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NEW SPECIES AND RECORDS OF EPHEMEROPTERA (INSECTA) FROM CENTRAL MÉXICO

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RESUMEN

Los efemerópteros (Insecta: Ephemeroptera) *Farrodes reevesi*, **sp. nov.** (Leptophlebiidae) y *Camelobaetidius shepardi* **sp. nov.** (Baetidae) se describen de San Luis Potosí y Querétaro, respectivamente. *Farrodes reevesi* está basada en adultos, y pueden ser distinguidos de otros adultos conocidos de *Farrodes* por la morfología de las proyecciones laterales del pene. *Camelobaetidius shepardi* está basada en larvas, y pueden ser distinguidas por el número de denticulos en las uñas tarsales, estructura de las partes bucales y coloración dorsal del abdomen. Además de los registros basados en las dos especies nuevas, 25 especies son registradas por primera vez en el estado de Querétaro y tres especies son registradas por primera vez en el estado de Guanajuato.

ABSTRACT

The mayflies (Insecta: Ephemeroptera) *Farrodes reevesi* **sp. nov.**, (Leptophlebiidae) and *Camelobaetidius shepardi* **sp. nov.** (Baetidae) are described from the Mexican states of San Luis Potosí and Querétaro, respectively. Adults, upon which *Farrodes reevesi* is based, can be distinguished from those of all other known species of *Farrodes* by the morphology of the lateral projections of the penes. *Camelobaetidius shepardi* is based on larvae and can be distinguished by the number of claw denticles, mouthpart structure, and dorsal abdominal coloration. In addition to the two records based on new species, 25 additional species are recorded for the first time from the state of Querétaro, and three species are recorded for the first time from the state of Guanajuato.

Randolph and McCafferty (2000) recently reported numerous new mayfly species (Insecta: Ephemeroptera) records from México, and reviewed the known Mexican state distributions of mayfly species in general. *Traverella longifrons* Lugo-Ortiz & McCafferty should be added to that list (Lugo-Ortiz and McCafferty 1996), as should the more recently described *Camelobaetidius kickapoo* McCafferty (McCafferty and Randolph 2000). Recently, additional mayfly specimens newly collected from México were donated to the Purdue Entomological Research Collection (PERC), West Lafayette, Indiana. These included a new species of *Farrodes* Peters (Leptophlebiidae), collected from San Luis Potosí, and a new species of *Camelobaetidius* Demoulin (Baetidae), collected from Querétaro, both of which are described herein. This brings the total of valid nominal Mexican species to 140, a significant number considering the fact that only 63 Mexican species were known just 20 years ago and that several names have recently fallen to synonomy (e.g., Baumgardner and McCafferty 2000, McCafferty and Randolph 2000).

The new collections also contain new species records from the states of Querétaro and Guanajuato. Previously, only the leptophlebiid *Neochoroterpes orientalis* Henry had been reported from Querétaro (Henry 1993), and no mayflies were known from Guanajuato. In addition to describing the new species mentioned above, we also present new state records herein.

NEW DESCRIPTIONS

Farrodes reevesi sp. nov.

Figs. 1-4

Male Adult. Body length: 5.3 mm; forewing length: 5.6 mm; hindwing length: 0.8 mm. Head: Eyes with medial margins appressed along length, dioptic with upper portion brown and lower portion dark gray; ocelli white, ringed with black basally. Antennae with scapes and pedicels light brown. Frons lighter brown than eyes, with anterolateral margin black. Thorax: General coloration

