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ABSTRACT

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The first positively associated larva and pupa of *Cernotina* are described. Tentative diagnoses are provided for distinguishing them from those of other genera of Nearctic Polycentropodidae, especially *Polycentropus s. lat.*, which *Cernotina* most strongly resembles. The larva of *Cernotina* may be distinguished from that of *Polycentropus s. lat.* by protarsi nearly as long as the protibiae and by sharply curved anal claws, each bearing a single dorsal accessory spine. The pupa of *Cernotina* may be distinguished from that of *Polycentropus s. lat.* by a fringe of swimming hairs on the protarsi, the absence of baso-lateral setae on the mandibles, only one pair of large bristles on the anterior portion of its labrum, and only about 10 setae on each of the rounded apical abdominal lobes. Larvae of *C. spicata* are predaceous and live in both lotic and lentic habitats, exhibiting an especially marked propensity to colonize artificial reservoirs in the southeastern United States.

The study of benthic insects has accelerated in recent years to satisfy demands for reliable monitoring of freshwater ecosystems. Such studies have been seriously hampered by the absence of adequate means of identifying the organisms. This paper helps meet that need for *Cernotina*, a common caddisfly genus in reservoirs of the southeastern United States.

As of 1977, only 6 of the 142 recognized genera of North American caddisflies remained unknown or unidentifiable in the larval stages (Wiggins 1977). Our descriptions below of *Cernotina spicata* Ross larva and pupa reduce that number by one. The remaining five genera belong to families other than Polycentropodidae.

Flint's (1964a) key to larvae of North American genera of Polycentropodidae (as Psychomyiidae: Polycentropodinae) included a previously undescribed larva he believed to be "almost certainly *Cernotina*." This form later (Flint 1968) proved to be of a species of *Polyplectropus*, a genus not recognized as occurring in North America in 1964. However, in the same year, Flint (1964b) described the larva and pupa of another unknown "Polycentropodinae species" from Puerto Rico. Later, Flint (1968) thought it probable that these immature stages were of a species of *Cernotina*. His hypothesis may indeed be true, based on the following observations, but if so, some characters other than those emphasized below must be found to assure generic diagnosis of pupae.

Positive association of larvae, pupae, and adults was assured for our material by the "metamorphotype method" (Milne 1938): examination of mature male pupae ("pharate adults") whose genitalia are identifiable beneath the pupal exuviae and whose 5th-instar larval sclerites were retained in the pupal case.

[1] Trichoptera: Polycentropodidae.

[2] A technical contribution of Southeast Reservoir Investigations, U.S. Fish and Wildlife Service, and Technical Contribution No. 1877 of the S.C. Agric. Exp. Stn., Clemson University, Clemson. Received for publication 2 March 1981.

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Cernotina spicata Ross, 1938

Egg

Unknown.

Larva

Last instar mean length 5.4 mm (Table 1). Lengths of other instars and head capsule widths in Table 1. 5th-instar head and pronotum golden brown to cream color with darker brown muscle scars arranged posteriorly and laterally on head and on center of each pronotal sclerite (Fig. 1). Pronotum with narrow, brown posterior band. Mandibles asymmetrical, with dorsal margins almost entirely overhanging ventral margins; left mandible with three irregular subapical teeth on each margin, dorsal and ventral margins separated by deep mesal groove; right mandible with two dorsal and three ventral subapical teeth (Fig. 2). Mesonotum and metanotum with short *sa1* setae. Prothoracic leg with tarsus about twice as long as broad, nearly as long as tibia, and bearing row of short, fine hairs on ventral margin (Fig. 3). Abdomen pale green in life, cream color in alcohol. Anal proleg with basal segment longer than distal segment and bearing several long setae dorsally and ventrally (Fig. 5). Two dark bands contiguous dorsomesally between lateral sclerite of distal segment and anal claw. Anal claw sharply curved about 90°, with indistinct ventral striae, but without ventral teeth or spines; single subapical accessory spine dorsally.

