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ON DORVILLEIDAE AND IPHITIMIDAE (ANNELIDA: POLYCHAETA) WITH A REDESCRIPTION OF *ETEONOPSIS GERYONICOLA* AND A NEW HOST RECORD

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Abstract.—The symbiotic polychaete, *Eteonopsis geryonicola* Esmark (Dorvilleidae, Polychaeta), occurs in the branchial chambers of the crabs *Geryon tridens* Krøyer, *Geryon quinquedens* Smith, and *Cancer borealis* Stimpson in the North Atlantic. The latter is a new host record. The species is herein redescribed and the original genus, *Eteonopsis,* revived. A historical summary is provided to clarify confusion concerning the original description. The family, Iphitimidae, a similar group of branchiate polychaetes, are synonymized with Dorvilleidae. *Eteonopsis* occurs with significantly greater frequency and intensity in male than female crabs. Gut analyses of the worms failed to discern their mode of nutrition. A key to the Dorvilleidae is provided.

Introduction

The symbiotic annelid, *Eteonopsis geryonicola* Esmark, 1874 (Polychaeta, Dorvilleidae), lives unattached among the gills and in the branchial chamber of the deep-sea crab *Geryon tridens* Krøyer (Esmark, 1874; Bidenkap, 1895; Wesenburg-Lund, 1938; Desportes et al., 1977) and *Geryon quinquedens* Smith collected from the Atlantic Canyon (250–400 fm) in the western North Atlantic. Wesenburg-Lund (1938) reported small worms most often occurred in newly molted host crabs (*G. tridens*) and larger worms in crabs which had not recently molted. Little is known about the life history of this worm (e.g. entry into the host, mode of nutrition, reproduction, and survival through host ecdysis).

A great deal of confusion exists in the literature concerning the original description of *Eteonopsis geryonicola.* The following historical summary is provided to alleviate such problems.

Eteonopsis geryonicola was named by Esmark (1874, often misquoted as 1873) in a brief summary of an oral presentation. A number of authors, including Hartman (1951), Desportes et al. (1977), and Hartmann-Schröder (1971) incorrectly date the description to 1878, presumably in reference to a second oral presentation given by Esmark that year, but first published in 1880. Through a *lapsus* the name was incorrectly given as *E. geryonis* in the latter report. A more complete description of Esmark's material fol-

lowed several years later (Bidenkap, 1895). Since the species is superficially similar to the phyllodocid polychaete, *Eteone,* Bidenkap established a new family for *Eteonopsis*: Pseudophyllodocidae. All specimens collected at that time were from the branchial chambers of the red crab, *Geryon*; hence the species name, *E. geryonicola.*

The generic name survived until Wesenburg-Lund (1938) referred *Eteonopsis* to the eunicid genus *Ophryotrocha,* and submerged the family name, Pseudophyllodocidae. Wesenburg-Lund (1938) must have been unaware that Esmark provided the original description (albeit poor) and incorrectly cited Bidenkap as the original author: *Ophryotrocha geryonicola* (Bidenkap). Subsequent authors have recognized Esmark as the original author, and referred the species to *Ophryotrocha geryonicola* (Esmark), now in the Dorvilleidae. Until recently, this species has been known only from the branchial chambers of two crabs, *Geryon tridens* Krøyer and *G. quinquedens* Smith. All other species of *Ophryotrocha* are free-living, interstitial burrowers (Åkesson, 1976).

In 1970, Fauchald established the family Iphitimidae for a number of polychaetes found primarily in crustacean branchial chambers. Though closely allied with dorvilleids, iphitimids could be distinguished in external morphology by the presence of conspicuous branchiae across the dorsum. *Ophryotrocha geryonicola* is abranchiate, as were all dorvilleids when Fauchald erected the Iphitimidae. Except for the presence of branchiae the general external morphology of iphitimids and dorvilleids is similar. Several analogous structures exist among the jaws of the two families as well. These are discussed below.

Recent discovery of branchiate dorvilleid species further eliminated the distinction between Iphitimidae and Dorvilleidae (Rullier, 1974; Armstrong and Jumars, 1978). It is proposed, therefore, that the two families be combined under Dorvilleidae, and furthermore, that the genus *Eteonopsis* Esmark, 1874 be revived for *E. geryonicola* to distinguish it from free-living species of *Ophryotrocha*. Since the original description of *E. geryonicola* was brief, a more complete description is provided herein.

This paper also reports on the occurrence of *E. geryonicola* in the red crab, *Geryon quinquedens* off the U.S. east coast, as well as the first documented evidence of *Eteonopsis* inhabiting the gills and branchial cavity of the Jonah crab, *Cancer borealis*. Collections were made at Station J-1 (Fig. 1) on the western Atlantic continental slope in May and August, 1977.

