A re-evaluation of the milliped genus *Motyxia* Chamberlin, with a re-diagnosis of the tribe Xystocheirini and remarks on the bioluminescence (Polydesmida: Xystodesmidae)

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Abstract: *Motyxia* Chamberlin is comprised of eight species of bioluminescent xystocheirine millipeds in which the gonopodal solenomere arises at different positions, from basally and subbasally on the acropodite to being fused with the companion acropodal branch and detaching proximad or near midlength. Previous synonymies of *Amplocheir* Chamberlin and *Luminodesmus* Loomis and Davenport under *Motyxia* are confirmed as is its assignment to the tribe Xystocheirini, which is redefined. Component species are *M. kerna* Chamberlin, the type species, *monica* Chamberlin, *sequoiae* (Loomis and Davenport), *tularea* (Chamberlin), *sequoia* (Chamberlin), *pior* Chamberlin, *porrecta* Causey and Tiemann, and *tiemanni* Causey. *Motyxia sequoia* is comprised of two races, the nominate and *sequoia alia* Causey and Tiemann; *sequoia ollae* Causey and Tiemann is properly a subspecies of *tularea*. *Motyxia pior* form *secca* is an invalid name without standing in nomenclature, and *M. tejona* Chamberlin, and *M. expansa* and *exilis*, both by Loomis, are placed in synonymy under *M. monica*, the oldest name for the southernmost species, as *Polydesmus dissectus* Wood is referrable to *Xystocheir* Cook. The bioluminescence is a continuous, neon-white glow of the entire dorsal surface including the antennae and legs.Its visibility at night suggests a warning function analogous to aposematic coloration. The phenomenon may observe a circadian rhythm, and controlled photoperiod experimentation may be productive.

Introduction

The dominant xystodesmid milliped genus in the southern Sierra Nevada, south of Sequoia National Park, is *Motyxia* Chamberlin. It ranges westward to the Pacific Ocean through the Tehachapi and Santa Monica Mountains and is the southernmost representative of the family in California and western North America (Figs. 1, 2). The only genus of bioluminescent millipeds, *Motyxia,* was revised by Causey and Tiemann (1969), but the cyphopods were not characterized, and two nomenclatural changes are necessary. *Motyxia sequoia ollae* Causey and Tiemann is actually a race of *M. tularea* (Chamberlin), and *M. monica* Chamberlin, the oldest of four synonyms, is the correct name for the southernmost species, as *Polydesmus dissectus* Wood is referrable to *Xystocheir* Cook (Shelley 1996).

Motyxia comprises a spectrum of forms in which the origin of the solenomere undergoes a complete transition regarding its position relative to the companion acropodal branch. The solenomere originates basally on the acropodite and is widely segregated from the companion branch in *M. kerna* Chamberlin, the type species, *M. monica*, and *M. sequoiae* (Loomis and Davenport); it arises basally and is narrowly segregated from the companion branch in *M. tiemanni* Causey; it arises subbasally and is moderately segregated from the latter in both subspecies of *M. tularea*; it is fused basally to the companion branch and detaches proximad in *M. sequoia alia* Causey and Tiemann; and it is fused and detaches near midlength in *M. s. sequoia* (Chamberlin), the type species of *Amplocheir* Chamberlin, *M. pior* Chamberlin, and *M. porrecta.* The intermediate positions between the extremes in the type species of *Motyxia* and *Amplocheir* confirm Causey and Tiemann's assignment (1969) of the latter to synonymy, as *Motyxia* is the oldest genus-group name for this assemblage. The third nominal genus, *Luminodesmus* Loomis and Davenport, is an obvious synonym because the gonopods of its type species conform to the pattern in *M. kerna. Motyxia* encompasses relatively large-bodied xystodesmids that are distinguished somatically by their orange base color, absence of dorsal papillation, and orientation of the anterior paranota, which angle anteriolaterad on segments 2-5 (Figs. 3-4). Gonopodal similarities between *M. s. sequoia* and *Xystocheir reducta* (Causey) indicate generic affinity and contribal status, so the Xystocheirini must be rediagnosed to accommodate *Motyxia*, whose species lack the lobes on the 3rd coxae of males and the 2nd of females that are present on other tribal components (Hoffman 1980). Because of apparent homologies, I assign the companion acropodal projection in *Motyxia*, lying caudad/laterad to the solenomere, the same label as in *Xystocheir*, "process 'B'" (Shelley 1996).

