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THE LARVA AND PUPA OF *BERAEA GORTEBA* ROSS (TRICHOPTERA: BERAEIDAE)

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Abstract.—The larva and pupa of *Beraea gorteba* Ross, one of three North American species of *Beraea*, are described for the first time. Comparisons are made to *B. nigritta* Banks and *B. fontana* Wiggins, both species of northeastern North America. Larvae of *B. nigritta* and *B. fontana* have five to seven spines on the anterolateral process of the pronotum whereas *B. gorteba* has three to four slightly larger spines on this process. Larvae of *B. gorteba* are burrowing detritivores and were collected along the margins of a small, spring-feed pool. Adults emerge from early May to early June and appear to be day active.

North American beraeids are rare, elusive caddisflies, with extremely local distributions. Beraeidae are a small family with five genera, and most of the 38 extant species are found in the western Palaearctic Region (Fischer, 1970; Malicky, 1983). Only three species occur in North America (Wiggins, 1977), all in the nominate genus, *Beraea,* which comprises 21 species worldwide.

Beraea nigritta Banks 1897, was described based on two female specimens from Nassau County, New York. A fragmented female specimen was reported by Betten (1934) from a locality near Ithaca, New York. Recently, Lake (1984, pers. com.) has reported *B. nigritta* from extensive seepages in the Blackbird Creek drainage area, New Castle County, Delaware. Lake's collections represent the first larvae and males of this species to be found.

Ross (1944) described a second species of North American *Beraea* from central Georgia, *Beraea gorteba.* Unpublished records of H. H. Ross indicate that a male and female of *B. gorteba* were collected in north Georgia in 1946. The immature stages and habitat of this species have remained unknown until now and are described herein.

Beraea fontana Wiggins, 1954, was found in Leskard, Ontario, Canada (ca. 65 km NE of Toronto). Wiggins noted that this species was very close to *B. nigritta,* but considered it distinct based on some small differences in the female genitalia. No males of *B. nigritta* were known at the time. This paper included the first description of the larva, pupa, and habitat of a *Beraea* species from North America. I have seen males, females, and larvae of supposed *B. nigritta* from Delaware and an unreported locality in Pennsylvania. The adults appear to be distinguishable from *B. fontana* based on details of the male and female genitalia, but the larvae of the two species appear to be inseparable.

During the summer of 1981 I collected an empty case containing larval sclerites

of *B. gorteba* at or near its type locality published as "five miles southeast Roberta, Georgia" (Ross, 1944). In the spring of 1982 and 1983 I collected adults and located the larval habitat of this species.

Methods

Larvae and pupae were collected by sifting substrate material through a large screen sieve. Specimens were immediately preserved in Kahle's fluid and transferred to 80% ethanol in the lab. Some larvae were cleared in hot 10% KOH, placed in glycerin, and examined with a compound microscope to study details of the head capsule, mouthparts, legs, and anal segments. Setal and sensory pit nomenclature of the head capsule and labrum follows that of Williams and Wiggins (1981).

Gut contents were studied by dissecting the digestive tract and squeezing the contents into a drop of glycerin on a glass microscope slide. The samples were examined under a compound microscope at magnifications up to ca. 300×.