Occurrence Along United States East Coast

A total of 34 of 277 (12.3%) *Geryon quinquedens* and 1 of 197 (0.51%) *Cancer borealis* contained polychaetes in the branchial chambers (Table 1). In contrast, Wesenburg-Lund (1938) recorded infestation by this polychaete

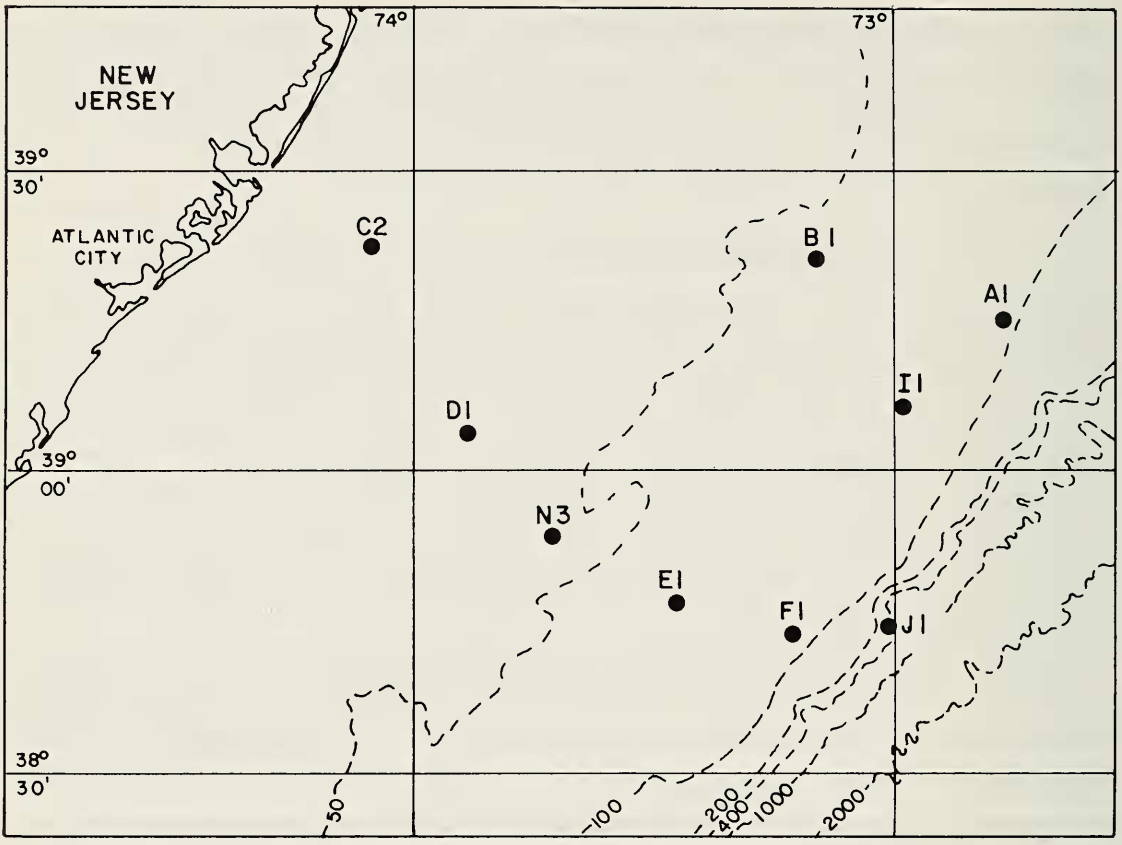


Fig. 1. Collection sites for host crabs, *Geryon quinquedens* and *Cancer borealis*. Virginia Institute of Marine Science, Bureau of Land Management Outer Continental Shelf benchmark study, 1975–1977. (Depths in meters.)

in 33% of 65 *Geryon tridens* examined in the Atlantic off Europe. Desportes et al. (1977) reported it from the western Mediterranean. *G. quinquedens* is quite common on the continental slope of the western North Atlantic (Williams and Wigley, 1977) while the distribution and abundance of *E. borealis* varies considerably with temperature (latitude) and depth. *C. borealis* is a common inhabitant of the waters off the United States east coast (MacKay, 1943) and is found in waters ranging in depth from several meters to 750 meters (Squires, 1966). Of the specimens of *C. borealis* collected on the continental shelf (<200 m), none was found to be infested with *E. geryonicola*. *C. borealis* occurred rarely in slope samples and only one specimen contained the symbiotic worm. *G. quinquedens,* however, was taken in large numbers from slope station J-1 (Fig. 1) and contained considerable numbers (range 0–12) of *E. geryonicola*.

In agreement with Wigley et al. (1975), a substantial difference in the occurrence of female vs. male *G. quinquedens* (Table 1) was found in the present study, where males constituted only 9.7% of the sample. The percentage of infestation of worms in male hosts was significantly greater than

Table 1.—Incidence of infestation by size and sex for the red crab, *Geryon quinquedens* by the polychaete, *Eteonopsis geryonicola*.