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brown. Mesonotum with black posterior margin. Wings hyaline. Forewings (Fig. 1) with brown spot basally, stigma cloudy and with 9-11 crossveins; longitudinal veins yellowish to light brown and crossveins pale. Hindwings (Fig. 2) with relatively long, narrow costal projection, extending approximately 0.26x width of wing; three unattached veins at hind margin. Abdomen: Terga generally dark brown with pale markings; tergum 1 uniformly dark brown; terga 2-9 each with anteriolateral pale markings, extending ventrally, and with paired pale oval markings extending posteriorly approximately 0.66x length of segment; tergum 2 dorsally with medial, subrectangular white marking extending across nearly entire width of segment; terga 3-4 each with narrow, subrectangular pale marking at anterior margin and with longitudinal, narrow, medial pale marking extending posteriorly; tergum 5 with medial, longitudinal white marking, wider than those anteriorly, extending across width of segment; tergum 6 with extensive white marking medially, anterior margin with noticeable dark markings near margin framing anterior pale margin; tergum 7 similar to tergum 6 but medial markings darker in color; tergum 8 primarily brown, with faint light patterning; terga 9-10 brown. Sterna pale, except posterior margin of sterna 1 and 2 brown, and sterna 7-9 brown. Genitalia (Fig. 3) with forceps with segment 1 uniformly brown and with 13-19 spines on medial margin; subgenital plate with basal spines on posterior lateral projections; medial process between forceps base subrectangular; penes (Fig. 4) fused in basal half, with apical V-shaped separation; lateral projections of penes relatively broad, with basal width subequal to medial width, with distinct undulating anterior and posterior margins, and with small, recurved spine apically.

Female adult. Unknown.

Larva. Unknown.

Material examined. HOLOTYPE: adult, México, San Luis Potosí, Río Tampaon near Sidral. 1-6-2000, W. Reeves (deposited at PERC, West Lafayette, IN) [forceps and penes on slide (medium: euparal); forewing and hindwing on slide].

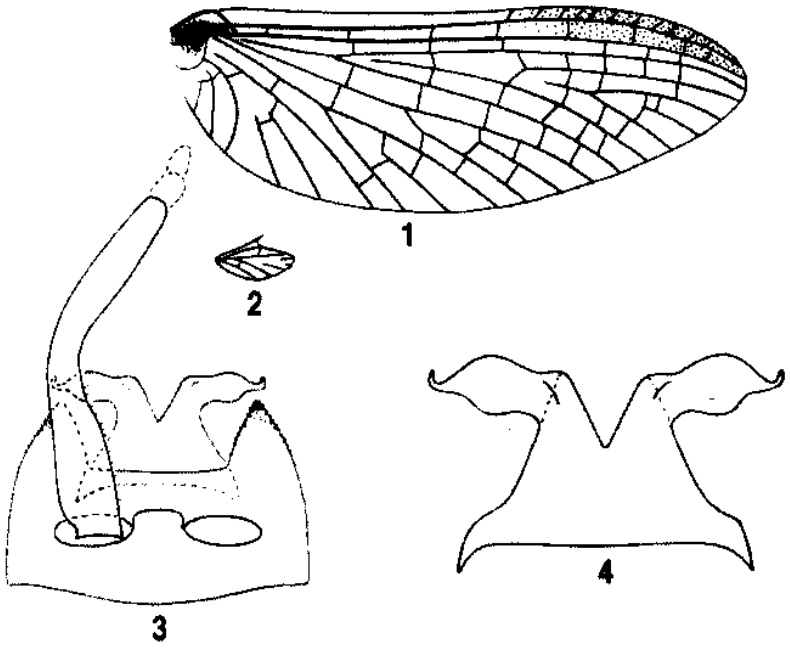
Etymology. We are honored to name this species after Will Reeves (Clemson, South Carolina), who has kindly provided us with Ephemeroptera samples from México and Central America.

Diagnosis. *Farrodes reevesi* will key to *F. xingu* Domínguez, Molineri & Peters if using the key in Domínguez et al. (1996). Based on male genitalia, *F. reevesi* (Figs. 3, 4) is most similar to *F. xingu*, *F. tepui* Domínguez, Molineri & Peters, and *F. pakitzi* Domínguez, Molineri & Peters (all of the *bimaculatus* species group), but it differs from those species by the relatively broader lateral projections of the penes, which have their basal width subequal to the medial width. The basal width of the lateral projections of the penes of *F. xingu*, *F. tepui*, and *F. pakitzi* is distinctly greater than the medial width. Also, the presence of three free marginal veins in the hindwings (Fig. 2) of *F. reevesi* is apparently distinctive.