Beraeidae

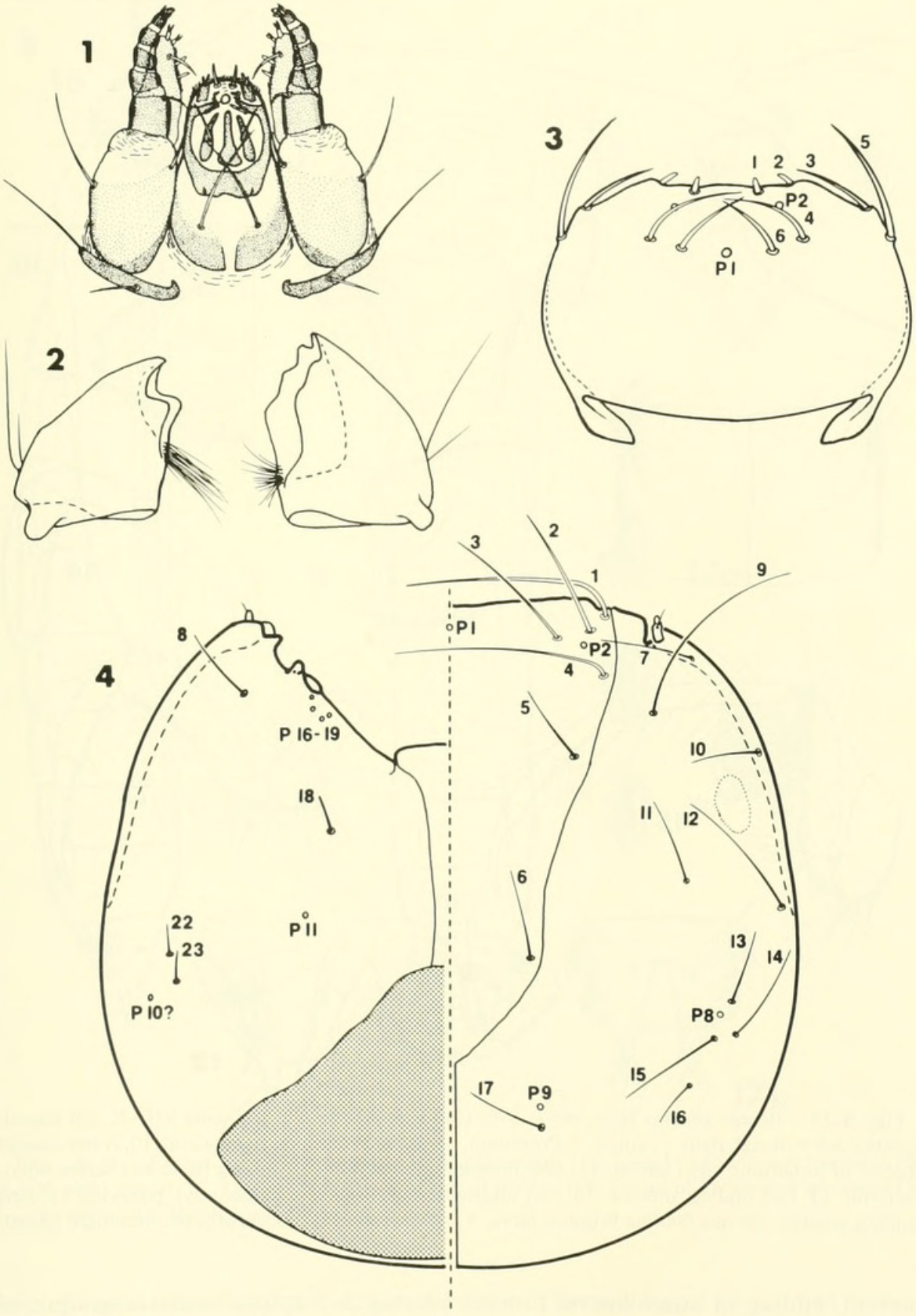
Beraeid larvae can be separated from those of other North American families by the following characters (Wiggins, 1977): anterolateral carina of head capsule with antenna at anterior end (Figs. 4, 20); diagonal carina on pronotum ending in anterolateral process (Figs. 7, 8, 20); lateral sclerite produced posteriorly over anal proleg and bearing long seta (Figs. 5, 6); brush of about 30 setae on mesoventral surface of anal proleg (Fig. 6). The case is constructed of small sand grains and is relatively smooth, slightly curved, and tapered posteriorly (Fig. 19).

North American beraeid pupae may be characterized as follows (Wiggins, 1984): mandibles simple, toothless (Fig. 18); lateral fringe lacking (Fig. 16); anterior hook-plates on segments III–VI each bearing single posteriorly directed hook; segment V also having posterior hook-plate with two anteriorly directed hooks (Fig. 17a); anal processes divergent in dorsal aspect, bifurcate apically (Figs. 16a, 17b).

