A NEW NEARCTIC *APOBAETIS* (EPHEMEROPTERA: BAETIDAE)[1]

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ABSTRACT: *Apobaetis lakota*, new species, is described from larvae collected in southeastern Nebraska and northeastern North Dakota. *Apobaetis lakota* appears more derived than the plesiotypic South American *A. signifer*, as evidenced by certain apomorphies shared with the North American *A. indeprensus*. The new species is somewhat larger than other known *Apobaetis*, and it is most easily distinguished by its unique labial and maxillary palps.

Apobaetis was established by Day (1955) for the North American species *A. indeprensus* Day, which was known from both larvae and adults. That species is found through much of central and western North America, including California, Colorado, Kansas, Saskatchewan, and Texas (Day 1955, Liechti 1982, McCafferty and Davis 1992, McCafferty et al. 1993, Lugo-Ortiz and McCafferty 1995, McCafferty and Randolph 1998). Larvae of *Apobaetis* are very small, long-clawed, shifting-sand dwellers with distinctive mouthparts, and adults include species with double marginal intercalary veins in the forewings, no hindwings, and a prominent penes plate (see illustrations in Traver [1935] and Edmunds et al. [1976]). This unique combination of adult characteristics, along with eye and egg morphology allowed Waltz and McCafferty (1986) to recognize *A. etowah* (Traver) (originally described in *Pseudocloeon* Klapálek) as a second species of North American *Apobaetis*. This latter species is known only from Georgia (Traver 1935) and remains unknown in the larval stage. Lugo-Ortiz and McCafferty (1997) recently discovered a third species of the genus (*A. signifer* Lugo-Ortiz and McCafferty) based on larvae taken in Brazil and Paraguay.

A fourth species recently taken in southeastern Nebraska and northeastern North Dakota is described below. Although its known range is apparently encompassed by that of *A. indeprensus*, the two species are morphologically very distinctive. Material examined of the new species is deposited in the Purdue Entomological Research Collection, West Lafayette, Indiana.

Apobaetis lakota, NEW SPECIES

Larva. Body length 5.0 mm. Caudal filaments approximately 2.0 mm. Head yellowish, without markings except for brown ocelli. Labrum (Fig. 1) without medial notch but with medial area with approximately 12 short, stout setae on distal margin, and approximately 14 long, simple, hairlike setae laterally on either half of distal margin (laterad of short, stout, medial setae). Lobes of hypopharynx subequal in length. Left mandible (Fig. 2) with incisors deeply cleft, outer set with small medially basal denticle, inner set with denticles more poorly

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defined; prostheca stout and pointed, with row of short, fine, simple setae along part of medial margin, with apical seta prominent and more developed than others; large acute triangular process near medial base of mola surrounded by clusters of small, sharp denticulations at base (see Fig. 2); somewhat smaller, blunt triangular process between larger process and mola; several moderately long, sharp spines also emerging from surface of mola. Right mandible (Fig. 3) with incisors deeply cleft; prostheca thick hairlike and appearing bifid; mola with sharp, simple setae at medial and lateral margins, and with some short, dully pointed spines emerging over molar surface, and with enlarged stout process in midregion of mola. Galealaciniae (Fig. 4) with two to three grouped, long, apical spines, linear row of three broad-based and spaced, long, subapical spines, and continuous linear row of five to seven slender, long, less sclerotized, subapical spines; maxillary palps three segmented, with segment 1 short, segment 2 extending slightly beyond tip of galealaciniae, and segment 3 subequal in length to 1 and 2 combined, slightly narrower and coming to blunt medioapical point. Labium (Fig. 5) with glossae and paraglossae subequal in width and length, but with paraglossae more convex laterally; glossae with medial margin somewhat roughened in apical half, with lateral marginal rows of sparse, simple setae in apical half connecting by subapical transverse row; paraglossae with submarginal lateral row of sparse, simple setae and additional sparse oblique row from midbase to apex; distal segment of labial palps relatively large, highly setaceous with profuse, fine, long, silklike setae in outer aspect; distomedial projection (inner lobe) of apical palp segment highly developed and rounded (about as large as entire outer lobe of distal palp segment); distolateral region (outer lobe) of main body of distal palp segment stongly curved medially; inward oriented distal margin of outer lobe approaching truncate, laterally with slightly projecting point and medially slightly rounded; several long spines along truncated margin. Thorax cream-yellow with some light brown sclerite margination dorsally. Hindwingpads absent. Claw of hindleg (Fig. 6) long and slender, slightly longer than tarsus. Abdominal terga cream-yellow, with pairs of pale brown, short, longitudinal dashes submedially, and with some lateral, brown shading on terga 3, 5, and 9 (barely developed on 3 and 9). Sterna cream-yellow and unmarked. Gills unknown (missing on specimens). Paraproct as in Figure 7. Caudal filaments slightly darkening in midregion (broken apically or missing on specimens); medial caudal filament well developed.