Discussion. Domínguez (1999) used the relative size of the costal process of the hindwing in relation to the total width of the hindwing (including the costal process), along with the general shape of the penes in *Farrodes*, to separate the *bimaculatus* (0.16x of total width) and *caribbianus* (0.19x of total width) species groups. Concurrently, separate identification keys for each species group were developed (Domínguez et al. 1996, Domínguez 1999). Unfortunately, having the presence of a large hindwing costal process was a parallel character that appeared independently in both species groups (Domínguez 1999), and therefore workers attempting to identify species of *Farrodes* could inadvertently use the incorrect key if the shape of the penes were not considered. Several species in the *bimaculatus* group, including *F. reevesi*, possess a costal process on the hindwing at least 0.20x the entire width of the wing. The structure of the penes, however, clearly shows these species to belong to the *bimaculatus* group. Thus, we suggest that the relative size of the costal process of the hindwing not be used when sorting species to either group for identification.

Farrodes is a Panamerican genus, occuring from southern Texas to Argentina (Domínguez 1999, Domínguez et al. 1996). Previously, species of *Farrodes* from México included *F. maya*

Domínguez, *F. mexicanus* Domínguez, *F. otiesa* Lugo-Ortiz & McCafferty, *F. texanus* Davis, and *F. tulija* Domínguez, Molineri & Peters (Randolph and McCafferty 2000). Of these, only *F. texanus* is known to occur north of México, in the state of Texas (Davis 1987).



Figures 1-4. *Farrodes reevesi*. 1. Forewing. 2. Hindwing. 3. Genitalia (ventral). 4. Penes (ventral).

***Camelobaetidius shepardi* sp. nov.**
Figs. 5-8

Male larva. Body length: 4-6.2 mm; caudal filaments: 1.5-2.3 mm. Head: Vertex with pale anterior margin extending posteriorly to antennal bases, with closely set paired black, oval markings posterior to median ocellus and extending anteriorly at oblique angle on either side of median ocellus. Labrum (Fig. 5) with anterior margin broadly rounded, dorsally with paired submedial setae, no

intermediate setae, and row of four to five simple setae extending to lateral margin. Right mandible with denticles fused for most of length; prostheca broad with apical margin fringed; no setae between prostheca and mola; mola with fine, simple setae on medial apical margin. Left mandible with denticles fused for most of length; prostheca narrow basally and broad apically, almost as broad as denticle width, with four long, narrow denticles medially and numerous small, rounded denticles on remainder of prostheca; large triangular process at base of mola. Galealaciniae with four denticles and numerous fine, simple setae apically; maxillary palp reaching apex of galealaciniae, segment 2 distinctly broader than width of segments 1 and 3, segment 3 subequal to or slightly longer than segment 2, and segment 1 less than 0.25x length of segment 2. Labium with palps (Fig. 6) with segment 1 subequal in length to segment 2 and 3 combined, segment 2 with rounded medial projection, and segment 3 rounded apically with numerous stout setae scattered over surface; glossae slightly narrower than paraglossae, with long, fine simple setae medially and numerous long, simple setae apically; paraglossae with row of four to five setae near medial margin and with numerous long, simple setae apically. Thorax: Prothorax light brown, with median, paired inverted U-shaped markings and lateral, pale subrectangular markings extending from outer arm of each inverted U to lateral margin. Meso- and metathorax with extensive gray-brown markings. Osmobranchiae absent. Legs pale, except femora with black band apically. Claws (Fig. 7) darker than legs (appearing dark brown) with medial brown-black subtriangular marking in body of claw, and vertex of triangle toward tarsus; foreclaws with 21-26 denticles; middle claws with 22-27 denticles; hindclaws with 21-26 denticles. Hindwingpads present. Abdomen: Terga (Fig. 8) 1-2 mostly pale, except tergum 1 bordered with dark anterior and narrower posterior markings; tergum 2 with dark, narrow posterior marking only; terga 3-7 and 10 much darker and with darker patterning; terga 3-7 with inverted V-shaped markings and dark round spot at tip of each arm, anteriorly with broad, dark border and posteriorly with narrower, dark border; terga 8-10 with dark medial spots only, except terga 8-9 with narrow, dark border posteriorly, and tergum 9 sometimes with posterior half enclosed with brown. Sterna pale, with longitudinal dark markings laterally on sterna 6-9 (markings sometimes faintly visible on sternum 5), anterior margins of sterna 3-8 with narrow dark border (sometimes visible only on sterna 6-8). Cerci pale, with long, fine simple setae present on medial margins. Median caudal filament approximately 0.80x length of cerci, with long, fine simple setae laterally.

