

**RANGE EXTENSION, ECOLOGICAL NOTES, AND
NEW RECORDS OF *PYCNOPSYCHE INDIANA*
(TRICHOPTERA: LIMNEPHILIDAE)
FROM FLORIDA¹**

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ABSTRACT: New records of *Pycnopsyche indiana* are reported from Florida, including records from the Florida peninsula that represent a significant southern range extension. The taxonomy and geographic distribution for *P. indiana* is reviewed. Southern Gulf Coastal Plain populations are widespread but uncommon, showing a disjunct distribution. In Florida, *P. indiana* is most often found associated with tannic streams and rivers. Tannic streams with intact broadleaf riparian vegetation within the southern Gulf Coastal Plain are postulated as being important refugia for populations of this species. Ecological and biological notes are given for the southern-most known population. Loss of intact riparian broadleaf forests will likely result in negative impacts on scattered populations of *P. indiana* within the southern Gulf Coastal Plain.

The limnephilid caddisfly genus *Pycnopsyche* is comprised of seventeen nominal species that are primarily eastern Nearctic in distribution. *Pycnopsyche* spp. are typically associated with temperate deciduous forest (Ross 1963) and are common inhabitants of cool, small to large streams with moderate to swift current, or the littoral zone of oligotrophic lakes (Flint 1960). Larvae are usually found associated with accumulations of allochthonous organic material and detritus. Larval cases are of various shapes, and may be constructed of small sticks, leaf and bark pieces, gravel, and sand (Wojtowicz 1982; Wiggins 1996). *Pycnopsyche* larvae are primarily classified as shredder-detritivores and play an important trophic role in the processing of autumn leaves (Wiggins 1996), although they may also consume periphytic algae as scrapers (Williams & Williams 1982; Martin et al. 1991). After reaching the terminal instar, larvae are known to remain inactive for extended periods as prepupae (Cummins 1964; MacKay 1972; 1977). Larvae and adults of two or more species of *Pycnopsyche* are commonly collected together and larval species identity is often difficult to determine in these situations. Adults of *Pycnopsyche* are stout-bodied with tannish, brown to orange wings that provide cryptic coloration adaptive for their emergence and flight, which is often during autumn months when deciduous leaves are changing colors and being shed.

Although a number of ecological studies have been conducted on *Pycnopsyche* spp. (e.g., Cummins 1964; MacKay 1972, 1977; MacKay & Kalff 1973; Wallace et al. 1992), mostly in the northern temperate zone, none has

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specifically focused on *P. indiana* (Ross). In this paper we give a summary of the taxonomy and geographic distribution of *P. indiana*. Also, we report new records of *P. indiana* from Florida and provide biological and ecological notes for a disjunct population from peninsular Florida.

Taxonomic Summary

The male and female of *Pycnopsyche indiana* (Ross) were first described by Ross (1938) in the genus *Stenophylax*. Later, Ross (1944) placed *S. indiana* within the genus *Pycnopsyche* and included a key to males and females for 6 species including *P. indiana*. Betten (1950) revised the genus and included keys, descriptions, and figures for males and females of 14 species. In Betten's revision he recognized the *Pycnopsyche lepida* group, which includes *P. lepida* (Hagen), *P. subfasciata* (Say), and *P. indiana*. Flint (1960) presented the first comprehensive treatment of Nearctic limnephilid larval taxonomy wherein he provided larval subfamily, generic, and in some cases species level delimitation. Although Flint (1960) had not examined larvae of *P. indiana* and several other species, he did attempt to separate the *P. lepida* group from other *Pycnopsyche* species based on case construction and the number of setae on the sternum of the first abdominal segment. Wojtowicz (1982) provided the first and only larval description for *P. indiana* in his thorough review of adults and larvae within the genus. His conclusion concerning larval identity was that *Pycnopsyche* larvae could not be reliably identified to species unless reared to the adult stage. He also postulated that the *P. lepida* group is recently evolved as evidenced by their close interspecific similarities and the apparent presence of intermediates between species in non-Coastal Plain populations.

