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A REVIEW OF THE ADULT *ANAGAPETUS* (TRICHOPTERA: GLOSSOSOMATIDAE)

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ABSTRACT.—Seven *Anagapetus* species [*aisha* Denning, *bernea* Ross, *chandleri* Ross, *debilis* (Ross), *hoodi* Ross, *schmidi* (Levanidova), *thirza* Denning] have been described from eastern Russia and western North America. *Anagapetus thirza* Denning is proposed as a synonym of *A. chandleri* Ross. *Anagapetus schmidi* is returned to *Glossosoma*. Descriptions, distributions, and figures are provided for both males and females of the remaining 5 *Anagapetus* species.

Key words: Trichoptera, Glossosomatidae, Anagapetus, Glossosoma schmidi.

Anagapetus (Ross 1938) was created as a subgenus of *Agapetus* Curtis for the male of *Anagapetus debilis* (Ross 1938), primarily because of the lack of specialized male secondary sexual characters typical of *Agapetus.* Without additional rationale, Ross (1947) treated *Anagapetus* as a distinct genus. Ross (1951) provided rationale to support *Anagapetus* as the most primitive glossosomatid and listed several characters to support this conclusion. Ross (1956) elevated *Anagapetus* to tribal status (Anagapetini vs. Agapetini and Glossosomatini within the Glossosomatinae) based on the presence of the short transverse suture that divides the mesepisternum (Fig. 1). Schmid (1962) suggested that *Anagapetus* was, in fact, a highly specialized group of species and that Ross's tribal elevation was unsupportable. Schmid (1980, 1998) reduced the 10 subgenera (Ross 1956) of *Glossosoma* to 6 and moved *Anagapetus* to a 7th subgenus of *Glossosoma* based on the opinion that the suture separating the upper and lower parts of the episternum "is not constant and is insignificant." Morse and Yang (1993) provided additional summary of the confusion and suggested 4 characters (see discussion below) that support separation of Anagapetini from Glossosomatini.

Glossosoma (*Anagapetus*) *schmidi* Levanidova (1979), an eastern Russian species described within the subgenus *Anagapetus,* presents problems for Morse and Yang's (1993, 2004) Glossosomatinae phylogeny. *Glossosoma schmidi* cannot be readily separated from either *Anagapetus* or *Glossosoma* based on the characters Morse and Yang (1993) used to separate the 2 genera. Morse and Yang (1993) suggested the larval forelegs originating near the middle of the pronotum (see Wiggins 1996) were autapomorphic for the Anagapetini; the *G. schmidi* larval forelegs originate near the apex of the pronotum. Morse and Yang (1993) listed 3 additional adult homologues to support tribal separation: the alignment of forewing veins SR, R4+5, R5 (straight in Glossosomatinae; see Ross 1956, Schmid 1980, 1998); male forewing callosity (present in Glossosomatinae; see Ross 1956, Schmid 1980, 1998); and male inferior appendage angled downward (present in Anagapetini; see Ross 1956). *Glossosoma schmidi* has the linear vein alignment but lacks any modification of the male forewing anal area typical of *Glossosoma.* The *G. schmidi* male inferior appendage (Levanidova 1979) is angled downward (a suggested autapomorphy for Anagapetini); however, the structure is shaped quite differently (see Ross 1956, Levanidova 1979).

Morse and Yang (2004) provide additional evaluation of the homologies to support the *Glossosoma* subgenera, including an additional character to support separation of Glossosomatini from Anagapetini: the unguitractor plate of Martynov (1927). *Glossosoma schmidi* possesses this structure (Levanidova 1979), but it is also present on *Anagapetus.* The unguitractor plate size in *Anagapetus* seems to vary, with that of *A. chandleri* Ross being very small, or absent, while that of *A. hoodi* Ross is as large