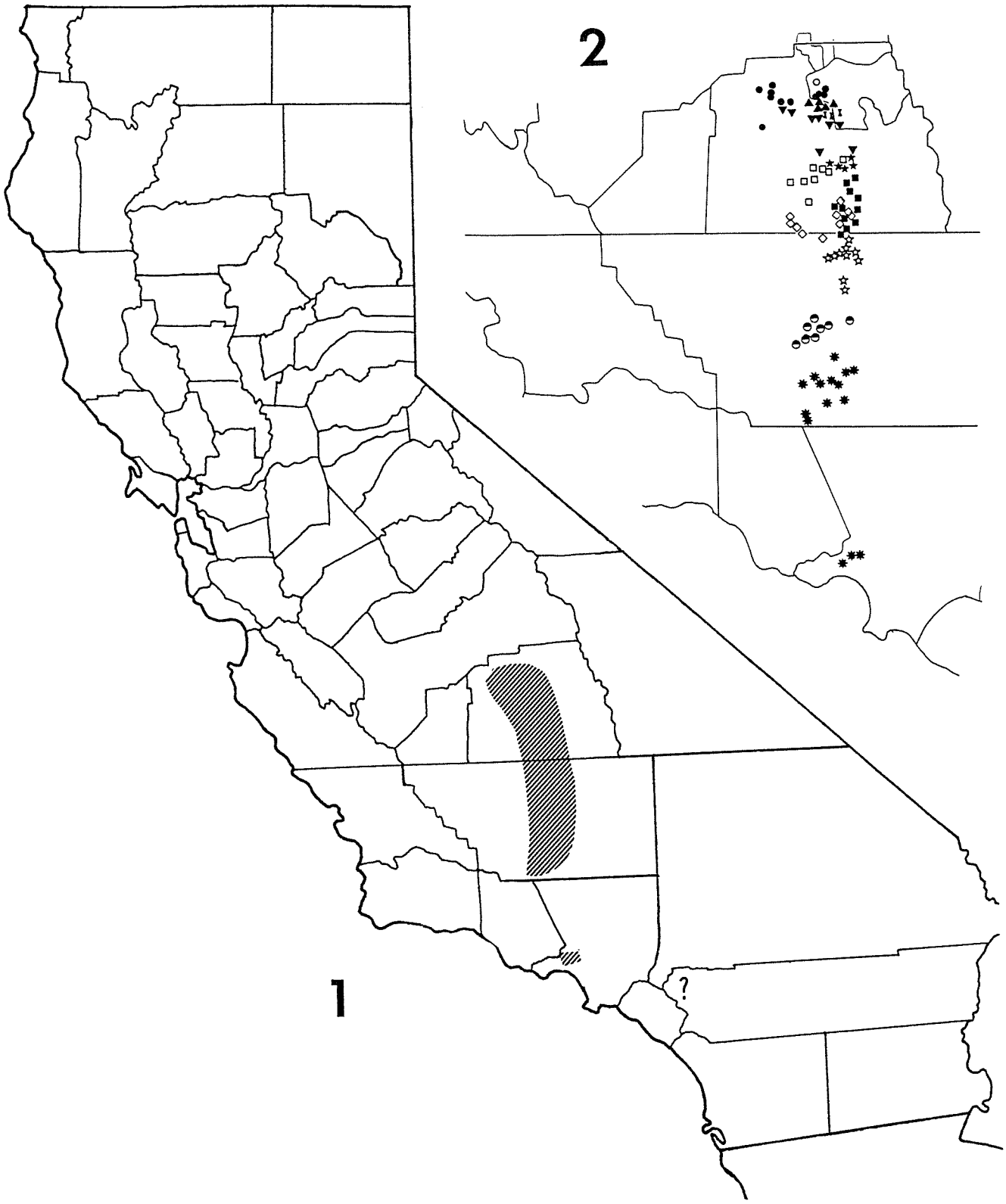
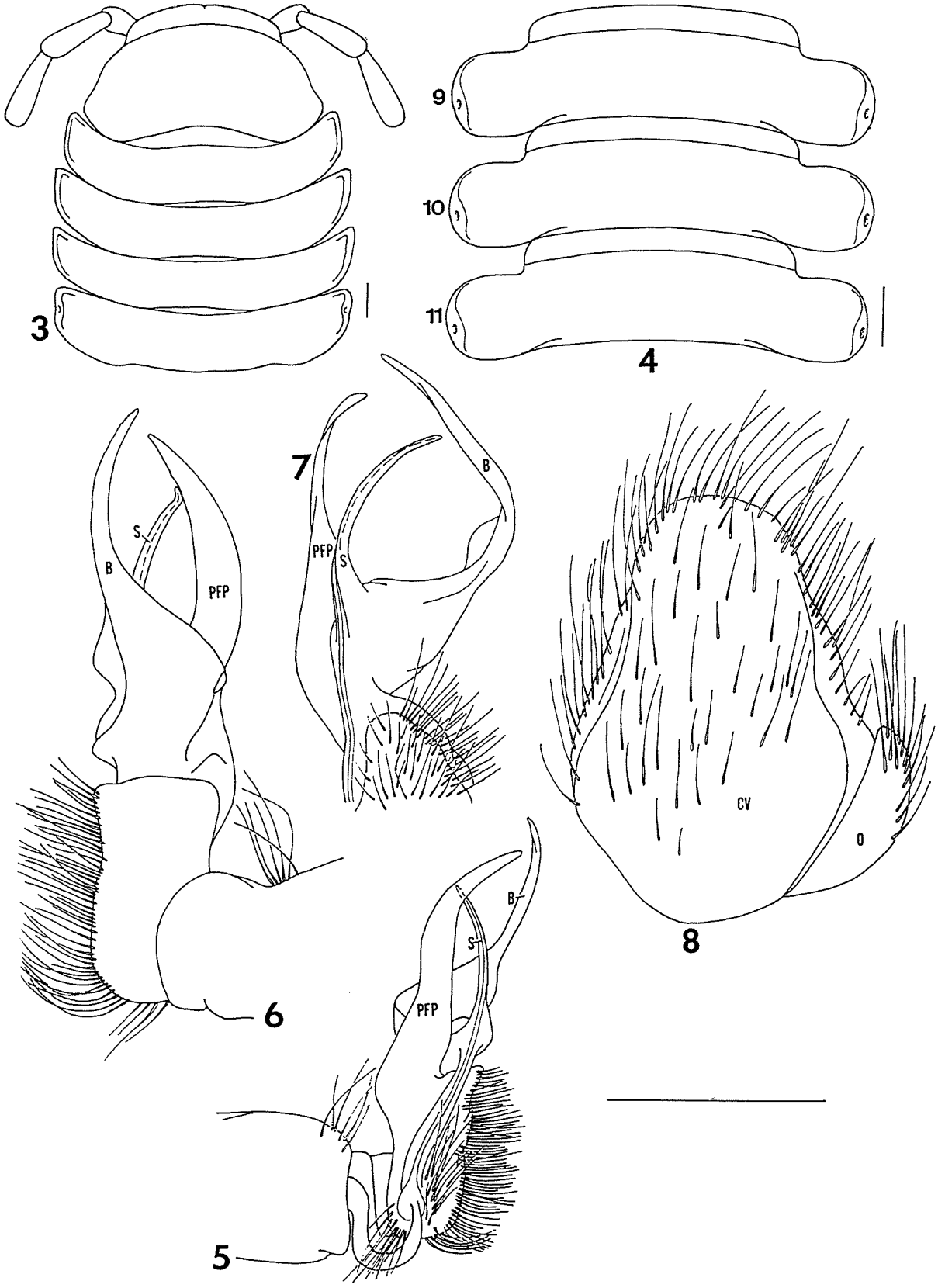