Geographic Distribution of *Pycnopsyche indiana* (Ross)

Pycnopsyche indiana has been reported from 17 states: Alabama, Arkansas, Delaware, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Missouri, New York, Ohio, South Carolina, Tennessee, Texas, Virginia, and West Virginia (Fig. 1). Populations of *P. indiana* within the Gulf Coastal Plain are widespread but quite uncommon. For instance, Harris et al. (1991) recorded *P. indiana* from 23 localities in Alabama with only 4 Coastal Plain records and only 1 record from the lower Coastal Plain near Florida. *Pycnopsyche indiana* was listed as rare by Holzenthal et al. (1982) in their survey of the Limnephiloidea of Mississippi and southeastern Louisiana. They collected *P. indiana* from only 1 locality, a small spring-fed blackwater stream in southeastern Louisiana. Within the Gulf Coastal Plain of Georgia, Wojtowicz (1982) reported *P. indiana* from several counties in central Georgia but none from southern Georgia Coastal Plain counties. However, *Pycnopsyche indiana* has been collected from the Gulf Coastal Plain in central Georgia within the Flint River drainage in Crawford County (J.C. Morse, pers. comm). *Pycnopsyche indiana* appears to be more common in the Atlantic Coastal Plain of Georgia

and South Carolina where it has been collected from a number of sites within the Savannah River drainage basin (Sherberger 1970; Morse et al. 1980).

Based on collections held at Florida A&M University (FAMU) and data from the Florida Department of Environmental Protection's Biological Database, the genus *Pycnopsyche* has heretofore been collected from 25 Florida counties, mostly within the northern part of the state (Fig. 1). Adult collections housed at FAMU indicate the presence of only 2 species in Florida (*P. antica* [Walker] and *P. indiana*) (Pescador et al. 1995; Rasmussen and Pescador, unpublished data). Gordon (1984) reported *P. antica* (as *P. scabripennis sensu lato*) and *P. guttifer* as occurring in Florida. However, re-examination of adult males identified by Gordon as *P. guttifer* showed them to be *P. antica*. Of the two *Pycnopsyche* species known to occur in Florida (*P. antica* and *P. indiana*), *P. antica* is the more common among adult collections and is usually found in North Florida associated with clear, spring-fed headwater streams.



Figure 1. Geographic distribution of *Pycnopsyche indiana*, including US state records and collection localities within Florida.

Within Florida, Wojtowicz (1982) reported *P. indiana* only from 1 unnamed locality in Okaloosa County in the western Florida panhandle. Because of the rarity of *P. indiana* within the southern Coastal Plain our recent discovery of a population of *P. indiana* within peninsular Florida merits its recognition. In this report we also provide biological and ecological data relative to this disjunct population and also report on *P. indiana* collected from 3 other localities within the western Florida panhandle.

RESULTS

New Florida Records of *Pycnopsyche indiana* (Ross)

Florida: Calhoun Co., Chipola River at Hwy. 20, 7.xi.1972, P.H. Carlson, 1 adult female. Okaloosa Co., Shoal River at US 90, 2 mi. E Crestview, 16.x.1997, M.L. Pescador & A.K. Rasmussen, 1 adult male. Okaloosa Co., East Turkey Hen Creek at Eglin Air Force Base Rd 601, N30°39'27", W86°34'05", 28.x.1998, M.L. Pescador & A.K. Rasmussen, 1 adult male. Seminole Co., Roberts Branch at Curryville Road, Southeast of Chuluota, N28°37'23", W81°04'01", D.R. Denson, 1 larva collected 12.ix.1997; same as above, 4 larvae collected 23.x.1997; same as above, 1 adult female (reared from pupa) collected 20.xi.1997; same as above, 1 larva collected 15.i.1998; same as above, 1 larva collected 9.ii.1998.