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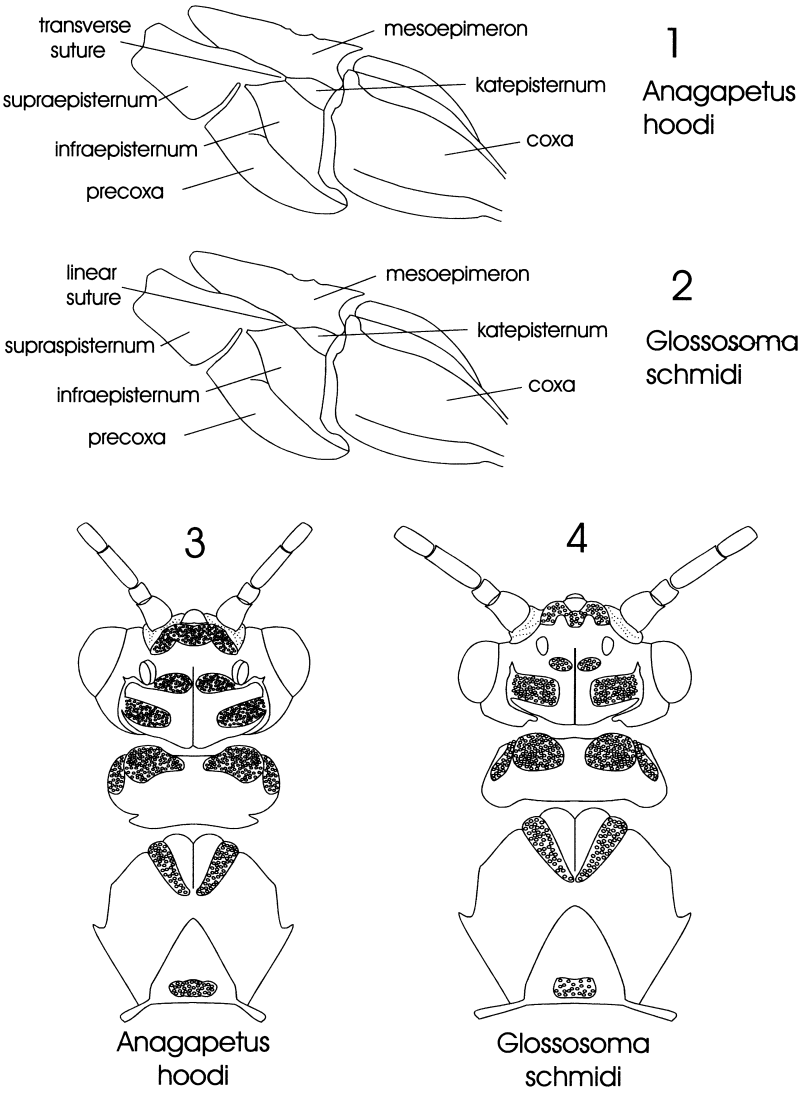

Figs. 1–4. Comparison of *Anagapetus hoodi* and *Glossosoma schmidi*: (1) *Anagapetus hoodi* mesepisternum; (2) *Glossosoma schmidi* mesepisternum; (3) *Anagapetus hoodi* head, pronotum, mesonotum; (4) *Glossosoma schmidi* head, pronotum, mesonotum.

as those of *Glossosoma.* Based on this, it is not clear that any characters support monophyly for *Anagapetus*, other than the downward-turned male inferior appendages (which Morse and Yang [2004] conclude are actually extensions of the 9th sternum), and the male apicolateral club hairs on the 9th segment. In either case, *G. schmidi* does not appear to belong within *Anagapetus*, and it is not clear to which *Glossosoma* subgenus (Morse and Yang 1993, 2004) *G. schmidi* belongs. It would appear that Schmid's (1980, 1998) removal of tribal status for *Anagapetus* is appropriate. Details of the *Glossosoma* females need to be evaluated in detail in hopes of clarifying these issues.

Anagapetus adults can be separated from *Glossosoma* by the downward-turned inferior appendages and lateral tuft of club hairs on the male 9th segment. *Anagapetus* larvae can be distinguished by the foreleg originating near midlength of pronotum (Wiggins 1996).