	Female	Male
No. crabs collected	250	27
No. and (percent) infested	22 (8.8)	12 (44.4)
No. worms in infested crabs mean and (range)	2.0 (1–7)	3.4 (1–12)
Carapace width—mean and (range) of infested crabs (mm)	108.8 (87–122)	138.1 (122–151)
Carapace width—mean and (range) of non-infested crabs (mm)	105.2 (84–122)	135.3 (120–144)

in females (chi-square test; $\alpha < 0.05$). Intensity of infestation (number of worms per host) was significantly greater for males than females ($\alpha < 0.05$, median test, Brown and Mood, 1951). The mean carapace width of infested males (138.1 mm) was noticeably larger than that of the infested females (108.8 mm) but no correlation between the occurrence of *E. geryonicola* and the size of the crabs could be determined. Factors which govern the investation of *G. quinquedens* and *C. borealis* by this dorvilleid cannot be resolved without additional data.

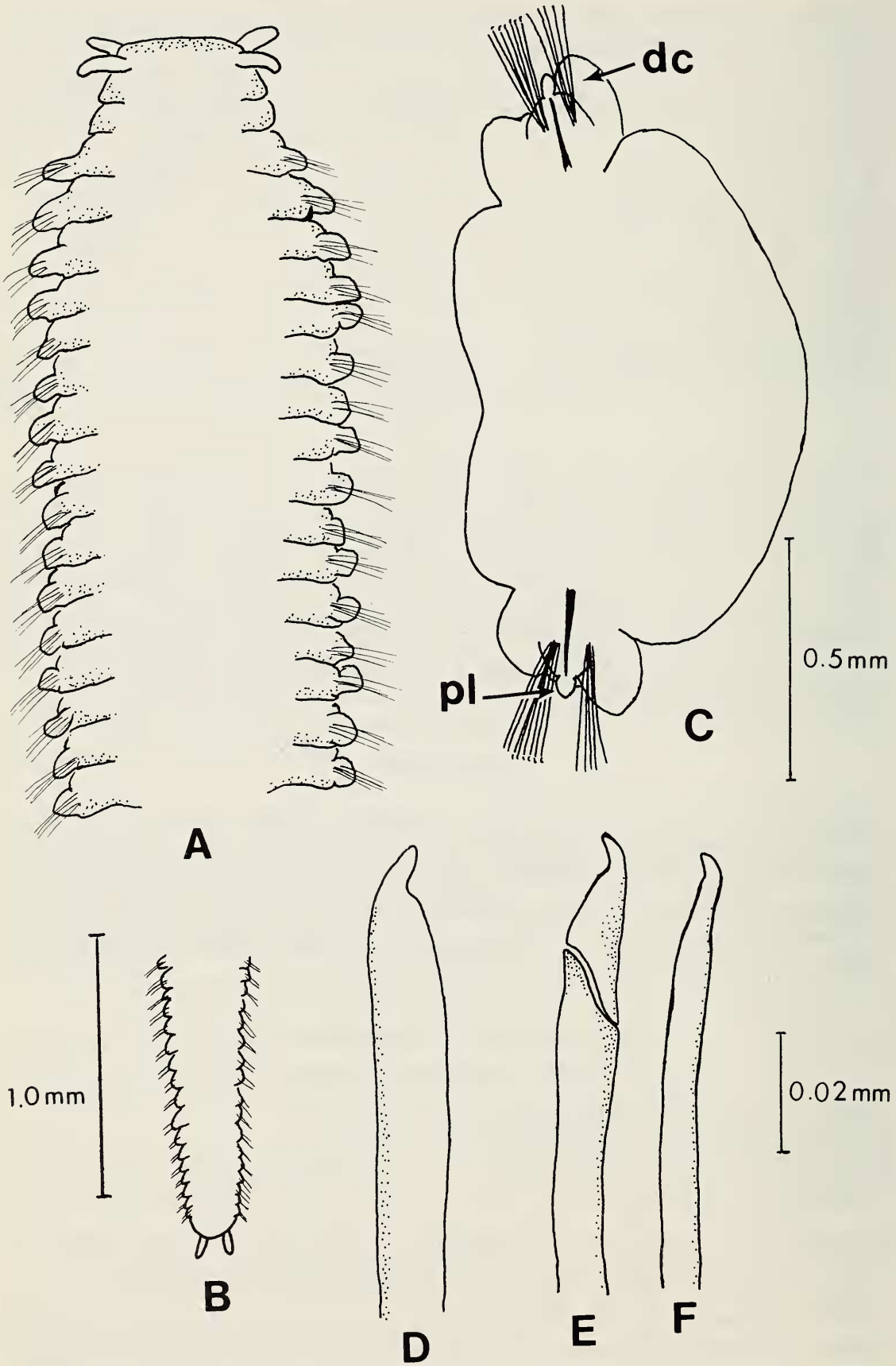
Gut Analysis

A microscopic analysis of the gut contents of these worms revealed an amorphous and acellular substance along with distinct clumps of bacteria. This substance stained well with astrablue (specific for mucopolysaccarides) and may, therefore, be digested mucus from the host crab. The question as to whether these worms are commensals or parasites with a metabolic dependence on the host, however, remains unclear.