Interestingly, *P. indiana* adults from the Florida panhandle localities listed above were collected, using blacklights, along with *P. antica*. This indicates that the 2 species are sympatric within certain situations. However, our records indicate that *P. antica* is the only *Pycnopsyche* species occurring from spring-fed headwater areas originating within North Florida sandhill habitat. The *Pycnopsyche indiana* listed above were collected from spring-fed habitats from low-lying areas within mixed- pine and hardwood forests. A number of *Pycnopsyche* larvae (not listed above), collected from several blackwater rivers (e.g., Aucilla and Econfina rivers) in the eastern Florida panhandle, which we examined are very likely to be *P. indiana*, but larval rearings and/or adult collections need to be done before making definitive species determinations.

Species identifications of larvae collected in Roberts Branch, Seminole County were based on the close agreement of larval morphology with the description of the larva of *P. indiana* presented by Wojtowicz (1982). The larval identity and species present in Roberts Branch was further confirmed by the adult female that emerged from a mature pupa which was collected. The other *Pycnopsyche* known to occur in Florida, *P. antica*, can be reliably separated from *P. indiana* if based upon last instar larvae or adult males and females. Last instar *P. indiana* are 5-10 mm shorter than last instar *P. antica*. However, case construction and setal characters are variable and show overlap between the two species.

Ecological and Biological Notes Concerning Roberts Branch (Seminole Co., FL) Population of *Pycnopsyche indiana* (Ross)

Roberts Branch, located in southern Seminole County, Florida (N 28°37'23", W 81° 04'01") near the town of Chuluota, is a small tributary of the St. Johns River. Originating in cypress wetlands in eastern Orange County near the town of Bithlo, Roberts Branch flows through deciduous forest and marsh, as well as low-density cattle pasture in some reaches. The sampling site upstream of Curryville Road is in an undeveloped forested section. The floodplain of this small (approximately 3 to 5 m width) darkly tannic stream is broad and flat, thus the water level varies less than a meter between wet and dry seasons. Stream depth ranges from 0.1 to 1.0 m, but averages about 0.5 m. Stream velocity averages about 0.3 m sec⁻¹. The water in the stream is acidic, with a mean pH value of 4.46 su. The Secchi depth is usually equal to or greater than the total depth of the stream. Dissolved oxygen varies considerably with the season, but averages about 5.5 mg/L overall. Measured water temperatures have ranged from a low of 16.9°C in January to nearly 25°C in August. The aquatic macrophyte community here is unusually diverse for a small stream of this type. Within the 100-m stretch sampled, the following aquatic/riparian macrophytes were noted: *Peltandra* sp., *Pontederia* sp., *Orontium aquaticum*, *Sphagnum* sp., *Woodwardia* sp., *Osmunda cinnamomea*, *Saururus cernuus*, and *Hydrocloa* sp.

Pycnopsyche indiana larvae were collected at Roberts Branch using a D-frame aquatic dipnet. In each instance, they were found in association with the root mass of streamside *Woodwardia* spp. ferns and/or small woody debris that had collected beneath them. Larval length, head width measured between the eyes, and case length for the larvae collected is given in Table 1. One mature pupa was collected 20.ix.1997. This specimen was kept alive and emerged as an adult female the same night. The two smallest larvae collected in early 1998 are likely to be offspring of adults that emerged sometime November-December. The sizes of the two larvae collected in 1998 (Table 1) suggest rapid larval growth during the first few months after hatching. Larval cases for the 5 last instars collected in 1997 were cylindrical and mainly composed of bark and other bits of woody material. Larval cases for the two earlier instars were shorter (Table 1), triangular in cross-section, and loosely made of cut leaf pieces.

Table 1. Measurements of *Pycnopsyche indiana* larvae collected at Roberts Branch, Seminole Co., Florida.