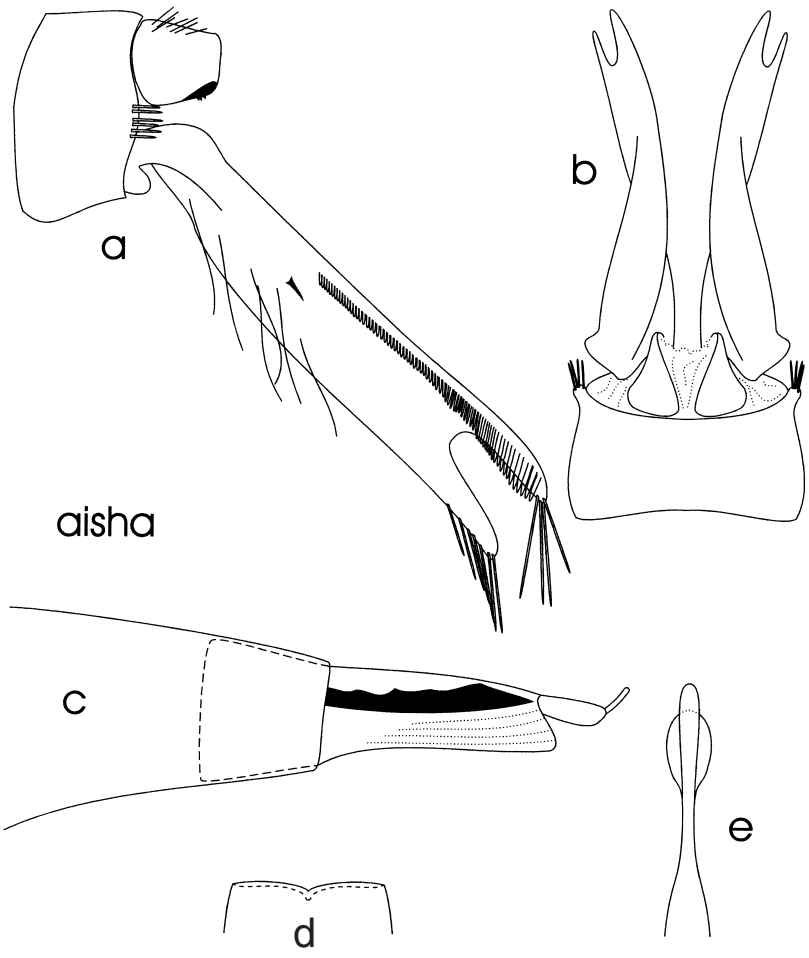

Fig. 5. *Anagapetus aisha*: (a) male genitalia, lateral view; (b) male genitalia, dorsal view; (c) female genitalia, lateral view; (d) female segment 8, dorsal view; (e) vaginal apparatus, ventral view.

Ross (1956) created 3 groups within *Anagapetus* (*chandleri*, *debilis* Ross, and *berneahoodi*), primarily based on a conclusion that *A. debilis* lacked the peculiar, pale club hairs on the apico-lateral margin of segment 9. These club hairs are present on all the *Anagapetus* species, including *A. debilis.* They are best seen from the dorsal or ventral view, as they are located on a distinct lateral hump. (This hump with club hairs is apparently lacking in *Glossosoma*, including *G. schmidi.*) The club hairs, while quite stout, can be rubbed off. And the hump can be small, which may have led to Ross's conclusions. No clear characters were discovered that would separate the species into distinct groups, although the species can be readily separated by the characters discussed, and figured, below.

Segment 8 of *Anagapetus* females is a tubular structure composed of a distinctly sclerotized distal portion while the cephalic sclerotized portion merges imperceptibly into a membranous area attached to segment 7. The relative shape of the distal portion is useful for species determinations. The vaginal apparatus is very similar in all species, except in *A. hoodi.* However, minor differences in the apex of the vaginal apparatus of the species are consistent within the material examined.

Distribution of the material examined during this study is presented in Figures 10 and 11 and can be obtained directly from the author.