Female larva. Body length: 5.5-6.0 mm; caudal filaments: 1.5-2.3 mm. Coloration similar to male larvae, except generally paler. Other differences include pale anterior margin extending posteriorly to posterior margin of antennal bases; brown band between median ocellus and lateral ocelli extending to anteromedial margin of each compound eye; pale band between compound eyes; brown band posterior to compound eyes; abdominal terga 3-5, 7 and 10 white with brown patterning; tergum 3 only with narrow posterior band; tergum 10 with medial dark spots (sometimes faint); and abdominal sterna pale but with faint longitudinal lateral markings on sterna 6-8.

Material examined. HOLOTYPE: larva, México: Querétaro: Ayutla, Río Ayutla, VII-14-2000, W. D. Shepard (deposited at PERC, West Lafayette, Indiana). PARATYPES:16 larvae, same data as holotype; 22 larvae, Neblinas, Río Verdito, VII-13-2000, W. D. Shepard.

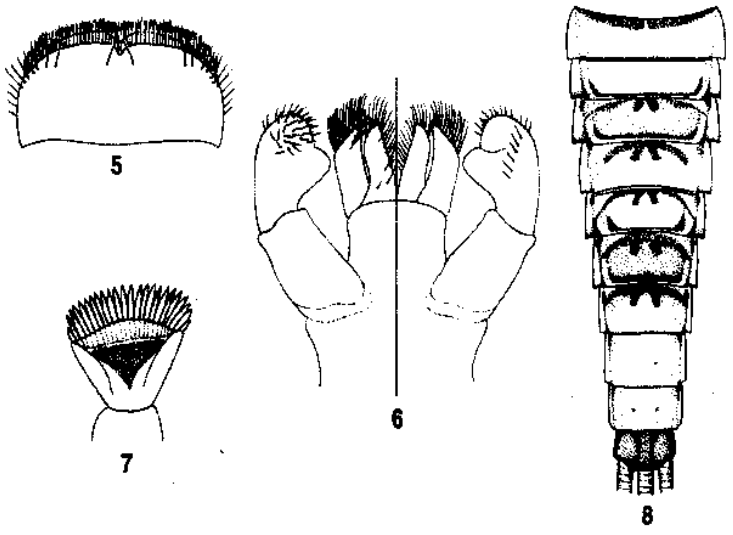
Etymology. We are honored to name this species after Bill Shepard (Sacramento, California), who has long provided us with Ephemeroptera species from many parts of the world.

Diagnosis. Larvae of *Camelobetidius shepardi* differ from all other known North American species of *Camelobaetidius* due to the presence of 22-26 denticles on the claws (Fig. 7). Other known species of *Camelobaetidius* possess either 5-18 denticles or 30 or more denticles. The only species with a similar range of denticles on the claw is the South American species *C. anubis* (Traver & Edmunds). However, the latter species is otherwise significantly different in having the second labial palp pointed medially and osmobranchiae present on the forecoxae.

