Hanson (1941) proposed Paraleuctra as a Nearctic genus embracing seven species. Subsequently, the number of accepted Nearctic species has fluctuated between four and nine with descriptions of new species, generic transfers and synonymies. Most of these systematic changes are summarized by Frison (1942), Ricker (1954), Nebeker and Gaufin (1966), Nelson (1977) and Harper and Wildman (1984).

Kawai (1967) recognized the presence of Paraleuctra in Japan and other species are now known from the Russian Far East (Zhiltzova 1974), Thailand (Harper 1977) and China (Yang & Yang 1995). After the work of Shimizu (unpublished) is presented, the total Asian Paraleuctra fauna will include eleven species until the status of several species similar to P. cercia (Okamoto) can be evaluated. Presently the genus includes fifteen Nearctic and Asian species united by these shared features extracted primarily from Hanson (1941) and Nelson (1977): (1) basisternum and pre sternum of prothorax partially fused, (2) basisternum and furcasternum of prothorax fused, (3) medio-cubital crossvein located beyond the fork of Cu1 in the hindwing, (4) median and radial sector veins with separate origins in the forewing, (5) outer paraproct lobes form slender suspensory bars, (6) inner paraproct lobes united into a subanal probe (titillator), (7) epiproct reduced to a small curved hook, (8) male cerci modified, and (9) female subgenital plate usually bilobed. We undertook this study to evaluate the status of the Nearctic species with scanning electron microscopy. The results support recognition of nine Nearctic species, but suggest two of these should be placed in a new genus.

METHODS AND MATERIALS

Legs and wings were removed from specimens stored in 80% ethanol and the bodies were agitated in an ultrasonic cleaner for 30 seconds. Cleaned specimens were dehydrated in 90%, 95% and 100% ethanol solutions for 10 minutes each, then transferred through two, 30 minute washes in hexamethyldisilizane (HMDS). Dehydrated specimens were blotted dry, attached to SEM stubs with double stick copper tape, and sputter coated with gold-palladium before study with SEM.

Specimens used in this study were provided by the following individuals and institutions: A.L. Sheldon Collection, Missoula, Montana (ALS); B.P. Stark Collection, Clinton, Mississippi (BPS); R.W. Baumann, Monte L. Bean Museum, Brigham Young University (BYU); C.R. Nelson Collection, Provo, Utah (CRN); B.C. Kondratieff, C.P. Gillette Museum, Colorado
Pomoleuctra gen. n.


Adult habitus. – Typical leuctrine including small size, dark wings and body and wings rolled around sides of abdomen.

Thoracic features. – Prothoracic basisternum and presternum partially fused forming a ‘spade’ shaped structure (fig. 1). Mesosternal furcasternum reduced in size and not divided by median longitudinal dark line; mesosternal spinasternum long, slender and open to base of metasternal presternum (fig. 4); metasternal presternum narrowly divided into small, almost circular sclerites (fig. 4).

Wings. – Typical paraleuctrine; forewing radial sector and media veins with separate origins; hindwing medio-cubital crossvein located beyond fork of Cu1 (fig. 5).

Male genitalia. – Vesicle present at base of sternum nine (figs. 6, 16, 21); sternum nine projecting caudally and dorsally (figs. 6-7, 16); titillator apex lacking scale-like armature (figs. 9, 19). Cerci with prominent basoventral thumb shaped lobe (fig. 17) and three apical spines (fig. 8).

Female genitalia. – Subgenital plate narrow, strongly sclerotized and deeply and narrowly cleft (figs. 12, 14); margins of plate scalloped (fig. 13). Posterior margin of sternum eight bearing prominent patches of coarse microtrichia adjacent to subgenital plate base (fig. 15). Sternum nine almost completely sclerotized.
Nymph. – Unknown.

Etymology. – The prefix ‘Pomo’ is used to honour the Native Americans of the Coast Range of the Pacific Northwest.

Included species. – *Pomoleuctra andersoni* (Harper and Wildman), *P. purcellana* (Neave), and an undescribed Japanese species (Shimizu unpublished).

Diagnosis. – *Pomoleuctra* species were previously included in *Paraleuctra*, consequently they are identified to that genus in Stewart and Harper (1996) and also in the revised version of Harper and Stewart (1984) given by Shepard and Baumann (1995). *Pomoleuctra* is distinguished from *Paraleuctra* by: (1) the absence of a dark line which divides the mesosternal furcasternum in *Paraleuctra*, (2) the divided metathoracic presternum, (3) the basoventral thumb shaped male cercal lobe and tridentate cercal apex, (4) the prolonged male ninth sternum, (5) the narrow, deeply cleft, marginally scalloped female subgenital plate, and (6) the patches of microtrichia on the hind margin of the female eighth sternum. We regard characters 3, 5 and 6 as apomorphies for *Pomoleuctra* and presence of a dark mesosternal line and fused metathoracic presternal plates as apomorphies for *Paraleuctra*. Although leuctrid cerci are often elaborated with lobes and spines, presence of a basoventral, bluntly rounded lobe and presence of three horn shaped apical spines is unique to *Pomoleuctra*. Similarly, the female characters (5 and 6) we regard as apomorphies for *Pomoleuctra* are apparently restricted to this genus.