Family Dorvilleidae Chamberlin, 1919
Eteonopsis geryonicola Esmark, 1874

Eteonopsis geryonicola Esmark, 1874:497–498.
Eteonopsis geryonis Esmark, 1880:14.
Eteonopsis geryonicola n. gen., n. sp. (Esmark, 1873) O. Bidenkap, 1895:72–74, pl. 3, figs. 1–3.
Ophryotrocha geryonicola (Bidenkap).—E. Wesenberg-Lund, 1938:1–14, figs. 1–11.—Pettibone, 1961:181.—Hartman-Schröder, 1971:264.

Material examined.—NORWAY: Skagerrak, 4 specimens from branchial chamber of *Geryon tridens*, B. Åkesson, coll.—EAST COAST NORTH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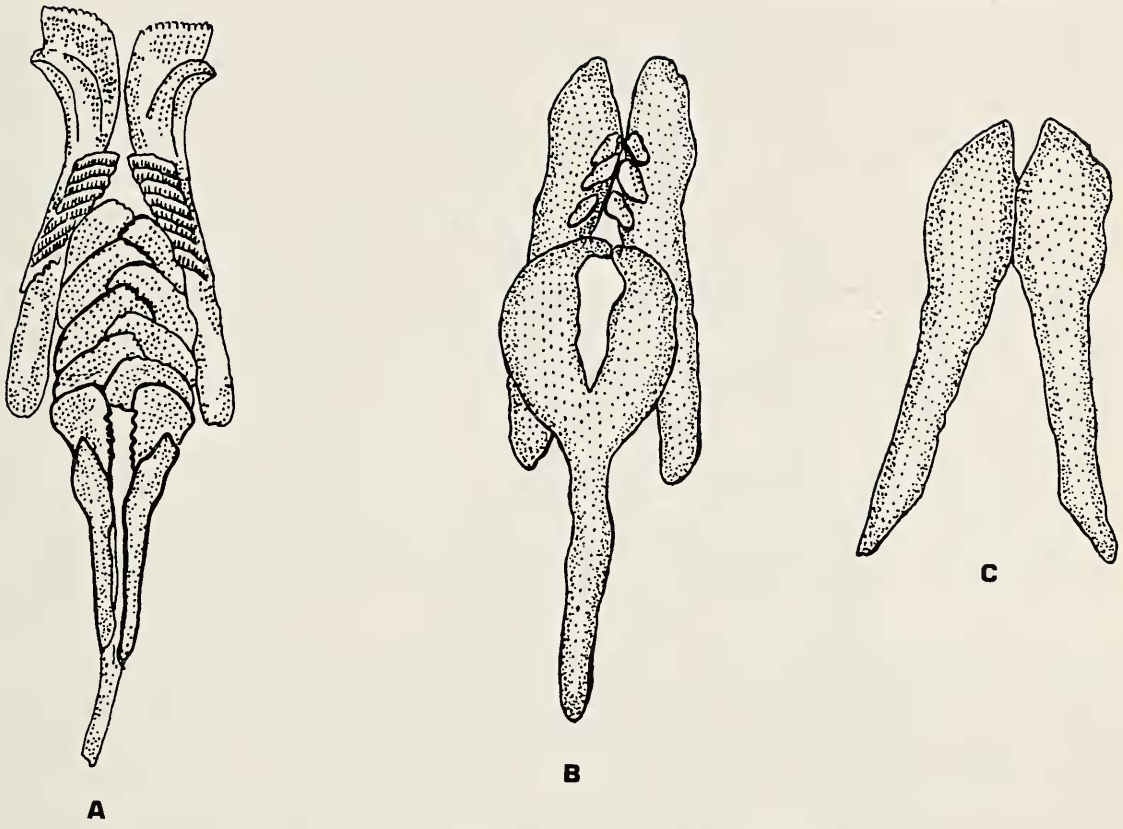

Fig. 3. *Eteonopsis geryonicola:* A, Maxillae and mandibles of a juvenile (5 mm long) specimen; B, Maxillae and mandibles of an adult (140 mm long) specimen; C, Mandibles of same. (A, B, C after Wesenberg-Lund, 1938.)