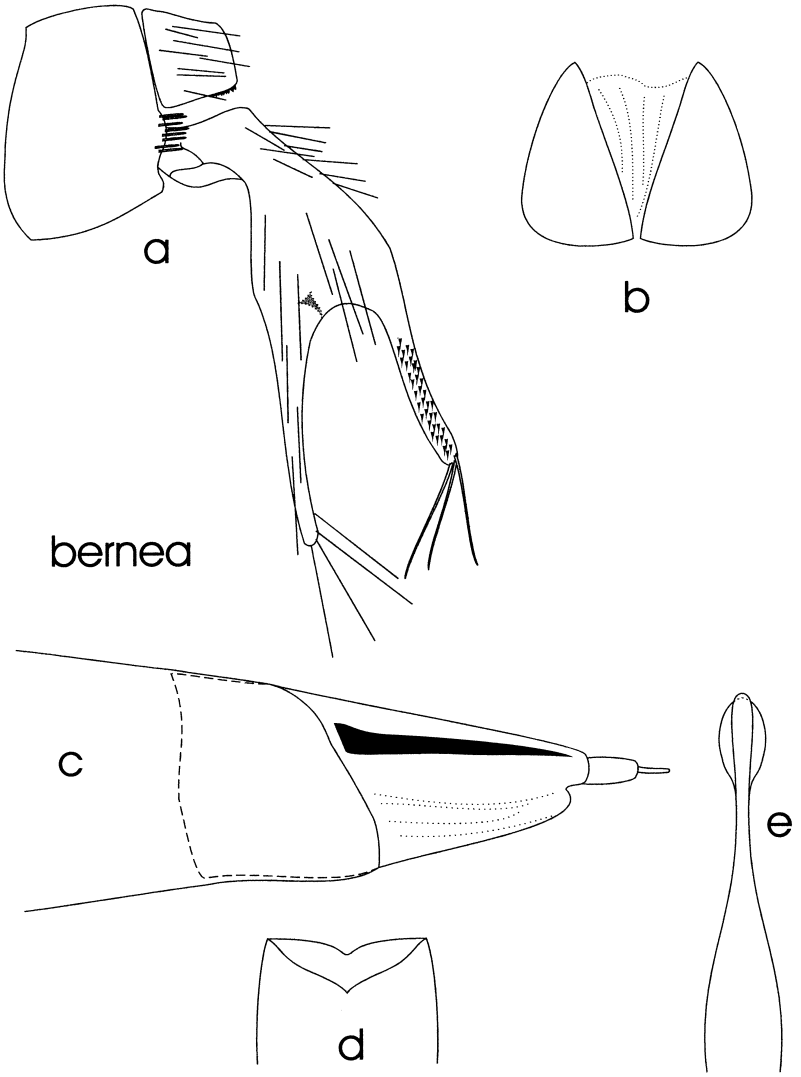

Fig. 6. *Anagapetus bernea*: (a) male genitalia, lateral view; (b) male segment 10, dorsal view; (c) female genitalia, lateral view; (d) female segment 8, dorsal view; (e) vaginal apparatus, ventral view.

Previously published records, particularly from California, should be reviewed to confirm the identifications.

Anagapetus Ross 1938

Spurs 2-4-4. Dorsal cephalic warts with a nonsclerotized, open suture extending from the mesal wart below the lateral ocelli to the posterior margin. Mes- and metepisterna each divided by a short transverse suture, mesotibia and tarsa oval in cross section, not flattened. Mesoscutellar wart a transverse oval, appearing as if 2 separate warts have fused mesally. Fifth segment with small flaps covering lateral glands, no apparent differences between species. Both sexes with short, stout sternal projection on segment 6, larger sternal projection on segment 7 of male. Male segment 9 annular, genitalia lacking superior appendages. Male segment 10 divided mesally; lateral portions sclerotized, and variously ornamented with fine spines or plates at apicoventral corners. Male inferior appendages long, distally broad, each with apical incision; with 1 or 2 sclerotized spurs on mesal surface, these spurs usually asymmetrical on left and right inferior appendages. Phallic