Fig. 1. Distribution of *Motyxia*. A smooth curve is drawn around range extremes in all directions, and the question mark denotes the dubious record of *M. monica* from Riverside County. **Fig. 2.** Distributions of species of *Motyxia*. asterisks, *M. monica*; diamonds, *M. kerna*; solid stars, *M. sequoiae*; solid squares, *M. t. tularea*; open squares, *M. tularea ollae*; triangles, *M. s. sequoia*; inverted triangles, *M. sequoia alia*; X's, *M. sequoia* intergrades; dots, *M. pior* (the circle indicates the sight record from Crystal Cave); half-shaded dots, *M. porrecta*; open stars, *M. tiemanni*.



Figs. 3-8. *Motyxia monica*. 3, head and tergites 1-4 of a male from Woodford, dorsal view. 4, tergites 9-11 of the same, dorsal view. 5, left gonopod of the same, medial view. 6, the same, lateral view. 7, acropodite of the same, caudal view. 8, left cyphopod of female from the same locality, caudal view. B, process "B"; CV, caudal valve; O, operculum; PFP, prefemoral process; S, solenomere. Scale lines for figs. 3-4 = 1.00 mm; line for other figs. = 1.00 mm for each.

The dominant North American polydesmoid family, occurring in three areas of the continent (Shelley 1987) — east of the Central Plains, along the Pacific Coast from Los Angeles to southern Alaska and inland to western Montana, and from southern Texas and New Mexico to El Salvador — the Xystodesmidae has been the subject of numerous systematic studies since 1940. This contribution completes modern treatments of the west-Nearctic fauna that began with the revision of *Orophe* Chamberlin and the proposal of the subfamily Orophinae (Hoffman 1964). Buckett and Gardner (1968a, b) revised *Harpaphe* Cook (Harpaphini) and *Wamokia* Chamberlin (Xystocheirini), and subsequently proposed the new genera *Anombrocheir* (Xystocheirini) (1969a, b) and *Metaxycheir* (Chonaphini) (1969c). After Causey and Tiemann's (1969) study of *Motyxia*, eleven years elapsed before Hoffman (1980) established the Harpaphini and Xystocheirini, and reduced the Orophinae and Chonaphinae Verhoeff (1941) to tribal status in the subfamily Xystodesminae. Thirteen years later, I (Shelley 1993a, b, c) updated *Orophe*, proposed *Thrinaphe* (Harpaphini), and revised *Isaphe* Cook (= *Hybaphe* Cook) (Harpaphini). These were followed by revisions of the tribes Chonaphini and Sigmocheirini (Shelley 1994, 1995a) and the proposal of *Parcipromus* (Xystocheirini) (Shelley 1995b). The companion publication on *Xystocheir* (Shelley 1996) addresses the last unrevised "western" genus, leaving only two unstudied genera in the United States -- the "eastern" taxa *Apheloria* and *Nannaria*, both authored by Chamberlin. Shelley (1989) described *Rhysodesmus chisosi*, from Big Bend National Park, Texas, and (1987, 1992) addressed *Stenodesmus tuobitus* (Chamberlin), in southern Texas and New Mexico, these being representatives of the "Meso-American fauna." This reexamination of *Motyxia* supplements Causey and Tiemann's revision (1969) by providing a historical section, an improved key to species and subspecies, cyphopod illustrations, and standardized gonopod drawings in medial and lateral views that are more readily compared and interpreted than their SEM photos. Species accounts include synonymies, listings of type specimens, diagnoses, statements on variation and distribution, and new localities (the initials DLT identify samples collected by Darwin L. Tiemann). I also supplement previous reports on the bioluminescence (Loomis and Davenport 1951; Davenport et al., 1952; Causey and Tiemann 1969, 1970) by summarizing current knowledge, adding personal observations, and suggesting a possible avenue for productive research. Acronyms of sources of preserved study material are as follows:

AMNH - American Museum of Natural History, New York, New York.
CAS - California Academy of Sciences, San Francisco.
FSCA - Florida State Collection of Arthropods, Gainesville.
LACMNH - Los Angeles County Museum of Natural History, Los Angeles, California.
NCSM - North Carolina State Museum of Natural Sciences, Raleigh.
NMNH - National Museum of Natural History, Smithsonian Institution, Washington, D. C.
UCB - Essig Entomological Museum, University of California at Berkeley.
UCD - Bohart Entomological Museum, University of California at Davis.
UCR - Entomology Department, University of California at Riverside.