AMERICA: 3 specimens from branchial chamber of *Geryon quinquedens,* 38°44′N, 73°00′W, 350 m, D. Benner, coll. (USNM 55174). 2 specimens from branchial chamber of *Cancer borealis,* 38°40.8′N, 73°04.3′W, 342 m, D. Benner, coll. (USNM 54957). 5 specimens from branchial chamber of a red crab, Atlantis Canyon, 39°50′N, 70°10′W, 250–400 fm, K. A. Wilhelm, coll. (USNM 54339). 2 specimens from red crab, Gloucester, Maine, K. A. Wilhelm, coll. (USNM 54338). 10 specimens from *Geryon quinquidens,* 38°44′N, 73°00′W, 350 m, D. Benner, coll. (VIMS Acc. No. 736). 1 specimen from *Geryon quinquidens,* 38°45.3′N, 73°01.0′W, 350 m, D. Benner, coll. (VIMS Acc. No. 1250).

Description.—Specimens of *Eteonopsis geryonicola* range from 5–140

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Fig. 2. *Eteonopsis geryonicola:* A, B, Anterior and posterior ends in dorsal view of 100 mm specimen; C, Transverse section, anterior view of segment 73 with presetal lobe (pl) and dorsal cirrus (dc) indicated; D, Simple falciger from middle notopodium; E, Composite falciger from middle neuropodium; F, Simple falciger from same.

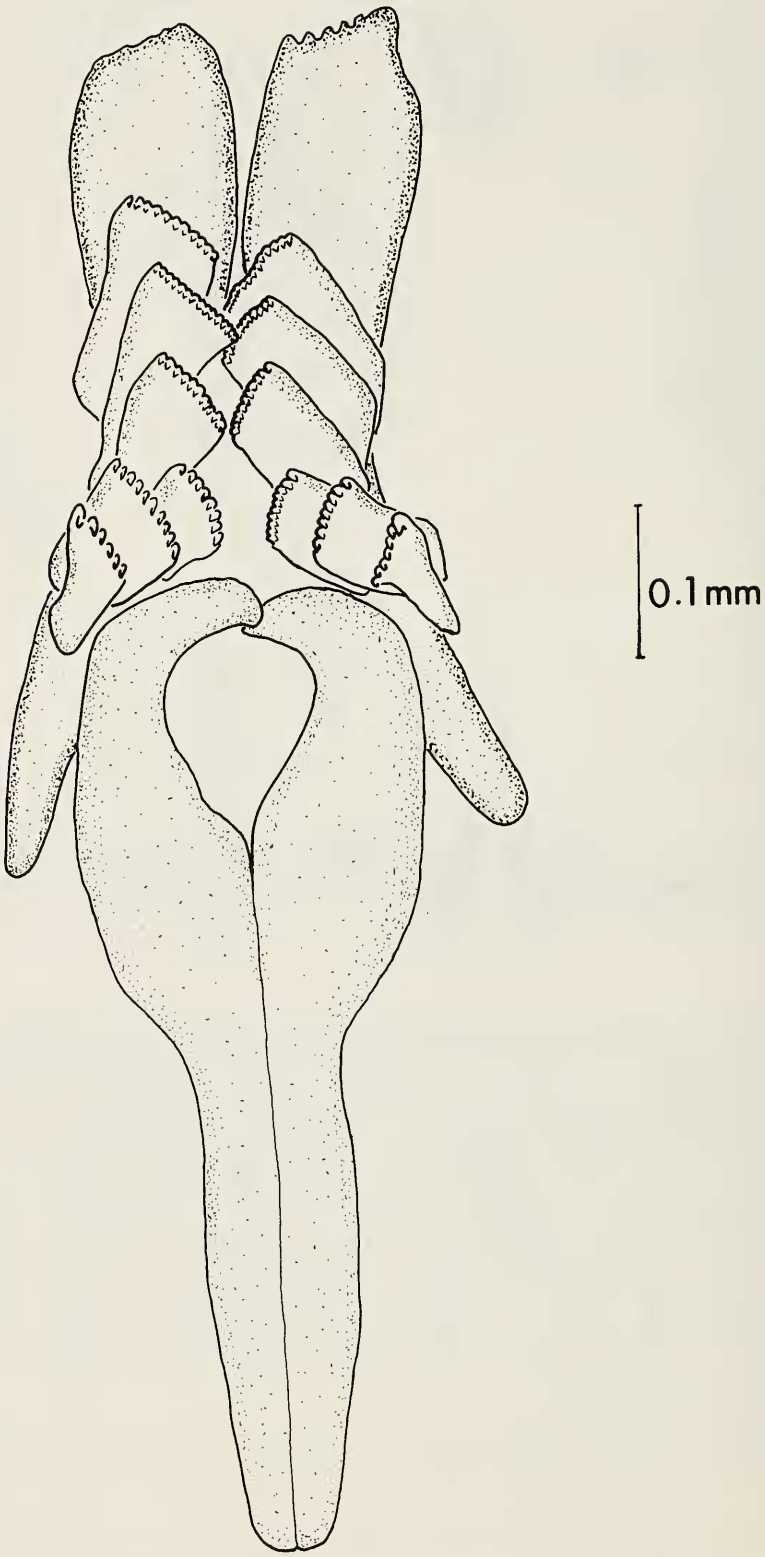

Fig. 4. *Eteonopsis geryonicola*: Maxillae and mandibles of an adult (100 mm long) specimen.