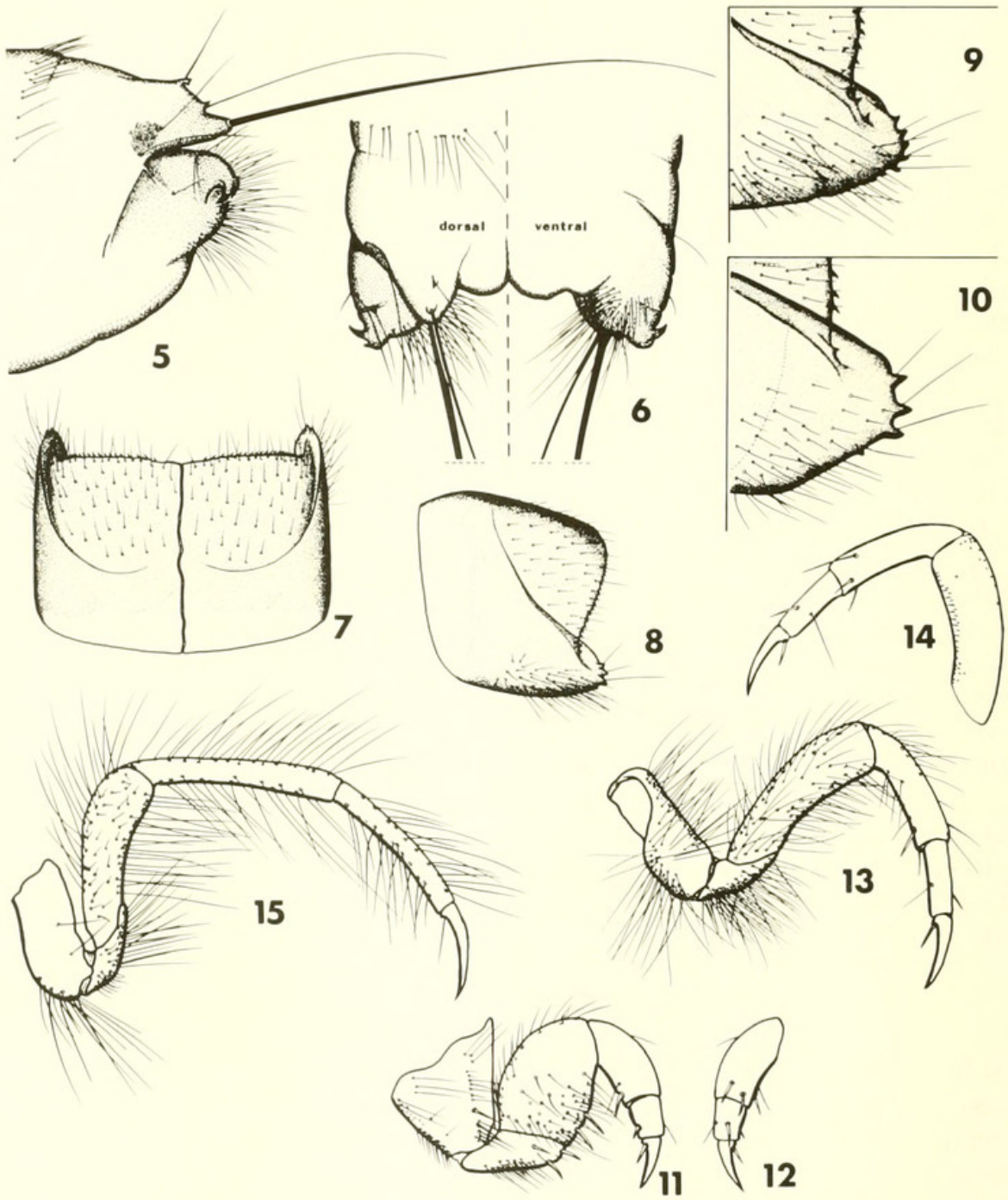
Beraea gorteba Ross

Diagnosis.—Larvae of *Beraea gorteba* can be distinguished from larvae of *B. fontana* and *B. nigritta* based on the number of spines on the anterolateral process of the pronotum. *Beraea fontana* and *B. nigritta* bear 5 to 7 medium-sized spines along the anterior margin of the process (Fig. 9), whereas *B. gorteba* larvae have 3 to 4 slightly larger spines with an occasional small accessory spine more ventral on the process (Figs. 10, 21, 24). No other characters have been found to separate the larvae of these two species nor have any characters been found to separate the pupae.