Literature Review

The history of *Motyxia* began with the paper by Chamberlin (1941), in which he described *Xystocheir sequoia*, from Sequoia National Park, and erected *Motyxia* for *M. kerna*, from Kern, and *M. pior*, from Tulare, counties. Chamberlin (1944, 1947) proposed *M. monica*, from the Santa Monica Mountains, and *M. tejona*, from Fort Tejon, respectively; he (Chamberlin 1949) proposed *X. tularea* for another species from Tulare County and established *Amplocheir* for *X. sequoia*. Loomis and Davenport (1951) proposed *Luminodesmus* for *L. sequoiae*, also from Tulare County, and Davenport et al. (1952) studied its ecology, life history, and bioluminescence, one of the few works on the "biology" of any xystodesmid. Loomis (1953) described *M. exilis*, from the Tehachapi Mountains, and *M. expansa*, from Fort Tejon, the second nominal species to be proposed from this site. Chamberlin and Hoffman (1958) incorporated all of the preceding taxa into the North American Checklist and placed *Luminodesmus* in synonymy under *Xystocheir*.

In recent works, Causey (1960) described *M. tiemanni*, from Kern County, but Buckett (1964) omitted this species from his list of California millipeds. Causey and Tiemann (1969) revised *Motyxia*, placed *Amplocheir* and *Luminodesmus* in synonymy, and transferred *X. dissecta* and *tularea*, *A. sequoia*, and *L. sequoiae* into the genus. They also placed *M. monica*, *tejona*, *expansa*, and *exilis* in synonymy under *dissecta*; proposed *M. porrecta* for another species from Kern County; and divided

M. sequoia into three races, the nominate and the new subspecies, *M. s. alia* and *s. ollae*. The same authors (Causey and Tiemann 1970) summarized the distribution, biology, and bioluminescence of the species of *Motyxia*, and Jeekel (1971) included *Motyxia*, *Amplocheir*, and *Luminodesmus* in the Nomenclator. In the final relevant work, Hoffman (1980) assigned *Motyxia*, with the synonym *Luminodesmus*, to the new tribe Xystocheirini and revived *Amplocheir* as a monotypic genus for *X. sequoia*, the type species.

Tribe Xystocheirini Hoffman

Diagnosis. Moderate to large size Xystodesminae with smooth and glossy to variably papillate dorsums, pustulate caudad in some species; sides of collum gently curved or folded and uplifted at midlength; caudolateral paranotal corners either broadly rounded and not prolonged or subacuminate and extending slightly or strongly caudad, occasionally curving mediad and appearing uncinate; 3rd male coxae with or without subconical, anteriorly directed lobes; 2nd female coxae with or without long, conical lobes overlying cyphopodal aperture; gonopodal aperture generally ovoid, caudal margin with at most only slight caudal extension; gonosternum strong, oriented along longitudinal, anterior/posterior body axis; coxa flattened, without apophysis, usually with one or two macrosetae, occasionally with field; prefemur generally sublinear and massive, densely or sparsely hirsute, with or without distolateral lobe extending beyond acropodal articulation; prefemoral process usually strong and clearly detached from stem, occasionally vestigial or absent, located either on anteriolateral corner, on medial surface short of latter, or caudolateral corner; acropodite highly variable and clearly demarcated from prefemur, consisting of either an undivided/shallowly divided structure, either upright, curving in sigmoid configuration, or narrow proximad and expanded distad, or from two to four terminal projections of varying configurations; solenomere either a separate branch arising from base to midlength of acropodite or a shorter projection arising proximad to near midlength of caudal acropodal branch (process "B"); cyphopods usually oriented transversely in aperture, valves usually densely hirsute, often with bent hairs, with hirsute operculum and hirsute or glabrous receptacle located on dorsolateral and dorsomedial corners of valves, respectively, with or without moderately sclerotized, glabrous, lateral accessory body.

Components. *Xystocheir* Cook, *Wamokia* Chamberlin, *Motyxia* Chamberlin, *Anombrocheir* Buckett and Gardner, *Parcipromus* Shelley.

Genus *Motyxia* Chamberlin

Motyxia Chamberlin, 1941:15. Chamberlin and Hoffman, 1958:38. Buckett, 1964:9. Causey and Tiemann, 1969:14-20. Jeekel, 1971:274. Hoffman, 1980:157.

Amplocheir Chamberlin, 1949:97. Chamberlin and Hoffman, 1958:17. Buckett, 1964:7. Jeekel, 1971:247. Hoffman, 1980:157.

Luminodesmus Loomis and Davenport, 1951:270-271. Jeekel, 1971:271.

Type species. Of *Motyxia*, *M. kerna* Chamberlin, 1941, by original designation; of *Amplocheir*, *Xystocheir sequoia* Chamberlin, 1941, by original designation; of *Luminodesmus*, *L. sequoiae* Loomis and Davenport, 1951, by original designation.