Camelobaetidius kickapoo McCafferty is a species also having an intermediary number of denticles, but in the 13-18 denticle range (McCafferty and Davis 1992, McCafferty and Randolph

2000). Other characteristics of *C. shepardi* that are of diagnostic significance in comparing North American species include the absence of osmobranchiae, labral setation, shape of labial palps, and abdominal pattern. In using the most recent key to larvae of North American *Camelobaetidius* species (McCafferty and Randolph 2000), *C. shepardi* will not key out, but could be ascertained at the first couplet because the claw denticle range of 21-27 does not fit the first couplet alternatives of 5-20 and 30-45 denticles. Although "20" claw denticles was anticipated in the key as probably applying to *C. kickapoo*, the most denticles we have observed in this species is 18, as noted above. Nevertheless, it is not beyond possibility for the denticle number in *C. kickapoo* to range as high as 20, and that of *C. shepardi* to range as low as 20. For any specimen with approximately 20 claw denticles in México or the southwestern USA, the differences in mouthpart structure, abdominal coloration, and body size may be used to separate *C. shepardi* from *C. kickapoo* (McCafferty and Randolph 2000).

Discussion. With the addition of *C. shepardi*, nine species of *Camelobaetidius* are now known from North America (Lugo-Ortiz and McCafferty 1995, Wiersema 1998, McCafferty and Randolph 2000). All but *C. waltzi* McCafferty are known to occur in México (Randolph and McCafferty 2000).



Figures 5-7. *Camelobaetidius shepardi*. 5. Labrum (dorsal). 6. Labium (left ventral, right dorsal). 7. Claw. 8. Terga.

NEW MEXICAN STATE RECORDS

All records based on larvae collected by W. D. Shepard

Guanajuato

Caenis bajaensis Allen: Santa Catarina, Río Tierra Blanca, VII-9-2000. ***Homoleptohyphes dimorphus*** (Allen): Santa Catarina, Río Tierra Blanca, VII-9-2000. ***Tricorythodes explicatus*** (Eaton): Santa Catarina, Río Tierra Blanca, VII-9-2000.