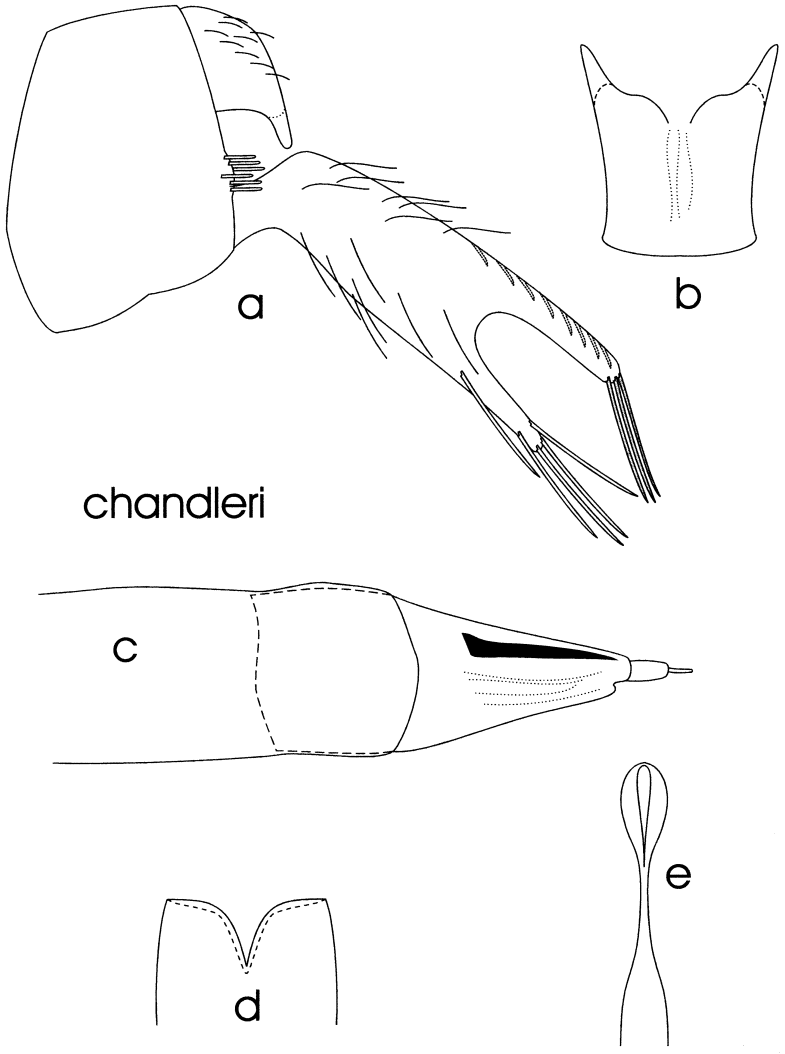

Fig. 7. *Anagapetus chandleri*: (a) male genitalia, lateral view; (b) male segment 10, dorsal view; (c) female genitalia, lateral view; (d) female segment 8, dorsal view; (e) vaginal apparatus, ventral view.

structure consisting of S-shaped sclerite retracted within segment 9; caudal portion highly membranous, which may allow the S-shaped sclerite to extend from abdomen. Female segment 8 weakly sclerotized anteriorly, without distinct anterior margin, distal margin variously cleft dorsally, ventrally, or both. Segment 9 extremely extensile, with its anterior margin folded within segment 8, for a distance relatively consistent within a particular species. Two large L-shaped sclerites located dorsally within membranous segment 9. Segment 10 small with 2 apical papillae. Vaginal apparatus sclerotized, long, with narrowed shaft before expanded oval apex.

Anagapetus aisha Denning 1964

(Fig. 5)

Anagapetus sp. Erman 1989.

The holotype is from Kings Canyon National Park, Fresno County, California (6400 feet altitude). It is not clear where this locality is since the road ends at Kanawyers turnaround at about 5000 feet altitude. This is also the only specimen of *A. aisha* examined during this

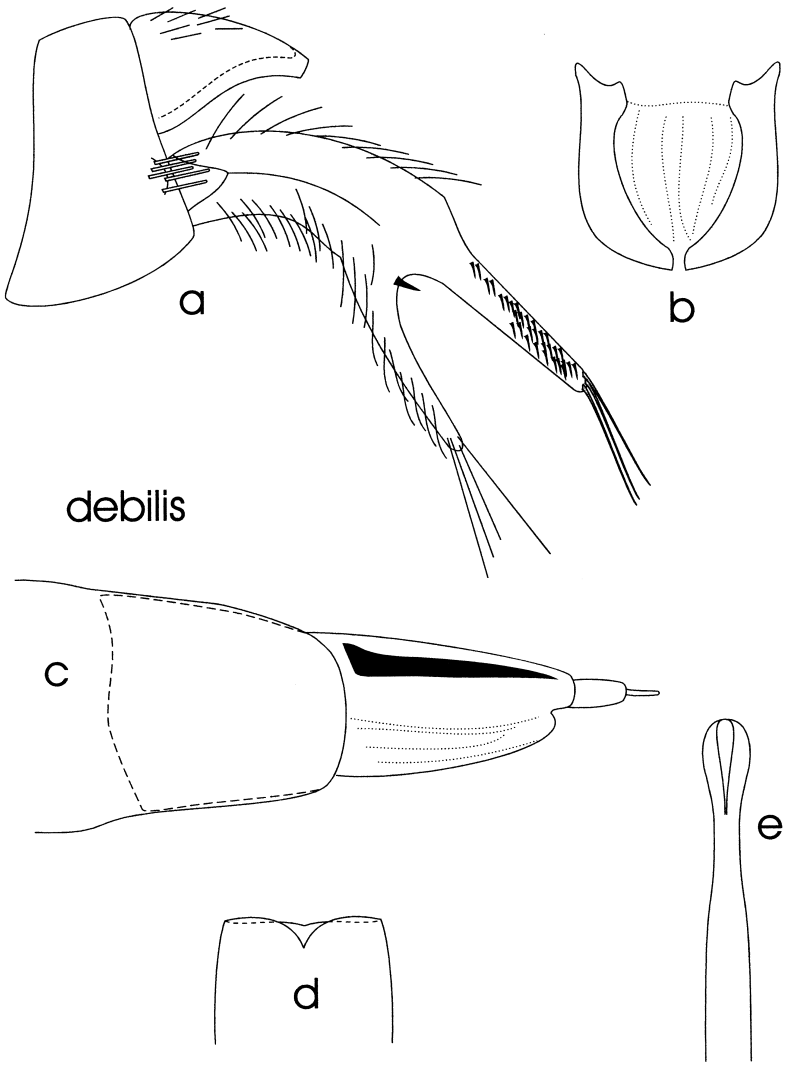

Fig. 8. *Anagapetus debilis*: (a) male genitalia, lateral view; (b) male segment 10, dorsal view; (c) female genitalia, lateral view; (d) female segment 8, dorsal view; (e) vaginal apparatus, ventral view.