Diagnosis. Moderate-size to large, bioluminescent Xystocheirini with orange base color; metatergites smooth and glossy, without papillation; sides of collum not uplifted; caudolateral paranotal corners broadly rounded, not prolonged caudad; 3rd male and 2nd female coxae without lobes; gonopodal prefemur generally upright, usually sparsely hirsute, with or without distolateral lobe; prefemoral process variable but usually long and broad, upright, sinuate, or curving anteriad or caudad, entire or divided into variably broad medial, and narrower lateral, subbranches, former with or without basal spur; solenomere variably long, arising either basally from acropodite as distinct, acicular projection, curving strongly or gently caudolaterad, widely or narrowly segregated from process "B", or fused basally to latter and detaching proximad or near midlength; process "B" varying in length, breadth, and configuration, broad and sublaminate or narrow and subacicular, upright, sinuate, or curving variably anteromediad; cyphopods oriented transversely in aperture, valves large and moderately hirsute, unequal with anterior valve larger, receptacle varying in size, hirsute or glabrous, absent from one species, operculum small and moderately hirsute.

Distribution. Occupying two segregated areas in southern California, a broad one extending in a generally north/south direction from the western side of Sequoia National Park, in northern Tulare County, through the southern periphery of the Sierra Nevada and the Tehachapi Mountains to Fort Tejon, in southern Kern County, and a small, disjunct area near the Pacific Coast in the Santa

Monica Mountains, Los Angeles County (Fig. 1). Species distributions are mutually exclusive except for overlap between *M. kerna, tularea,* and *sequoiae* in central and southern Tulare County (Fig. 2). The species with undivided prefemoral processes (three total telopodal projections) occur on the peripheries -- *M. pior* on the north, and *M. tiemanni, porrecta,* and *monica* on the south -- while those with divided processes (four total branches) occur centrally. This pattern implies that loss of the second prefemoral subbranch has occurred twice and that the three-branched condition in *M. pior* is convergent with those in the other species.

Species. Eight, two divided into two geographic races each. The occupied area in California has been thoroughly sampled (Tiemann 1963, 1964), and all species have probably been discovered. However, future sampling may disclose interconnecting forms among the species with divided prefemoral processes. *Motyxia sequoia* is definitely composed of two races, as the nominate subspecies and *M. s. alia* are linked by anatomically and geographically intermediate forms in the vicinity of Clough Cave in the southwestern corner of Sequoia National Park. I also recognize two races of *M. tularea* because of their narrow separation and the close similarity of their gonopods; while none are available, intergrades are presumed to occur in the lacuna. *Motyxia kerna* and *M. sequoiae* are also very close anatomically, the chief difference being the apical configuration of the medial prefemoral subbranch; however, the intervening area has been reasonably well sampled without the discovery of intergrades, so I interpret this difference as evidence of reproductive isolation. Beyond these examples, I think that meticulous sampling in uncollected areas in central Tulare County may reveal anatomically intermediate forms that join all the four-branched species, because their gonopodal differences are so small as to be easily bridged. For example, *M. sequoia* is diagnosed primarily by the basal spur on the medial prefemoral subbranch, but this structure varies in size, and a vestigial spur, coupled with a more proximal detachment of the solenomere from process "B", would blur the distinction between *M. s. alia* and *M. tularea ollae,* and imply that *M. sequoia* and *tularea* are conspecific. Thus, while the present material indicates eight species, the actual number may be only four or five.

Remarks. Aside from bioluminescence, *Motyxia* is characterized by a loss of hairs on both the gonopods and cyphopods. Except for *M. monica,* the gonopod prefemora are sparsely hirsute with only scattered hairs on the stem and a light cluster or no hairs basally around the pit of the prostatic groove. The cyphopod receptacle is absent from this species, glabrous in *M. tularea, porrecta,* and *tiemanni,* and hirsute in the remaining species; however, the setation is notably sparse in *M. kerna, sequoiae,* and *pior*. The glabrous receptacles distinguish these species from all other western xystodesmids, and *M. monica* is the only Pacific representative lacking the structure.

Many specimens of *Motyxia* were collected in the 1960's by Darwin L. Tiemann (Shelley 1995a, 1996); some were coated with shellac or another substance and placed on insect pins at the LACM-NH, and most of the others were deposited in Dr. Causey's private collection, which was transferred to the FSCA after her death in 1979. The pinned specimens are unusable except for external, *in situ* examinations and measurements, and I present tabulated data for all taxa in the variation sections, with localities listed in general north to south sequences.

Key to species and subspecies of *Motyxia*

1. Prefemoral process divided into medial and lateral subbranches, telopodite with 4 terminal projections (Figs. 9-11, 13-15, 17-19, 21-26, 28-31) 2
— Prefemoral process not divided, telopodite with 3 terminal projections (Figs. 5-7, 32-36-38, 40-41) 7

2. Medial subbranch of prefemoral process with variable basal spur; solenomere fused basally to process "B" (Figs. 25-26, 28-31) *sequoia* (Chamberlin)3
— Medial subbranch of prefemoral process without basal spur; solenomere arising basally or subbasally from acropodite (Figs. 9-11, 13-15, 17-19, 21-24) 4