Pupa

Mean length 4.5 mm (Table 1). Anterior portion of labrum with one pair of long bristles and five pairs of short, inconspicuous setae (Fig. 7); posterior portion (anteclypeus) with two pairs of large bristles and one pair of minute lateral setae. Clypeus with three pairs of conspicuous setae. Mandibles thin, sickle-shaped, and without lateral setae at base. Protarsi with postero-dorsal row of fine swimming hairs on the basal four segments (Fig. 6). First four segments of mesotarsi with dense rows of swimming hairs near both ventral and dorsal edges. Hook plates anteriorly on abdominal terga III–VIII, pos-

Table 1.—Lengths of larvae and pupae and head capsule widths of larvae of *C. spicata* from Lake Keowee, S.C.

Stage or instar	Overall length (mm)			Head capsule width (mm)		
	Mean	Range	Sample size	Mean	Range	Sample size
Pupal	4.5	3.5–5.2	10			
5th	5.4	3.4–7.8	31	0.69	0.63–0.76	59
4th	3.4	2.5–4.6	12	0.50	0.53–0.46	24
3rd	2.1	1.8–3.1	12	0.35	0.33–0.38	29
2nd	1.2	0.8–1.4	5	0.24	0.24–0.25	13
1st				0.17		1

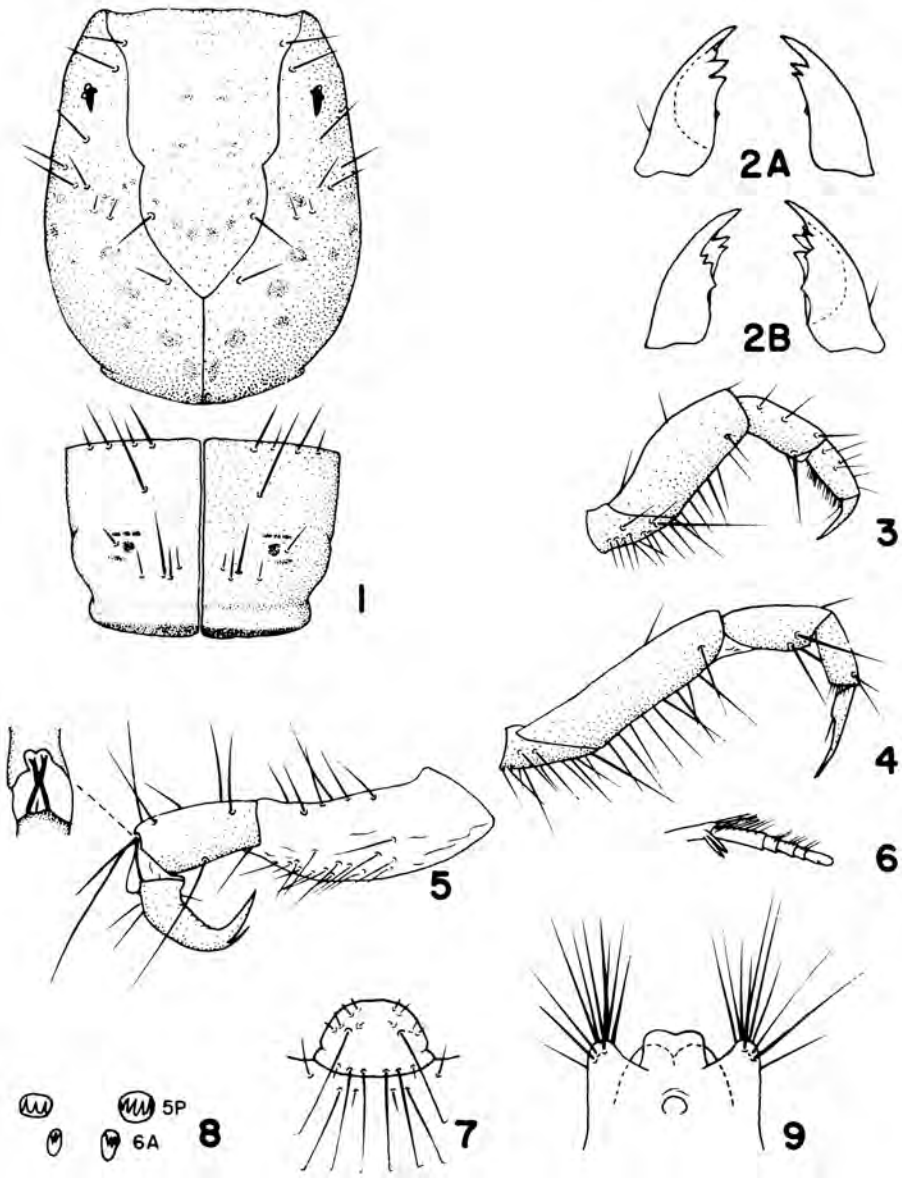

FIG. 1–9.—*C. spicata* larval and pupal characters. (1) Larval head and pronotum, dorsal. (2A) Larval mandibles, dorsal; (2B) larval mandibles, ventral. (3) Right larval prothoracic leg, posterior. (4) Right larval metathoracic leg, posterior. (5) Right larval anal proleg, lateral (inset—dorsal bands). (6) Right pupal protarsus, posterior. (7) Pupal labrum and anterior portion of clypeus, dorsal. (8) Posterior hook plates of pupal abdominal segment V (5P) and anterior plates of segment VI (6A), dorsal. (9) Caudal abdominal processes of pupa, dorsal.

teriorly on V (Fig. 8). Lateral gills on abdominal segments II–VII; bifid on II–V, single on VI–VII. Apical abdominal processes rounded, each with 9 to 13 setae (Fig. 9).

Material Examined

Georgia: Murray County, Carters Reservoir, near dam, 26 July 1976, one larva, P. L. Hudson. North Carolina: Hertford-Gates County line, Chowan River, (date not indicated) one larva, D. Lenat; Burke County, Lake James, 14 May 1979, Loc. M., 4.0 m, PG3, two larvae (collector not indicated). South Carolina: Chesterfield County, Lake Robinson, 9 May 1979, one larva, D. Herlong; same, 5 June 1979, four larvae; same, 12 June 1979, one pupal exuviae; Oconee-Pickens County line, Keowee Reservoir, 15 May 1976, 11 