study from south of El Dorado County, California. The male has a combination of a relatively shallow apical cleft on each inferior appendage and segment 10 is about as long as tall, with a row of small sclerotized teeth along the ventromesal margins. The interior surface of the apicodorsal arm of each inferior appendage is covered with a scurf of downward-directed setae; this scurf extends more than half the length of the inferior appendage. The mesal process at the base of each inferior appendage is very small, apically acute, and directed dorsomesad. Clavate hairs are present on the lateral margin of segment 9. Denning's (1964) description is incorrect on 2 points: (1) the apicoventral projection of each inferior appendage is broken in the type, normal specimens having the ventral projection as long as the dorsal projection, and (2) clavate hairs are present on the lateral margin of segment 9. There are other specimens determined by Denning as *A. aisha* in the Brigham Young University collection that have the complete ventral inferior appendage projection and clavate segment

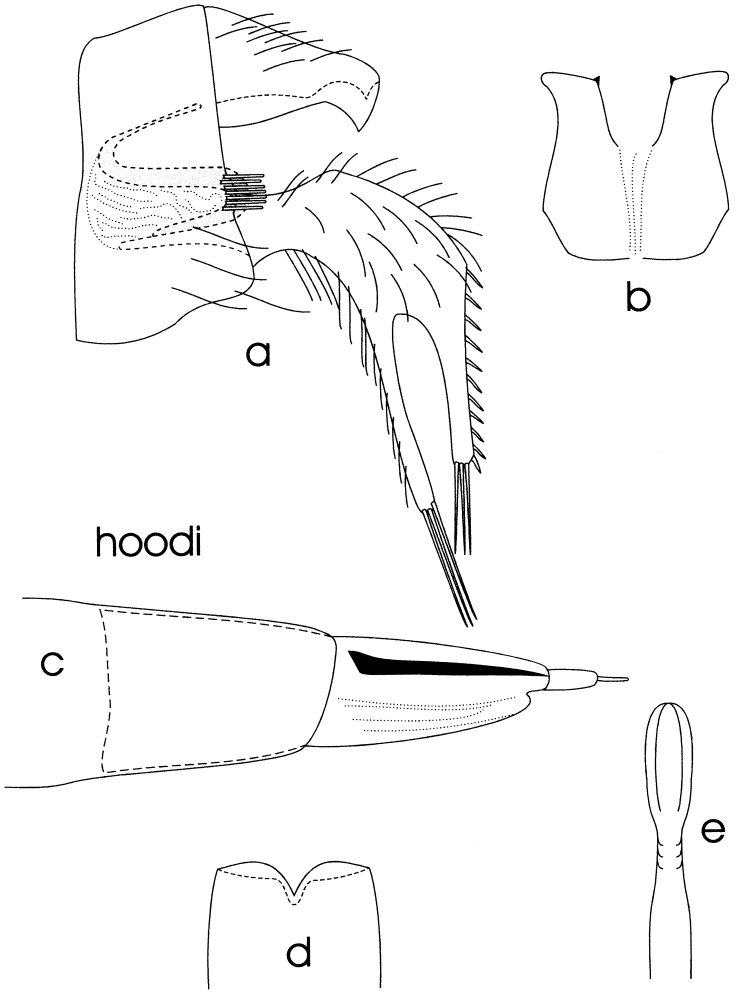

Fig. 9. *Anagapetus hoodi*: (a) male genitalia, lateral view; (b) male segment 10, dorsal view; (c) female genitalia, lateral view; (d) female segment 8, dorsal view; (e) vaginal apparatus, ventral view.

9 setae. Specimens examined during this study indicate the depth of the apical inferior appendage cleft varies from less than one-fourth the inferior appendage length to nearly one-third. The best character to separate *A. aisha* from the closely related *A. bernea* is the long area of scurf on the inferior appendage of *A. aisha.*

The *A. aisha* female has a nearly quadrate distal portion of segment 9, with the distal dorsal and ventral apical margins each only slightly cleft.