3. Detached part of solenomere relatively long, subequal in length to distal part of process "B"; latter and medial subbranch of prefemoral process relatively narrow for entire lengths, sides tapering smoothly and continuously to subacuminate tips (Figs. 25-26); vicinity of Hammond, Tulare County ..... *s. sequoia* (Chamberlin)
— Detached part of solenomere relatively short, less than half as long as distal part of process "B"; latter and medial subbranch of prefemoral process relatively broad to subspatulate for at least part of length, sides expanding either proximad or distad, apically broad or rounded (Figs. 28-29); Three Rivers to Balch Mountain Park,

Tulare County .... *s. alia* Causey and Tiemann

4. Solenomere arising basally on acropodite, curving strongly caudolaterad, overlapping margin of process "B"; latter extending caudolaterad basally then curving anteromediad and extending ventrad (Figs. 11-15) 5
— Solenomere arising subbasally on acropodite, either upright and extending directly ventrad or curving only apically and at most only slightly caudolaterad; process "B" generally upright (Figs. 17-19, 21-24) *tularea* (Chamberlin) 6

5. Medial branch of prefemoral process apically expanded and upright (Figs. 9-10); Cold Springs Saddle and White River vicinity, Tulare County, to northern fringe of Kern County .... *kerna* Chamberlin
— Medial branch of prefemoral process apically sigmoid, curving caudolaterad (Figs. 13-14); Camp Wishon to Coy Flat, Tulare County .... *sequoiae* (Loomis and Davenport)

6. Medial branch of prefemoral process with caudal margin indented apically, tip acuminate (Figs. 17-19); Quaker Meadows, Tulare County, to northern fringe of Kern County ....*tularea tularea* (Chamberlin)
— Medial branch of prefemoral process apically expanded and rounded (Figs. 21-22, 24); Camp Wishon to Deer Creek Road south of Tule River Indian Reservation .... *tularea ollae* Causey and Tiemann

7. Solenomere arising basally on acropodite (Figs. 5, 7, 40) 8
— Solenomere fused basally to process "B", detaching proximad to near midlength (Figs. 33-34, 37-38) 9

8. Solenomere widely segregated basally from process "B"; latter extending sublaterad basally then curving broadly anteromediad and extending ventrad; cyphopod without receptacle (Figs. 7-8); vicinity of Breckenridge, Kern County, to Santa Monica Mountains, Los Angeles County ..... *monica* Chamberlin
— Solenomere narrowly segregated basally from process "B"; latter upright, extending directly ventrad; cyphopod with receptacle (Figs. 40, 42); Greenhorn Mountains from Tulare County Line to Evans Flat, Kern County .... *tiemanni* Causey

9. Process "B" broad and semilunar; detached part of solenomere minute and blunt, barely projecting beyond margin of process "B" (Figs. 32-24); Woodlake Valley east to Crystal Cave and Hospital Rock, Sequoia National Park, Tulare County .....*pior* Chamberlin
— Process "B" subspatulate, extending ventrad in sinuate configuration; detached part ofsolenomere short but distinct, clearly projecting from margin of process "B" (Figs. 36-39);Kern River Valley, Kern County .... *porrecta* Causey and Tiemann

Motyxia monica Chamberlin

Figs. 3-8

Motyxia monica Chamberlin, 1944:57, figs. 1-3. Chamberlin and Hoffman, 1958:39. Buckett, 1964:9.
Motyxia tejona Chamberlin, 1947:25, figs. 4, 4a. Chamberlin and Hoffman, 1958:39. Buckett, 1964:9. **New synonymy.**
Motyxia expansa Loomis, 1953:422, fig. 19. Chamberlin and Hoffman, 1958:39. Buckett, 1964:9. **New synonymy.**
Motyxia exilis Loomis, 1953:422, fig. 20. Chamberlin and Hoffman, 1958:39. Buckett, 1964:9. **New synonymy.**
Motyxia dissecta (Nec Wood) Causey and Tiemann, 1969:21-22, figs. 2-3, 8, 10-12.

Type specimen. Male holotype (NMNH) collected by R C. Stebbins, 4 March 1944, at "Madelia Canyon," Sherman Oaks, Santa Monica Mountains, Los Angeles County. The vial label and original description state, "Meadow Canyon," which is believed to be a *lapsus* for Madelia Canyon. Madelia Avenue is a short street off Valley Vista Boulevard west of Beverly Glen Boulevard on the north slope of the Santa Monica Mountains in Sherman Oaks, between Mulholland Drive and the Ventura Freeway.

Diagnosis. Prefemoral process entire, broad basally, narrowing smoothly and continuously to narrowly rounded tip, curving broadly laterad; solenomere arising basally from acropodite, curving broadly caudolaterad, directed toward midlength of, but not overlapping, process "B"; latter widely segregated basally from solenomere, extending sublaterad basally then curving broadly anteromediad and extending curvilinearly ventrad, sides expanding basally then narrowing smoothly and continuously to subacuminate tip; cyphopod without receptacle (Figs. 5-8).

Variation. The gonopods of *M. monica* are quite uniform, the only observable variation being slightly less or greater curvatures of the projections than illustrated in figs. 5-7. Measurements of pinned adults are summarized in table 1; sexes are subequal in size, and on the average, individuals be-

come shorter and narrower to the south in the range.