Description.—Larva (Figs. 1–8, 10–15, 19–24). Overall length of 5th (final) instar 5.5–6.6 mm. Case: 8.0–10.0 mm in length (Fig. 19). Head: width 0.65–0.76 mm; with sharp, dorsolateral carina extending from notch near anterior corner of frontoclypeus to point near base of seta 12; antenna at anterior end of carina; setae and sensory pits as in Fig. 4; color reddish-brown, paler around eye and at back of head; dorsum of head with pebbled texture, lateral area with scale-like texture; concolorous muscle scars visible due to lack of texture (Fig. 20). Labral setation as in Fig. 3. Mandibles, maxillae, and labium as in Figs. 1 and 2. Pronotum: width 0.76–0.90 mm; well developed diagonal, dorsolateral carina

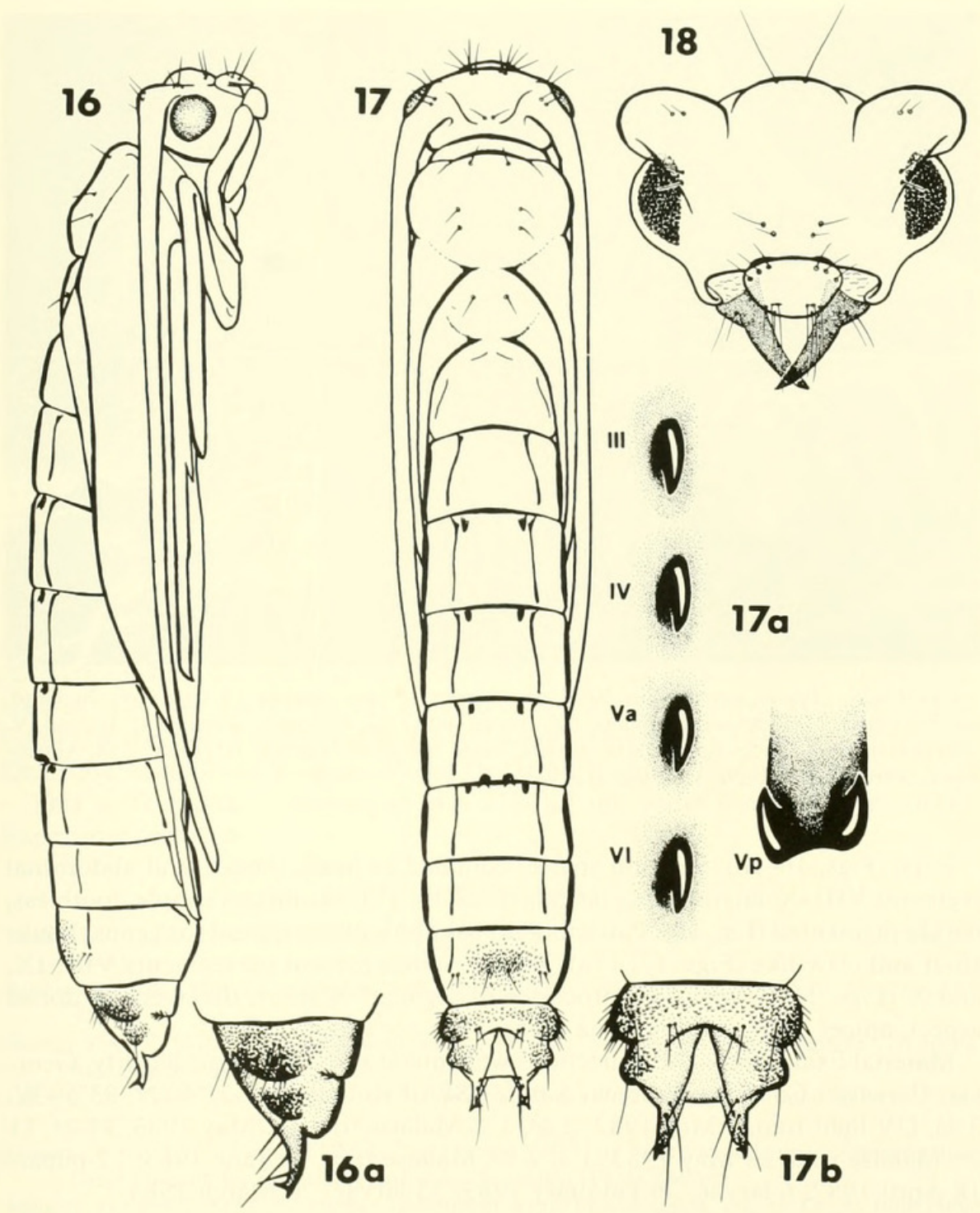


Figs. 1–4. *Beraea gorteba* Ross, larva. 1, Maxillae and labium, ventral. 2, Mandibles, ventral. 3, Labrum, dorsal. 4, Head capsule chaetotaxy, right = dorsal, left = ventral.