The Sagehen Creek, Nevada County, California, population of *Anagapetus* (Erman 1989) initiated this paper. After comparison of several other populations, and the holotype of *A. aisha*, with the Sagehen Creek specimens, I have concluded that the Sagehen Creek population is *A. aisha.*

Anagapetus bernea Ross 1947

(Fig. 6)

The holotype is from Oxbow Springs, Hood River County, Oregon. Paratypes are from Stevens Pass, Berne, Washington, on Highway 2. Berne is in Chelan County, east of Stevens Pass. The male has a combination of deeply cleft inferior appendages and segment 10 about as long as tall. The apex of segment 10 is broadly rounded, usually with a small, sclerotized tooth at the apicoventral corner. Each

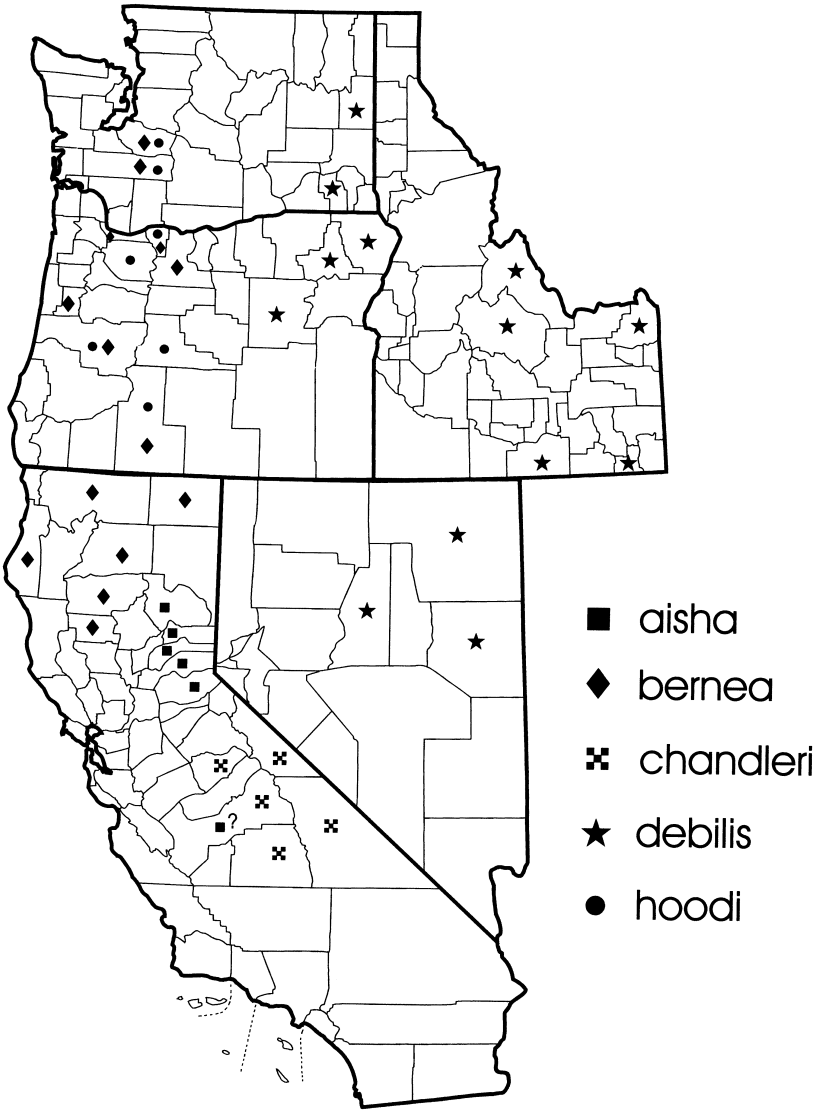

Fig. 10. Distribution of material examined.

apicodorsal inferior appendage arm is covered with a scurf of downward-directed setae. The mesal process at the base of each inferior appendage is acute at the apex and directed dorsomesad.

The female segment 9 margin is distinctly tapered in lateral view, with the dorsal margin shorter than the ventral. Both the dorsal and ventral distal margins are cleft mesally.

Anagapetus chandleri Ross 1951
(Fig. 7)

Anagapetus thirza Denning, 1965 (**new syonym**)

The holotype is from 2 miles east-southeast of Mariposa Grove, Mariposa County, California (7000 feet altitude). There is a roadside park along the access road to Mariposa Grove about 2 air miles southeast of Mariposa Grove, but the