larvae, P. L. Hudson; same, 11 August 1977, one mature male pupa; same, 28 August 1977, one mature male pupa. Virginia: Louisa County, Lake Anna, near power plant, 4 May 1974, one larva, J. R. Voshell, Jr; same, 1 August 1974, one mature male pupa; same, 4 September 1974; 11 larvae; same, 3 September 1975, one mature male pupa; same, 10 May 1976, seven larvae. Voucher specimens are deposited in the Clemson University Insect Museum and the Virginia Polytechnic Institute and State University (VPI & SU) insect collection.

Discussion

Distinguishing larvae of *Cernotina* species from those of other Polycentropodidae, especially *Polycentropus s. lat.* species, is complicated by at least three factors: (1) known larvae of species in these genera resemble each other very closely, (2) the larvae of only 15% of the North American species included in these genera have been described, and (3) the European caddisfly workers and several others around the world consider North American *Polycentropus* to consist of three genera: *Holocentropus, Plectrocnemia* and *Polycentropus s. str.* Lepneva (1964) and Hickin (1967) provided keys for distinguishing the larvae of these three genera. Despite these limitations and taxonomic complications, we nevertheless offer our best hypothesis for the discrimination of larval *Cernotina*. Larvae of *Cernotina spicata* will key to *Polycentropus* in the works by Flint (1964a) and Wiggins (1977). (In early-instar larvae, the basal segment of the anal proleg is only slightly longer than the distal segment, but specimens of these instars are distinguishable from those of *Neureclipsis* species by the presence of many long hairs on this membranous, basal segment.) For further diagnosis, continue with the following couplets:

1. Protarsi broad and only half as long as protibiae (Wiggins 1977: Fig. 15A) . . . *Polycentropus s. str.*; protarsi narrow and at least two-thirds as long as protibiae, (Fig. 3) 2
2. Anal claws obtusely curved (Hickin 1967: Fig. 327, Lepneva 1964: Fig. 607, 620) . . . *Polycentropus* (*Plectrocnemia*); Anal claws curved approx. 90° (Fig. 5) 3
3. Anal claws each with two or three dorsal accessory spines (Hickin 1967: Fig. 331, Lepneva 1964: Fig. 646) . . . *Polycentropus* (*Holocentropus*); anal claws each with only one accessory spine (Fig. 5) ..... *Cernotina.*