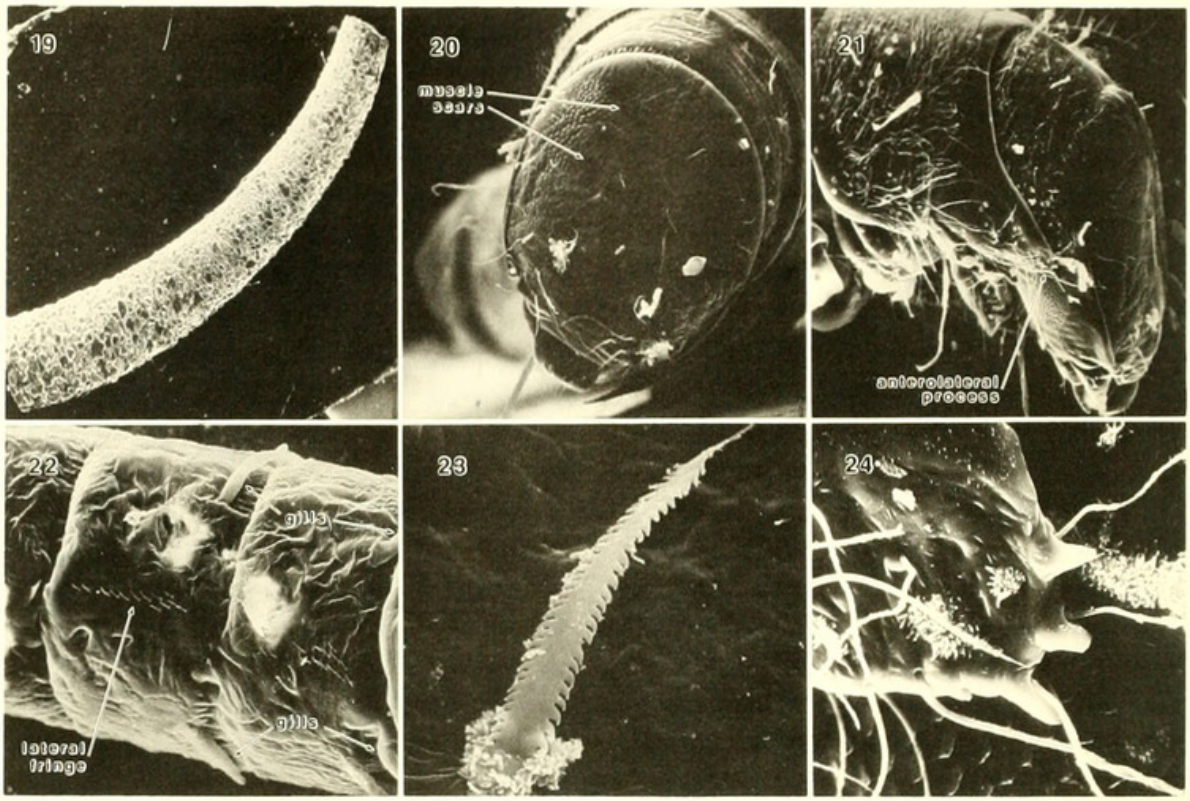
Figs. 5–15. *Beraea gorteba* Ross, larva, 5–8, 10–15. 5, Abdominal segments VIII–X, left lateral. 6, Same, left = dorsal, right = ventral. 7, Pronotum, dorsal. 8, Pronotum, right lateral. 10, Anterolateral process of pronotum, right lateral. 11, Left foreleg, anterior. 12, Left foreleg (tibia and tarsus only), posterior. 13, Left midleg, anterior. 14, Left midleg (femur, tibia, and tarsus only), posterior. 15, Left hindleg, anterior. *Beraea fontana* Wiggins, larva, 9. 9, Anterolateral process of pronotum, right lateral.