Adult. Unknown.

Material examined. HOLOTYPE: Larva, North Dakota, Cavalier County, Little South Pembina River near Langdon, IX-24-1996, M. Elle [mouthparts and paraproct mounted on slide (medium Euparol)]. PARATYPE: Larva, Nebraska, Saline County, Big Blue River below Friskies Pet Food Plant, Sec. 26, T08N, R04E, X-I-1997, K. Bazata [mouthparts mounted on slide (medium Euparol)].

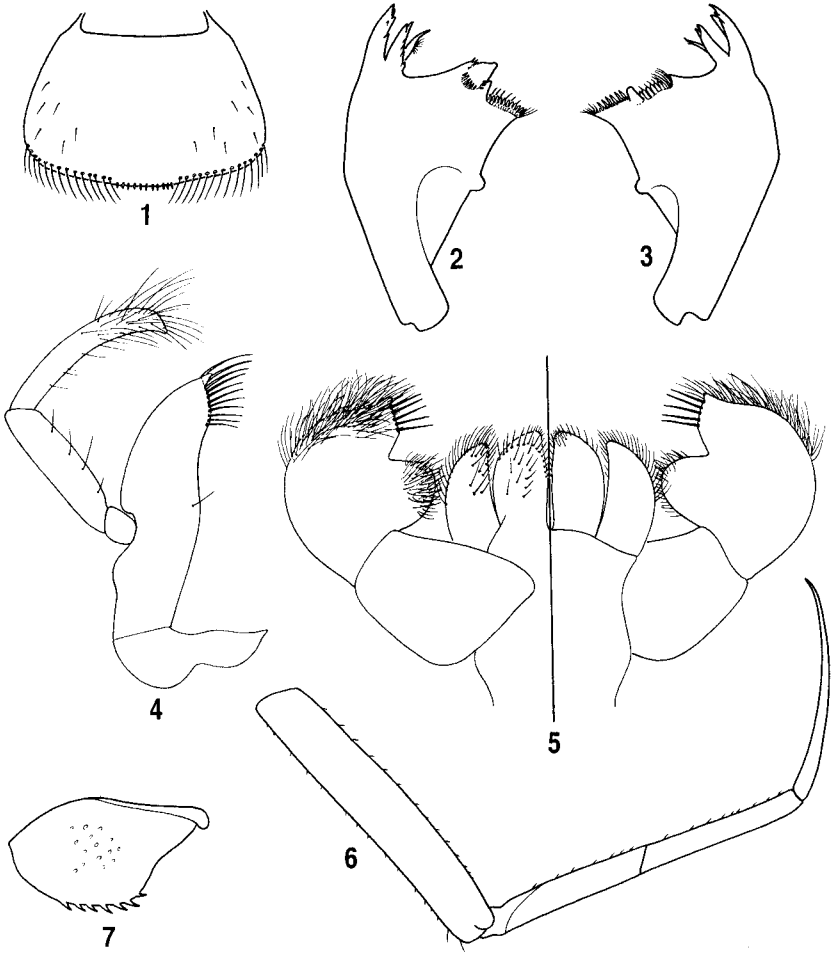
Etymology. The new species name is noun in apposition taken from the Lakota, Native Americans that inhabited much of the northern plains area prior to the twentieth century.

Discussion. This lotic, psammophilous species is generally similar to *A. indeprensus* and *A. signifer*, both of which are also known as larvae. The interspecific relationships of *A. lakota* can only be suggested at this time, and mouthpart morphology may be instructive in this respect.

The labrum of *A. lakota* (Fig. 1) is very similar to that of both *A. indeprensus* (Day 1955: Fig. 2) and *A. signifer* (Lugo-Ortiz and McCafferty 1997: Fig. 1); however, marginal lateral setation is most similar in *A. lakota* and *A. signifer*.

It cannot be determined from this character, when considered independently from other characters, if this similarity is plesiomorphic or apomorphic (however, see below).