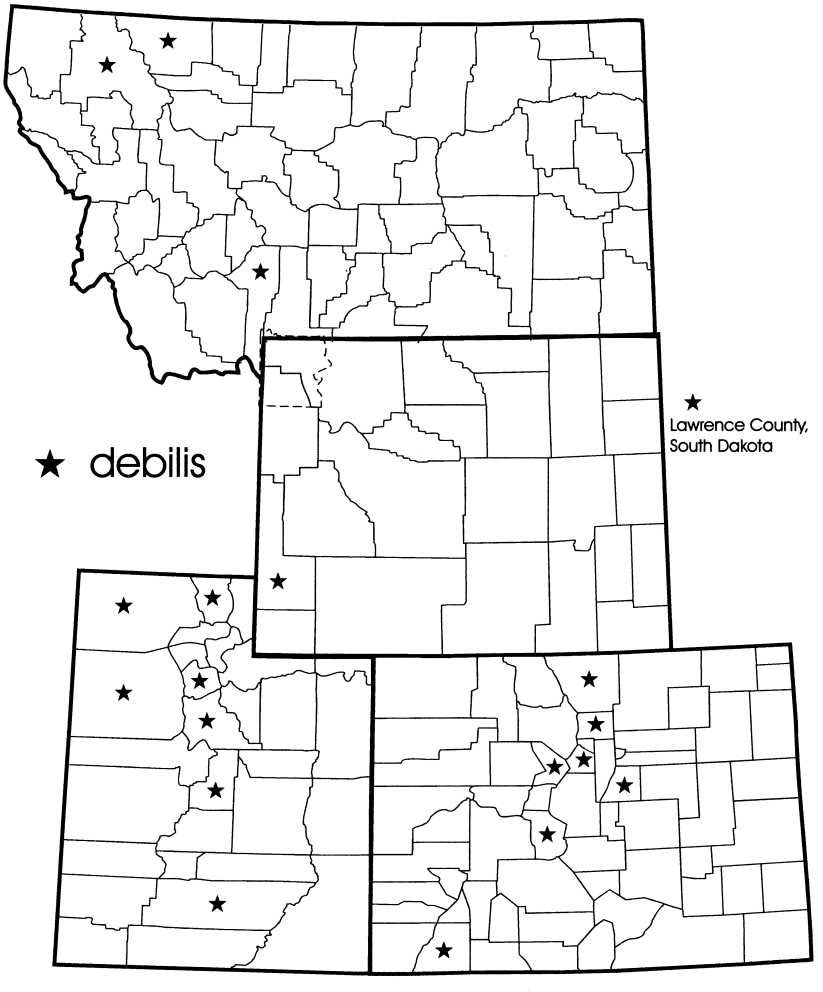

Fig. 11. Distribution of material examined.

altitude is 5585 feet. The highest point near Mariposa Grove is Wawana Point at about 6800 feet. All streams in the area appear to be tributary to Big Creek in Yosemite National Park.

The male has a combination of a relatively shallow apical cleft in the inferior appendages and segment 10 about as long as tall, with a distinct, fingerlike ventrolateral sclerotized projection. The ventromesal edge of segment 10 may have a row of very fine spines. The dorsal edge of the apicodorsal inferior appendage arm has a linear row of setae directed dorsodistad. The mesal process at the base of each inferior appendage is acute at the apex and directed dorsomesad.

The female segment 9 has a very short distal portion, with the dorsal and ventral apical margins each deeply cleft.

The holotypes of *A. chandleri* and *A. thirza* were compared and found to be identical.

Anagapetus debilis Ross 1938

(Fig. 8)

The holotype is from Logan River Canyon, Cache County, Utah. The male is distinguished by the combination of deeply cleft inferior appendages, segment 10 about twice as long as tall, and interior surface of apicodorsal arm of each inferior appendage covered with a

scurf of downward-directed setae. The mesal process at the base of each inferior appendage is bifid at the apex and curved caudomesad. This results in the distinction between the figures of Ross (1938) and Schmid (1982). Depending on position at preservation, the bifid apex is more or less visible. Clavate hairs are present on the lateral margin of segment 9, not as figured by Ross (1938). Some specimens have a row of minute spines on the mesal surface of segment 10.

In lateral view the distal portion of female segment 9 is longer than tall. The transverse apicoventral margin is nearly linear, and the apicodorsal margin is slightly cleft.

Anagapetus hoodi Ross 1951

(Fig. 9)

The holotype is from North Fork Iron Creek, Hood River County, Oregon. The male has a combination of deeply cleft inferior appendages and segment 10 about twice as long as tall. The dorsal edge of each apicodorsal inferior appendage arm has a linear row of setae directed dorsodistad. The mesal process at the base of each inferior appendage is bifid at the apex and directed dorsad, usually hidden within tergite 10. Clavate hairs are present on the lateral margin of segment 9.

In lateral view the apical portion of female segment 9 is longer than tall, and the dorsal and ventral apical margins are each cleft.

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