The pupa of *Cernotina* seems to be distinguishable from that of *Polycentropus* (*Plectrocnemia*) species by its possession of protarsal swimming hairs; from those of *Polycentropus s. lat.* species by having only one rather than two pairs of long bristles on the anterior portion of the labrum (see Fig. 612 and 635 in Lepneva [1964]) and by having only about 10 rather than over 20 apical abdominal setae; and from those of all other *Polycentropodidae* by the lack of setae at the lateral base of each mandible.

Flint's (1964b, 1968) "probable" *Cernotina* species larva differs from that of *Cernotina spicata* in its immaculate head and pronotum. He did not mention the configuration of any dark banks on the anal proleg between the anal claw and the lateral sclerite. The pupa of his species reportedly lacks abdominal gills and has two pairs of long setae on the anterior portion of the labrum. Thus, either Flint's species does not belong to *Cernotina* or the pupal distinctions proposed above are inadequate for the genus as a whole.

We have taken *C. spicata* adults at light traps in the southeastern United States from early May through late September. The species has been reported from several eastern and midwestern states (Kansas, Hamilton and Schuster [1980]; Maine, Michigan, and Oklahoma, Ross [1944]; New Hampshire, Morse and Blickle [1953]; South Carolina, Morse et al [1980]; Virginia, Parker and Voshell [1981]). To these we add Georgia, Louisiana (J.C.M. collection), Mississippi (P. K. Lago, personal communication), and North Carolina.

Although most species of *Cernotina* inhabit fast-flowing streams, we found *C. spicata* thriving in both lotic and lentic habitats, including small rocky creeks, large rivers, and impoundments. This species seems especially able to exploit the relatively predator-free, predominately chironomid-oligochaete benthic community of artificial reservoirs. In Lake Anna (5,261-ha impoundment of North Anna River, Louisa-Spotsylvania County line, Va.) *C. spicata* did not appear until the third year of impoundment. The dominant caddisflies during the first 2 years were several species of Leptoceridae and Hydroptilidae. The colonization by *C. spicata* coincided with the final decay of the inundated herbaceous, terrestrial vegetation and coarse, nonwoody detritus, leaving mostly bare bottom covered with fine sediment and scattered patches of the macrophyte *Potamogeton pusillus* L. Two other species of Polycentropodidae, *Cyrnellus fraternus* (Banks) and *Nyctiophylax affinis* (Banks), appeared in Lake Anna during the third summer after impoundment. *Cyrnellus fraternus* was more common at first, but by the fourth summer *Cernotina spicata* was the most abundant.

Polycentropodid collections were first made in Lake Keowee (7,435-ha impoundment of Seneca

River, Pickens-Oconee County line, S.C.) 5 years after impoundment; *Cyrnellus fraternus* was regularly taken, but in smaller numbers than *Cernotina spicata*. In Lake Keowee, larvae of *Cernotina spicata* were most commonly collected along shorelines riprapped with large rocks. Periphyton, silt, and detritus covering the upper surfaces of these rocks made detection and observation of larval retreats very difficult. Retreats appeared to cover small depressions in the rock surfaces, with one or both openings flared out into regular flaps of silken threads, similar to retreats of *Cyrnellus* and *Nyctiophylax* (Wiggins 1977). Larvae were present in only 9% of the Lake Keowee samples; average density when they were present was 300/m² (up to 1,200/m²). Larvae were collected most often at depths of 0.5 to 4.0 m, but were taken occasionally as deep as the thermocline (7 m in Lake Anna, 16 m in Lake Keowee).

Analyses of gut contents ($n = 5$, late instars) indicated that *Cernotina spicata* larvae are predators. The most common prey were chironomid larvae and microcrustaceans. The foregut of one specimen was filled with a chironomid larva that had been ingested head first. The foreguts of other specimens contained a series of cladocerans.

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