mm in length, 0.3–5.0 mm wide, and 25 to several hundreds of segments long. Body white in fresh and preserved specimens. Prostomium rounded lobe with a pair of papilliform antennae and similar pair of palps (Fig. 2A). No eyes present. Body gradually tapers posteriorly. Two short anal cirri present (Fig. 2B). Between prostomium and first setigerous segment are 2 apodous and achaetous segments.

Maxillary carriers (Fig. 3B) fused medially, free ends form pincer-like structure. Maxillae vary in number depending on size. Two small specimens (40–50 mm) have 2 sets of maxillae with up to 14 paired maxillae total (Fig. 3A). Largest specimens (120–140 mm) have as few as 3 small paired maxillae with Maxillae I (Mx I) fused to maxillary carriers (Fig. 3B). Intermediate-sized specimens (ca. 100 mm) have large maxillary carriers fused to Mx I and 6 additional maxillae (Fig. 4). Maxillary carriers and Mx I of similar size and general form in all specimens 80–140 mm long. These structures of smaller specimens poorly developed (Fig. 3A). Mandibles fused medially (Figs. 3C, 4).

Parapodia uniramous and similar throughout. Conspicuous presetal lobe, 2 rounded postsetal lobes, and blunt dorsal cirrus present (Fig. 2C). A translucent aciculum bisects each parapodium. Each parapodium contains: dorsally—4–8 long, simple, falcigers with blunt tip (Fig. 2D); ventrally—5–8 long, composite falcigers and 0–3 simple, hooked setae of similar length but more narrow shafts (Fig. 2E, F). Branchiae lacking.

Remarks.—Bidenkap (1895) failed to mention the simple setae in the lower parapodial bundle. These are not present in all parapodia and may be difficult to see. The most conspicuous difference in the morphology of *Ophryotrocha* (Fig. 5) and *Eteonopsis* (Fig. 2) is the greater size of *Eteonopsis*. Most species of *Ophryotrocha* are less than 10 mm long while *Eteonopsis* may attain a length of 140 mm. In addition, *Ophryotrocha* species are free-living, interstitial forms and *E. geryonicola* is known only as a symbiont in crab branchial chambers. Ciliary rings present in many *Ophryotrocha* are lacking in *Eteonopsis*. The setae of the two genera differ. Blades of composite falcigers are shorter in *Eteonopsis* (Figs. 2D, E, F; 5B, C). Both genera, however, reportedly have a reduction in maxillae with age (Wesenberg-Lund, 1938).

There are a number of similarities between the species of Iphitimidae (Fig. 6) and *Eteonopsis geryonicola* (Fig. 2): both inhabit crab branchial chambers; the mandibles of each (Figs. 3C, 7) are simplified and maxillary carriers are fused with Mx I into pincer-like structures (Figs. 4, 7); setae of both (Figs. 2D, E, F; 6C) include composite falcigers and simple hooks (Hartnoll, 1962); both *Iphitime* and *Eteonopsis* may occur in crab branchial chambers, but certain species of *Iphitime* (e.g. *I. hartmanae*) may also occur beneath the abdomens of egg-bearing female crabs (Kirkegaard, 1977).