Mandibles are very similar in the three species, but the left mandible of *A. lakota* (Fig. 2) is apparently unique in its possession of a clustered row of small denticulations near the base of the large triangular process medial of the mola.



Figs. 1- 6. *Apobaetis lakota* larva. 1. Labrum (dorsal). 2. Left mandible. 3. Right mandible. 4. Maxilla. 5. Labium (left-ventral, right-dorsal). 6. Hindleg. 7. Paraproct.

Shape and apical and subapical armature of the galealaciniae are similar in the three species; however, the maxillary palps differ considerably among the species. *Apobaetis indeprensus* is clearly the most apomorphic in this respect, with a narrow-elongate segment 3 and a unique small segment 4 (Day 1955: Fig. 5). The other species lack segment 4: *A. lakota* has a three-segmented palp (Fig. 4); *A. signifer* has a two-segmented palp (Lugo-Ortiz and McCafferty 1997: Fig. 5). Transition from a two- to three- to four-segmented maxillary palp is evident in the genus *Apobaetis*, with the palp of *A. lakota* representing an intermediate state between the most plesiomorphic palp of *A. signifer* and the most apomorphic palp of *A. indeprensus*. Importantly in this respect, a closer cladistic relationship between *A. lakota* and *A. indeprensus* than between *A. lakota* and *A. signifer* is suggested. This would appear logical from a biogeographic standpoint (see McCafferty 1998), and also, by deduction, would suggest that the similar labral setation in *A. lakota* and *A. signifer* is plesiomorphic. In *A. lakota*, the longer maxillary palp segment 2, relative to the length of the galealaciniae, is apparently autapomorphic, particularly if segment 1 of *A. signifer* is assumed to be homologous with the combined segments 1 + 2 in *A. lakota* and *A. indeprensus*.

The shape of the labial palps are very similar in *A. indeprensus* (Day 1955: Fig. 6) and *A. signifer* (Lugo-Ortiz and McCafferty 1997: Fig. 6). In *A. lakota*, the extreme development of the inner lobe of the distal segment (Fig. 5) is highly specialized and unique among the known species of the genus *Apobaetis*. The apex of the palp (outer lobe) may not appear as truncate in *A. lakota* as it is in *A. signifer* and *A. indeprensus*, due mainly to a slight rounding of its distomedial aspect. Whereas these shape modifications of the palp would not in themselves suggest any relationship because they are not shared by any other known species of *Apobaetis*, the development of long setae in the outer portion of the distal segment of the labial palps in *A. lakota* and *A. indeprensus* does give additional credence to the hypothesis of a closer (possibly sister) relationship between these two species. Also, the presence of well-developed spines on the truncate apical margin of the outer lobe of the distal segment of the palp in *A. lakota* and *A. indeprensus* is of similar cladistic significance. These apical spines, moreover, appear to be most developed in *A. indeprensus*.

Based on the above, it appears that *A. lakota* and *A. indeprensus* share a recent common ancestor, and they represent a more apotypic grade of evolution from that of the *A. signifer* lineage and possibly other Neotropical species that remain unknown. The various autapomorphies associated with either *A. lakota* or *A. indeprensus* define these species and allow them to be easily distinguished from each other.

Apobaetis lakota is about 20% larger in body size than other known species, and its tarsal claws are exceedingly long (they are somewhat variable in *A. indeprensus*). The most striking diagnostic feature of *A. lakota* is the highly

developed and rounded inner lobe on the distal segment of the labial palps (Fig. 5). The inner lobe is small and pointed in the other known species (Day 1955: Fig. 6; Lugo-Ortiz and McCafferty 1997: Fig. 6). The three-segmented maxillary palp of *A. lakota* (Fig. 4) is also diagnostic, keeping in mind that the short palp segment 1 in both *A. lakota* and *A. indeprensus* is sometimes apparent only with very close examination. Not only are the maxillary palps four segmented in *A. indeprensus* (Day 1955: Fig. 5), but the fact that palp segment 2 is shorter relative to the apex of the galealacinia in *A. indeprensus* allows diagnositc use of the maxillary palps even if the more delicate palp segments 3 or 4 have been broken in larval specimens, which apparently often happens. The left mandible is also diagnostic (see above) but may require very close inspection.

The larva of *A. etowah* from Georgia remains unknown. Any possibility that the larva of *A. lakota* represents the unknown stage of *A. etowah* is extremely remote. Body sizes of the two species are disparate, and ranges would appear at this time to be considerably disjunct.

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