Distribution. Occurring south of the Kern River in two apparently disjunct areas of unequal size, the larger extending from Breckenridge Mountain through the Tehachapi Mountains to Fort Tejon, Kern County, and the smaller being near the Pacific Ocean, some 50 mi (80 km) to the south, in the Santa Monica Mountains, Los Angeles County. Known elevations range from around 700 to 7,000 ft. The intervening area of eastern Ventura County, in the Los Padres National Forest around Pyramid and Pinu Lakes, is plausible for *M. monica.*

A new locality is available from the Santa Monica Mountains, but metropolitan Los Angeles now covers much of this range, and south-facing canyons like Beverley Glen are virtually completely urbanized. I drove the length of Beverley Glen Boulevard in 1989, but with continuous houses and private property on both sides, could not find anyplace to search. Western facing Topanga Canyon, in the Santa Monica Mountains National Recreation Area, is a more plausible site, but I could not find any specimens in three visits. Searches to the east, in the San Gabriel Mountains of Los Angeles and San Bernardino counties, have not revealed the milliped, but a dubious sample is available from Riverside, Riverside County, some 80 mi (128 km) east southeast of the Santa Monicas. This city is inconsistent with the known, coherent ranges of both the genus and species; specimens have not been collected there again; and the precise location in Riverside is unknown. The desert habitat at Riverside is wrong for *M. monica*, whose known environments are more moist with an abundance of trees, so the locality almost surely is wrong. Specimens were examined from the following new localities: **Los Angeles Co.**, Santa Monica Mts., Topanga Cyn. at Greenleaf Cyn., 10M, 5F, 8 December 1966, DLT (LACMNH), and Beverly Glen Cyn., 2M, F, March 1953, collector unknown (NMNH).

Dubious Record. Riverside Co., Riverside, 3M, Fall 1953, L. D. Anderson (UCR).

Remarks. Shelley (1996) showed that Wood's name, *dissecta*, is correctly referrable to *Xystocheir* Cook and that the purported locality, Fort Tejon, is wrong. Consequently, *M. monica*, the oldest of the four available species-group names, is the correct name for this species.

Motyxia kerna Chamberlin

Figs. 9-12

Motyxia kerna Chamberlin, 1941:15, pl. 3, fig. 29. Chamberlin and Hoffman, 1958:39. Buckett, 1964:9. Causey and Tiemann, 1969:25, figs. 4, 19-20.

Type specimen. Male holotype (NMNH) collected by S. and D. Mulaik, 19 March 1942, 7 mi (11.2 km) N Glenville, Kern County.

Diagnosis. Prefemoral process divided basally into narrow, linear lateral, and broad, expanded medial subbranches, former 3/4 as long as latter, not bowed anteriad, latter entirely upright, apically expanded and broadly rounded; solenomere arising basally from acropodite, curving strongly caudolaterad, overlapping and extending slightly beyond margin of process "B"; latter widely segregated basally from solenomere, extending directly laterad basally then curving strongly anteromediad and extending sublinearly ventrad, sides expanding slightly distal to curve then narrowing to narrowly rounded tip; cyphopod with hirsute receptacle (Figs. 9-12).

Variation. The apical expansion of the medial prefemoral subbranch is greater in scattered males, and the solenomere curls dorsad apically in a few males from the vicinity of White River. Measurements of pinned adults are summarized in table 2; the few available females are larger in both dimensions than average males from the same sites, but no geographic trends are evident.

Distribution. Southern Tulare County from the vicinity of Cold Springs Saddle to the adjacent northern fringe of Kern County, extending westward to the vicinity of White River along Arrastre Creek Road, distances of around 10.8 mi (17.3 km), north/south, and 12.8 mi (20.5 km), east/west. Specimens were examined from the following new localities: **Tulare Co.**, 7.3 mi (11.7 km) NE White River, 68M, 15F, 21 February 1965, DLT (FSCA, LACMNH); 1 mi (1.6 km) "below" Sugarloaf Mtn. Park, 18M, 8F, DLT (FSCA); and 7 mi (11.2 km) Greenhorn Mtn. Peak, along CA hwy. 15, M, F, 1 June 1984, T. Schackman (NCSM).

Motyxia sequoiae (Loomis and Davenport)