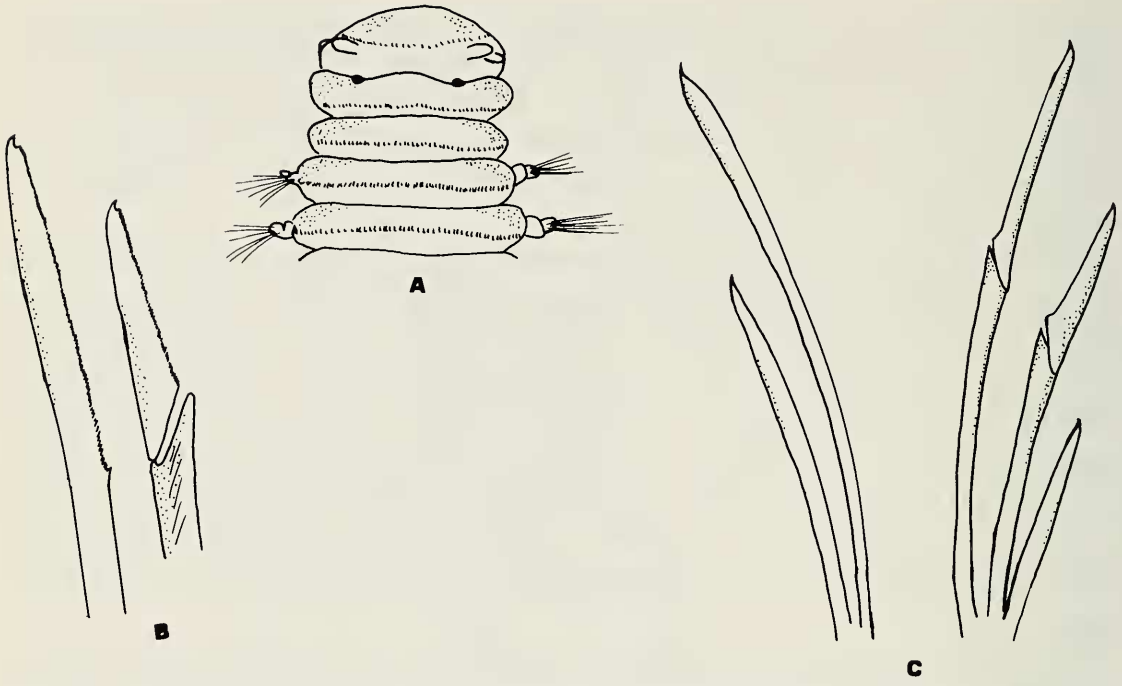

Fig. 5. *A, Ophryotrocha puerilis siberti,* dorsal view of anterior end; B, simple and composite falcigers; C, *Ophryotrocha gracilis,* simple and composite falcigers. (A, B, C after Hartman-Schröder, 1971.)

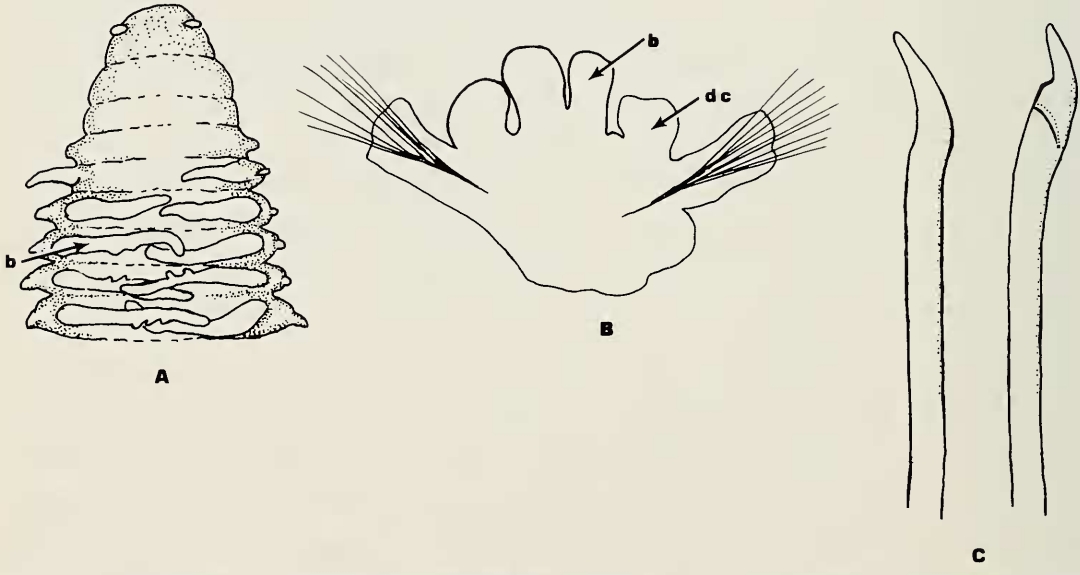

Fig. 6. A, *Iphitime loxorhynchi,* anterior end in dorsal view, branchiae (b) indicated (after Fauchald, 1977); B, *I. hartmanae* Kirkegaard, transverse section of middle segment with branchiae (b) and dorsal cirri (dc) indicated (after Kirkegaard, 1977); C, *I. loxorhynchi,* simple and composite falcigers (after Hartman, 1952).

