphic pleopods.

The genus *Ingolfiella* is the most apomorphic taxon within the entire suborder (Stock 1976, Ruffo 1985). *Metaingolfiella* Ruffo, 1969, *Trogloleleupia* Ruffo, 1974a, and *Stygobarnardia* Ruffo, 1985, possess numerous plesiomorphic characters (Ruffo 1969, 1970, 1985; Stock 1976). Sexual dimorphism has been reported for these three genera. In males of *Metaingolfiella mirabilis* Ruffo, 1969, the third pleopod is morphologically different from pleopods 1 and 2 (Ruffo 1969, 1970) while in *Trogloleleupia* and *Stygobarnardia* the first pair of pleopods are modified (Ruffo 1970, 1985). Since sexual dimorphism is present in all four genera it is reasonable to assume that sexual dimorphism, at least in the pleopods, was inherited from an immediate common ancestor and is most likely a plesiomorphic condition in the Ingolfiellidea.

Our interpretations support Ruffo (1985: 52) in questioning the classification of *Ingolfiella* at the subgeneric level. If *Ingolfiella fuscina* is included in the subgenus *Hanseniella,* to which its most closely related species reportedly belong, then the absence of sexual dimorphism can no longer be used as a diagnostic feature for the subgenus. The male of *I. fuscina* differs from the female by a stout carpus of gnathopod 2 with an indented palmar area, one seta on pleopod 1, and a pectinate spine on the peduncle of uropod 1.

The shape and armament of the appendages of ingolfiellids have been so inadequately described by most workers that meaningful comparisons within the group are at present difficult to make. Detailed redescriptions of the majority of species are needed before the validity of the five subgenera of the *Ingolfiella* and the evolutionary relationships proposed by Stock (1976) can be evaluated. Unfortunately some of the type species material (e.g. *I. acherontis, I. manni*) no longer exists or cannot be located. We suggest that the shape of the ungulus of the pereopods and morphological details of other appendages (e.g. gnathopods and mouthparts) may be useful as taxonomic characters in the future.

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