Collection Date	No. of Individuals	Body Length (mm)	Head Width (mm)	Case Length (mm)
12.ix.1997	1	16.0	1.2	21.0
23.x.1997	4	16.0-21.0	1.2-1.3	18.0-22.0
15.i.1998	1	11.0	0.7	15.0
9.ii.1998	1	14.8	1.1	18.0

The second author (DRD) has attempted numerous times unsuccessfully to collect *Pycnopsyche* at Roberts Branch since it was last taken there in February 1998. There are a number of junkyards near the extreme headwaters of the stream, and residential development is accelerating downstream from there. It is possible that habitat degradation and destruction has caused or will cause the extirpation of this species from the Florida peninsula.

The conditions present at Roberts Branch seem to be especially suitable to the success of trichopteran. In addition to *P. indiana*, the second author (DRD) has collected the following caddisfly larvae here: *Cernotina* sp., *Chimarra* sp., *Hydropsyche* sp., *Molanna tryphena* Betten [also probably the southernmost collection point for this species], *Nectopsyche pavida* (Hagen), *Oecetis georgia* Ross, *O. nocturna* Ross, *Nyctiophylax* sp., *Polycentropus* sp., *Triaenodes ignitus* (Walker), and *T. perna* Ross. An adult male of *T. perna* was also collected. This is an unusually large number of trichopteran taxa for a small stream in this area of the state. However, with the exceptions of the dipterans and odonates (with 33 and nine taxa, respectively, collected at Roberts Branch to date), most other macroinvertebrate groups are not so well represented. For example, only two mayflies (*Eurylophella doris* [Traver] and *Acerpenna pygmaea* [Hagen]), five beetles, one megalopteran (*Corydalus cornutus* [Linnaeus]), and one mollusk (*Ferrissia hendersoni* Walker) have been collected here. The low pH probably accounts for the scarcity of mollusks. Other macroinvertebrate groups are likewise represented by only one or a few taxa.

DISCUSSION

The close ecological association of *Pycnopsyche* with temperate deciduous forests leads one to believe that *Pycnopsyche* geographic distributions are largely a reflection of the past and present distribution of deciduous forests (Ross 1963). Certainly Pleistocene events, which caused catastrophic changes in the size and location of temperate forests, also created similar changes in species distributions of forest insects such as *Pycnopsyche*. Areas of the southern Coastal Plain were believed to have been key refugia for deciduous forests during the Pleistocene (see review of Watts 1980), and it is quite likely that the southern Coastal Plain, especially areas with watershed connections to the Eastern highlands, harbored greater species diversity and abundance of *Pycnopsyche* than at the present time.

Presently, *Pycnopsyche* spp. are largely restricted in the southern Coastal Plain to streams that are heavily influenced by groundwater inputs. Thermally buffered habitats such as these provide the only habitats where cool-adapted taxa such as *Pycnopsyche* are able to survive (Ross 1956). At the extreme southernmost (i.e., Florida) limits of the genus, *P. antica* and *P. indiana* are the only known representatives. *Pycnopsyche antica* are most commonly encountered in headwater reaches of clear streams of spring-seep origin.

Pycnopsyche indiana, on the other hand, occurs in more tannic low-lying streams and rivers. The presence of the Roberts Branch disjunct population of *P. indiana* in peninsular Florida further supports the notion that tannic streams with intact riparian broadleaf forests are important refugia in the southern Coastal Plain for scattered relict populations of *P. indiana*. Intact riparian broadleaf forests function both to lower potential maximum stream temperatures and to provide allochthonous energy inputs (leaves and coarse woody debris), thus driving detrital-based food chains in which *Pycnopsyche* are important components (Grubs and Cummins 1996). Greater sampling efforts, including adult collecting, are needed to better understand the distribution and habitat requirements of southern-disjunct populations of *P. indiana*. Furthermore, conservation and sound watershed management practices that protect specialized habitats are vital for the survival of isolated populations of this species. Clearly, *P. indiana* would be a candidate for listing as a threatened/ endangered species in the state of Florida.

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