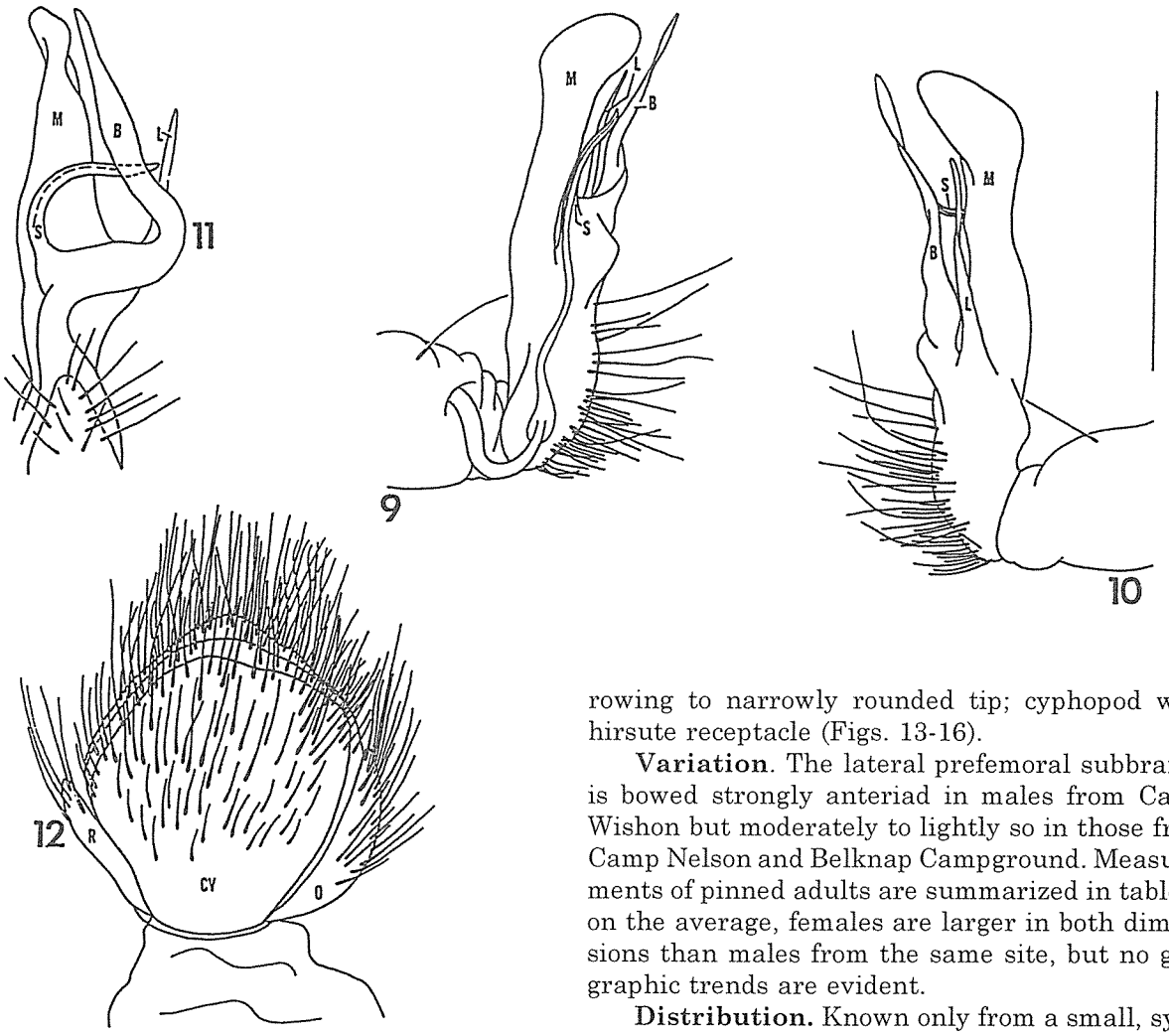
Figs. 13-16

Luminodesmus sequoiae Loomis and Davenport, 1951:271-272, fig. 1.

Xystocheir sequoiae: Chamberlin and Hoffman, 1958:54-55. Buckett, 1964:10.

Motyxia sequoiae Causey and Tiemann, 1969:31, figs. 17-18.

Type specimens. Male holotype and female paratype (NMNH) collected by D. L. Tiemann, 12-14 May 1950, above Camp Nelson, Sequoia National Forest, Tulare County.



Figs. 9-12. *Motyxia kerna*. 9, left gonopod of a male from 3.3 mi (5.3 km) SE White River, medial view. 10, the same, lateral view. 11, acropodite of the same, caudal view. 12, left cyphopod of a female from the same locality, caudal view. L, lateral subbranch of prefemoral process; M, medial subbranch of prefemoral process; R, receptacle; other abbreviations as in figs. 3-8. Scale line = 1.00 mm for all figs.

Diagnosis. Prefemoral process divided basally into relatively narrow, linear lateral and moderately broad, expanded medial subbranches, former 3/4 as long as latter, not bowed anteriad, latter generally upright but curving caudolaterad distally in sigmoid configuration, sides narrowing proximal to curve, expanding greatly distad then narrowing to blunt tip; solenomere arising basally from acropodite, curving strongly caudolaterad, overlapping but not extending beyond process "B"; latter widely segregated basally from solenomere, angling sublaterad basally then curving broadly anteromediad and extending curvilinearly ventrad, sides expanding strongly distal to curve then narrowing to narrowly rounded tip; cyphopod with hirsute receptacle (Figs. 13-16).

Variation. The lateral prefemoral subbranch is bowed strongly anteriad in males from Camp Wishon but moderately to lightly so in those from Camp Nelson and Belknap Campground. Measurements of pinned adults are summarized in table 3; on the average, females are larger in both dimensions than males from the same site, but no geographic trends are evident.

Distribution. Known only from a small, symmetrical area, 4.4 mi (7.0 km) in both dimensions, in the headwaters of the Middle Fork of the Tule River. It extends, north/south, from Camp Wishon to Coy Flat and, east/west, from Cedar Slope to the crossing of Moorehouse Creek by highway 190. No new localities are known.

Motyxia tularea (Chamberlin)

Diagnosis. Prefemoral process divided basally into narrow, linear lateral and broad, expanded, subspatulate medial subbranches, former 1/2-3/4 as long as latter, bowed slightly anteriad, latter upright, apically broad or narrow; solenomere arising subbasally from acropodite, generally upright, at most curving only slightly caudolaterad, barely overlapping process "B"; latter generally upright, sides expanding proximad, narrowing distad to narrowly rounded tip; cyphopod with glabrous receptacle.

Remarks. Intergrades are not available, but two closely similar and narrowly segregated forms,