Querétaro

Acentrella insignificans (McDunnough): Río Victoria, 1 km S San Miguel Palmas, VII-9-2000. ***Americabaetis pleturus*** (Lugo-Ortiz & McCafferty): Río Concá, 1 km NW Adjuntas, VII-13-2000. ***Asioplax*** sp. 1: Río Concá, 1 km NW Adjuntas, VII-13-2000. ***Baetis magnus*** McCafferty & Waltz: Puerto de Alegrías, Arroyo Los Zúñigas, 2000m, VII-2000; El Plátano, Arroyo El Plátano, 1225mVII-10-2000; Neblinas, Río Verdito, VII-13-2000; Chuveje, Río Chuveje, VII-12-2000. ***Baetodes inermis*** Cohen & Allen: Neblinas, Río Verdito, VII-13-2000; 1 km NW Adjuntas, Río Conca, VII-13-2000. ***Baetodes longus*** Mayo: unnamed spring run, Balneario Oasis, VII-14-2000; Río Concá, 1 km NW Adjuntas, VII-13-2000; Ayutla, Río Ayutla, VII-14-2000. ***Baetodes tritus*** Cohen & Allen: unnamed spring run, Balneario Oasis, 1200m, VII-14-2000. ***Baetodes velmae*** Cohen & Allen: unnamed spring run, Balneario Oasis, 1200m, VII-14-2000. ***Callibaetis pictus*** (Eaton): Arroyo Jalpán, 1 km S Huasquilco, 1725m, VII-11-2000. ***Camelobaetidius kickapoo*** McCafferty: Río Concá, 1 km NW Adjuntas, VII-13-2000. ***Camelobaetidius mexicanus*** (Traver & Edmunds): Neblinas, Río Verdito, VII-13-2000; 1 km SSE San Pedro Escanela, Arroyo Real, 1685m, VII-11-2000. ***Camelobaetidius shepardi*** Randolph & McCafferty: see description herein. ***Camelobaetidius variabilis*** Wiersema: Ayutla, Río Ayutla, VII-14-2000; Río Concas, 1 km NW Adjuntax, VII-13-2000. ***Camelobaetidius warreni*** (Traver & Edmunds): Ayutla, Río Ayutla, VII-14-2000 ; unnamed spring run, Balneario Oasis, 1200m, VII-14-2000. ***Choroterpes inornata*** Eaton: Río Victoria, 1 km S San Miguel Palmas, VII-9-2000. ***Cloeodes excogitatus*** Waltz & McCafferty: Arroyo Jalpan, 1 km S Huasquilico, VII-11-2000; Chuveje, Río Chuveje, VII-12-2000; 1 km SSE San Pedro Escanela Arroyo Real, 1685m, VII-11-2000; unnamed spring run, Balneario Oasis, 1200m, VII-12-2000 ***Epeorus metlacensis*** Traver: Arroyo Jalpán, 1 km S Huasquilco, 1725m; Chuveje, Río Chuveje, VII 12-2000. ***Fallceon quilleri*** (Dodds): Río Chuveje, Chuveje, VII-12-2000; Arroyo Real, 1 km SSI San Pedro Escanela, 1685m, VII-11-2000; unnamed spring run, Balneario Oasis, VII-14-2000; Puert de Alegrías, Arroyo Los Zúñigas, 2000m, VII-8-2000; Neblinas, Río Verdito, VII-13-2000; Bucarel Río Estoras, VII-11-2000; Río Victoria, 1 km S San Miguel Palmas, VII-9-2000; Arroyo Jalpan, km S Huasquilco, VII-11-2000; Río Concá, 1 km NW Adjuntas, VII-13-2000; Río Victoria, 1 k S San Miguel Palmas, VII-9-2000; Ayutla, Río Ayutla, VII-14-2000. ***Farrodes otiesa*** Lugo-Ort & McCafferty: Puerto de Alegrias, Arroyo Los Zúñigas, 2000m, VII-8-2000; Arroyo Jalpán, 1 k S Huasquilco, VII-11-2000;1 km SSE San Pedro Escanela, Arroyo Real, 1685m, VII-11-200 ***Leptohyphes zalope*** Traver: Río Concá, 1 km NW Adjuntas, VII-13-2000. ***Moribaetis macafei*** Waltz: Neblinas, Río Verdito, VII-13-2000; Ayutla, Río Ayutla, VII-14-2000. ***Nixe bella*** (Allen Cohen): Chuveje, Río Chuveje, VII-12-2000; 1 km SSE San Pedro Escanela, Arroyo Real, 1685 VII-11-2000; Arroyo Jalpán, 1 km S Huasquilco, 1725m, VII-11-2000. *Paracloeodes minut* (Daggy): Río Victoria, 1 km S San Miguel Palmas, VII-9-2000. ***Thraulodes brunneus*** Koss: Arro Real, 1km SSE San Pedro Escanela, 1685m, VII-11-2000; Chuveje, Río Chuveje, VII-12-20 ***Thraulodes eccentricus*** Lugo-Ortiz & McCafferty: Bucareli, Río Estóras, VII-11-2000; Río Victo 1 km S San Miguel Palmas, VII-9-2000. ***Thraulodes speciosus*** Traver: Arroyo Jalpán, 1 km Huasquilco, VII-11-2000; Río Victoria, 1 km S San Miguel Palmas, VII-9-2000; Puerto de Alegri Arroyo Los Zúñigas, 2000m, VII-8-2000.

San Luis Potosí
Farrodes reevesi Randolph & McCafferty: see description herein.

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