THE LARVA OF PARACAPNIA DISALA (JEWETT) (PLECOPTERA: CAPNIIDAE)

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ABSTRACT
The larva of Paracapnia disala (Jewett) was associated from two first order headwater streams in the H.J. Andrews Experimental Forest, Oregon, U.S.A. Larvae of this first western Paracapnia species to be associated, were studied and compared morphologically with those of the eastern Paracapnia angulata Hanson to determine if it conforms with proposed generic characters and if it has specific diagnostic characters. Habitus and character drawings and SEM's of P. disala and P. angulata larval mouthparts are presented. Wingpad presence/absence and ventral lacinial comb hair differences between the two species are diagnostic.

Keywords: Plecoptera, Capniidae, Paracapnia, larvae

INTRODUCTION
The work of Stewart & Stark (1988, 2002) established the generic level benchmark for larval morphology, identification and biology of the 104 North American stonefly genera. Their proposed generic characters, illustrations and keys to larvae were based on the few generotypes or other congener species that had been associated, and they encouraged further species associations and descriptions to test proposed generic characters and increase taxonomic resolution, where possible, within genera.

The ideal goal to eventually develop diagnostic illustrated keys to larvae of all species may prove to be problematic (Stewart 2009), since as Zwick (2004) pointed out, adults in most genera can be identified to species only by genital characters making it likely that less morphological resolution can be anticipated in immatures. The few studies describing the nymphs of all or a few species within selected North American genera were reviewed by Stewart & Stark (2002) and Stewart (2009). Only in the genera Strophopteryx (Earle & Stewart 2008), Taenionema (Stewart 2009), Taeniopteryx (Fullington & Stewart 1987, with the larva of T. nelsoni later added by Kondratieff & Kirchner 1982), Isogenoides (Sandberg & Stewart 2005), and Setvena (Stewart & Stanger 2004) have whole genera been studied, leading to diagnostic illustrated keys. Other larval studies have dealt with individual or a few species within genera.

The capniid genus Paracapnia contains four Asian species and an additional six Nearctic species, two in eastern North America, and four western (Stark et al. 2009). A revision of the Nearctic members of the genus (Stark & Baumann 2004) and addition of the new species Paracapnia humboldia (Baumann & Lee 2007) were based on adult characters. Larvae of only the eastern species P. angulata Hanson have been described and illustrated in detail (Stewart & Stark 1988, 2002), and P. opis (Newman) partially described (Hardin & Mickel 1952; Harper & Hynes 1971). Larvae of P. disala (Jewett) and the other three western species have remained unknown until this report. The objective of this study was to describe and illustrate the field associated larvae of P. disala and compare them with those of P. angulata to determine if they fit with the proposed generic characters of Stewart & Stark (2002) and possibly possess specific, different characters.
basins designated as WS-7 and WS-8 in young growth of the experimental forest. Adults were apterous, as reported for all western Paracapnia species by Stark & Baumann (2004). Adults and larvae were preserved in 80% ETOH and studied and drawn using a Wild M-5 stereomicroscope with a Wild Drawing Attachment. Scanning electron micrographs of mouthparts were

**MATERIALS AND METHODS**

Adult males and females and associated larvae of *P. disala* were collected by Charles Frady in 2003 and 2004 in two of the uppermost, 1st order head waters of the McRae Creek drainage in the H.J. Andrews Experimental Forest, Oregon, 5 km north of 44.2°N and at approximately 122.2°W. These two headwater streams originate in small, approximately 10-12 ha basins designated as WS-7 and WS-8 in young growth of the experimental forest. Adults were apterous, as reported for all western Paracapnia species by Stark & Baumann (2004). Adults and larvae were preserved in 80% ETOH and studied and drawn using a Wild M-5 stereomicroscope with a Wild Drawing Attachment. Scanning electron micrographs of mouthparts were
taken of *P. angulata* from East Fork of Stony Fork of Reed Creek, Wythe County, Virginia (same data as Fig. 7.17 Stewart & Stark 2002), and *P. disala* (from the WS-7 and WS-8 locations above) by Bill Stark generally using procedures outlined by Stark & Stewart (2005). The mouthparts of both species were too fragile to sonicate, so SEM's show some adhering small particulate matter.

**Material examined.** Oregon: Lane County, 1st order tributaries of McRae Creek (WS-7, WS-8), H.J. Andrews Experimental Forest, approximately 5 km north of N44.2° and at approximately W122.2°, 6o larva, 4o+ larva, 30-XI-2003, Charles Frady; 2o+, 1o+, 13-III-2004, Charles Frady; 7o+, 1o+, ll-JV-04, Charles Frady.

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**RESULTS AND DISCUSSION**

*P. disala* larval morphology. Body small, hairy, male 4-4.5 mm, female 5-5.5 mm. Head and pronotum with faint, darker pattern (Fig. 1A). Antennal segments 44-46. Lacinia palmate, with long, stout apical teeth, long dorsal and ventral combs of 12-14 long bristles, and striated palm surface devoid of hairs (Figs. 2-3). Left mandible with 4 major unserrated apical teeth, inner molar pad with small, short marginal comb of about 10 teeth, and a large palmate brush of many long bristly hairs (Figs. 6-7). Pronotum rectangular with complete marginal fringe of long hairs (Fig. 1A). Apterous (wingpads absent) (Fig. 1A), reflecting condition of
adults (Stark & Baumann 2004). Femora clothed with long bristly hairs, tibia clothed with hairs and with an outer fringe of long hairs (Fig. 18). Abdominal segments clothed with numerous hairs, and with distinct posterior tergal hair fringe (Fig. 1A). Sexual dimorphism evident; male 10th tergum with a tubular process (Fig. 1D, E), female 10th tergum without a process (Fig. 1C). Cereal segments more than 28 (tips broken off on all available larvae), with apical circle of bristles and no intercalary hairs or bristles (Fig. 1F).

Generic and species diagnoses. The generic diagnosis of a bristly (hairy) body separating Paracapnia larvae from those of the other capniid genera (Stewart & Stark 1988, 2002) is upheld by this study of P. disala, but their mention and illustration of "a few short intercalary bristles" on the cereal segments of P. angulata was incorrect. I have reexamined their P. angulata larval material from Wythe County Virginia, and specimens from Wisconsin and West Virginia, and there are no intercalary hairs present on cereal segments, as is also the case with P. disala (Fig. 1F); therefore, absence of cereal intercalary hairs is the current generic interpretation for Paracapnia.

There is interesting species difference between larvae of the eastern P. angulata and western P. disala. Those of P. angulata have macropterous wingpads, and the lacinia bears a short ventral comb of 6 or 7 medium length bristles (Figs. 4-5), whereas those of P. disala are apterous, with no wingpads (Fig. 1A), and the lacinia bears a long ventral comb of 12-14 long bristles (Figs. 2-3). The mandibles of both species are similar in teeth, molar pad, and brush of long, bristly hairs in the palm (Figs. 6-8). It will be interesting in future study of the larvae of Paracapnia opis and those of the three other western Paracapnia species to see if the same east-west wingpad condition/lacinial differences hold.

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