present, ending in anterolateral process bearing 3–5 spines; anterior margin of pronotum with about 15–20 spine-like setae on each side; numerous setae on dorsal surface anterior to diagonal carina and on ventrolateral surface (Figs. 7, 8, 10, 21). Color light brown, slightly paler than head capsule; posterior margin unpigmented. Mesonotum: completely sclerotized, unpigmented; with sparse vestiture of fine, elongate setae. Metanotum: unsclerotized, unpigmented; patch of



Figs. 16–18. *Beraea gorteba* Ross, pupa. 16, Right lateral. 16a, Detail of abdominal segments IX and X, right lateral. 17, Dorsal. 17a, Detail of dorsal hooks. 17b, Detail of abdominal segments IX and X, dorsal. 18, Head, anterior.

fine, elongate setae across anterolateral margin. Thoracic legs: Pale reddish-brown to yellowish-brown, prothoracic legs darkest, meso- and metathoracic legs paler; setation as in Figs. 11–15. Abdomen: anterior margins of segments II and III each with a pair of dorsolateral and ventrolateral gills; lateral line of specialized setae present on segments II–VIII (Figs. 22, 23); sclerites of segments IX and X brown to yellowish-brown; setation as in Figs. 5 and 6.



Figs. 19–24. *Beraea gorteba* Ross, larva, scanning electron micrographs. 19, Case (8×). 20, Head, anterior (40×). 21, Head and prothorax, right lateral (40×). 22, Abdomen, segments II, III, and IV, right lateral (40×). 23, Specialized seta of lateral fringe, abdominal segment III (1000×). 24, Antero-lateral process of pronotum, right lateral (330×).

Pupa (Figs. 16–18). Setation sparse, confined to head, thorax, and abdominal segments VIII–X; lateral fringe lacking (Figs. 16, 17). Mandibles simple, toothless, darkly pigmented (Fig. 18). Pattern of dorsal hook-plates typical for genus, hooks stout and claw-like (Figs. 17, 17a). Minute spines present on segments VIII, IX, and X (Figs. 16a, 17b). Anal processes of segment X short, divergent in dorsal aspect, apices bifurcate (Figs. 16a, 17b).

Material Examined.—All collections were made at the following locality. Georgia: Crawford Co., Spring Creek, 5 mile SSE of Roberta, ca. 32°40′N, 83°59′W. 3 ♂♂, UV light trap, 7 May 1982; 2 ♂♂, 1 ♀, Malaise trap, 21 May 1983; 11 ♂♂, 11 ♀♀, Malaise trap, 28 May 1983; 1 ♂, 2 ♀♀, Malaise trap, 11 June 1983; 12 pupae, 18 April 1982; 6 larvae, 26 February 1983; 55 larvae, 20 March 1984.

Habitat and Life History

The larva and pupa of *B. gorteba* were collected in a small, side-channel of Spring Creek, a small, 2nd order, blackwater stream near Roberta, Georgia. The side channel (ca. 1.5 m wide × 10 m long × 0.5 m deep) does not normally receive flow from the stream, but instead receives ground water and seepage from hillside springs. It is heavily shaded (ca. 90% canopy cover). Riparian vegetation includes *Nyssa aquatica, Quercus, Pinus, Calmia, Rhododendron, Smilax,* and *Arundinaria* spp. The only aquatic macrophyte is *Orontium aquaticum.*

The larvae and pupae are associated with the sand and organic matter at the interface of the water and the shore. This material is bound together by masses of rootlets and is covered with mosses and liverworts. The larvae are found most

commonly, but not exclusively, in the area of the main seepage into the side-channel. The pupae appear to be more generally distributed along the margin of the side-channel. Larvae are apparently burrowing detritivores. Gut analysis revealed small bits of vascular plant material, numerous pieces of fungal mycelia, and many pieces of unrecognizable material. No animal parts were found. The habitat and habits of *B. gorteba* appear to be very similar to those reported for *B. fontana* (Wiggins, 1954, 1977) and palaearctic species of *Beraea* (Wiberg-Larsen, 1979; Lepneva, 1966).

In central Georgia, larvae apparently overwinter as 5th instars, pupate in April, and emerge as adults during May and early June. Three adult males were collected in an ultraviolet light trap on 7 May 1982. No additional adults were captured at UV lights operated biweekly during 1983. All other adults were collected in a Malaise trap placed directly over the larval habitat. Adult *Beraea* appear to be primarily day active and fly only very short distances (Wiggins, 1954).

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