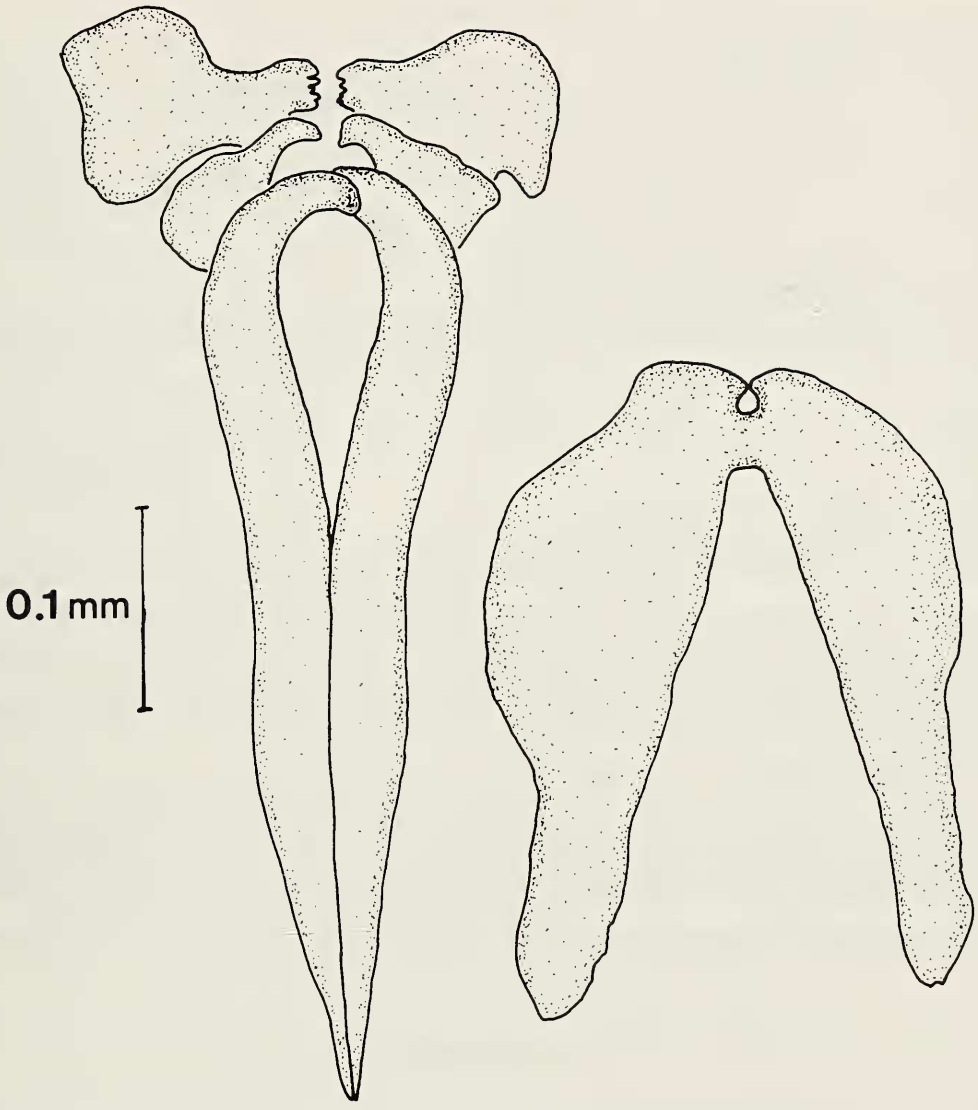

Fig. 7. *Iphitime loxorhynchi:* Maxillae and mandibles.

The fusion of the maxillary carriers with Mx I in adult *Iphitime* (Fauchald, 1970) and *Eteonopsis* distinguishes them from other Eunicea such as Onuphidae, Lumbrineridae, and Eunicidae whose pharangeal apparatus may otherwise be similar. Both *Iphitime* and *Eteonopsis,* like many dorvilleids, have reduced maxillae in adult specimens (Fig. 3A, B). *Eteonopsis* may be separated from *Iphitime* by its lack of branchiae and presence of palps (Figs. 2A, C; 6A, B).

Key to the Genera of the Dorvilleidae
(after Jumars 1974)

1. Parapodia uniramous, without notoacicula 4
– Parapodia sub-biramous, with enclosed notoaciculum 2

2. Furcate setae present 3
– Furcate setae absent ..... *Dorvillea*
3. Antennae small, simple; jaw pieces with 14 denticle rows ..... *Pettiboneia*
– Antennae long, multiarticulate; jaw pieces with 4 denticle rows ..... *Schistomeringos*
4. Furcate or geniculate setae present 5
– Furcate and geniculate setae absent 6
5. Palps well developed, with at least one article; jaws with 4 denticle rows ..... *Protodorvillea*
– Palps very small, simple or biarticulate; jaws with 2 denticle rows ..... *Meiodorvillea*
6. Setae all simple, acicular ..... *Paraophyrotrocha*
– Setae include some falcigers 7
7. Setiger 1 modified, with 2 types of large specialized setae: a simple recurved spine and a large, thick, sharply recurved composite falciger; antennae and palps biarticulate ..... *Exallopus*
– Setiger 1 not modified; antennae and palps reduced, papilliform ... 8
8. Branchiae present across dorsum ..... *Iphitime*
– Branchiae absent 9
9. Composite falcigers with elongate blades (Fig. 4B, C); body small (<10 mm); interstitial burrowers ..... *Ophryotrocha*
– Composite falcigers with short blades (Fig. 2E); body large (25–140 mm); symbiotic in crab branchial chamber ..... *Eteonopsis*

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