Because *Calileuctra* Shepard and Baumann (1995) was not included in the Stewart and Harper (1996) key to Nearctic leuctrid genera, we offer the following key modified from Stewart and Harper (1996) and Shepard and Baumann (1995).

**Key to the Nearctic genera of Leuctridae**

1. Hind wing with six anal veins, forewing usually with an apical stigma ....................... *Megaleuctra*
   – Hind wing with three or four anal veins, forewing without stigma .......................... 2
2. Rs and M veins of forewing arise from a common origin on R .................................. *Perlomyia*
   – Rs and M veins of forewing arise from separate origins on R (fig. 5) ....................... 3
3. Cu1 vein not forked in hind wing ...... *Calileuctra*
   – Cu1 vein of hind wing forked (fig. 5) .......... 4
4. M-Cu crossvein located distal to Cu fork in hind wing (fig. 5) ................................. 5
   – M-Cu crossvein located proximal to Cu fork in hind wing ...................................... 7
5. Basisternum and pre sternum of prothorax completely separated; male tergum nine with a deep V or U-shaped mesal cleft; female terga 1-8 without mesal sclerite ....................... *Zealeuctra*

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**Pomoleuctra andersoni** (Harper & Wildman) **comb. n.**


Material. – California: Humboldt Co., tributary Willow Creek, Hwy 299, 2.3 mi E Berry Summit, 2 May 1999,
Figs. 6-11. *Pomoleuctra andersoni* male terminalia. – 6, sternum nine; 7, caudal aspect of sternum nine and cerci; 8, cercal apices; 9, caudal aspect of titillator (subanal probe); 10, apex of sternal plate; 11, surface macrotrichia of sternal plate bulb. (B = bulb; Ce = cercus; Csp = cercal spines; H = horn; Mp = mesal setal patch; N = notch; Stp = sternal plate; Tl = titillator or subanal probe; Vs = vesicle).


Diagnosis. – Harper & Wildman’s (1984) figures and description identify the features essential for recognition of this species. The outstanding feature of the male is the prolonged ninth sternal plate which terminates in a membranous bulb and a pair of stout, bidentate horns (figs. 7, 10); the bulb surface is covered with peculiar digitate macrotrichia (fig. 11). The subanal probe, partially concealed by this process, is apically notched and bears a pair of short terminally projecting horns (fig. 9) and a lateral pair of smaller, caudally projecting horns; on either side of the notch in caudal and apicolateral aspects are sparse patches of fine setal-like spines. The cercal apex projects downward and bears a large, usually tridentate spine (fig. 8); a thumb shaped basoventral cercal lobe projects inwardly in most specimens.

The female subgenital plate is a stalked, bilobed structure arising from the sclerotized margin of sternum eight; basolateral to the plate are a pair of projecting horns (fig. 12); the hind margin of sternum eight beneath the plate bears a patch of microtrichia. Margins of the plate near the apex are coarsely scalloped (fig. 13).

Distribution. – Cascade and Coast Range Mountains from northern California to central Oregon.

Pomoleuctra purcellana (Neave) comb. n.


Figs. 16-21. *Pomoleuctra purcellana* male terminalia. – 16, sternum nine; 17, cerci with basoventral lobe; 18, caudal aspect of titillator; 19, lateral aspect of titillator; 20, titillator apex; 21, vesicle.
Diagnosis.—Baumann et al. (1977) presented the most recent figures for this species. These clearly show the three apical spines and thumb shaped basoventral cercal lobe of the male, and the narrow, deeply cleft female subgenital plate. The male cercus is shown in fig. 17 and the female subgenital plate and detail of the microtrichial patches of sternum eight in figs. 14-15. The male ninth sternum is prolonged, but not so much as in \textit{P. andersoni} (fig. 16) and a small hairy vesicle occurs at the base of the sternum (fig. 21). The subanal probe is slender, sclerotized to the tip, and deeply notched (figs. 18-20). Basolaterally the probe bears a strip of scale-like armature and the caudal margins of the notch are lined with fine setal-like spines; below the notch in anterior aspect are a pair of triangular flaps (fig. 20).

Distribution.—Northern Rocky Mountains from Alberta and British Columbia to Wyoming and eastern Oregon.

Key to Nearctic \textit{Pomoleuctra} species

1. Apex of male sternum nine greatly prolonged into a slender probe which covers the subanal probe (fig. 7); projecting portion of female subgenital plate about three times long as wide, and with laterally projecting horns at base of plate (fig. 12) \textit{andersoni} ..........................................................\textit{andersoni}

– Apex of male sternum nine moderately prolonged, not covering subanal probe (fig. 16); projecting portion of female subgenital plate slightly longer than wide and lacking basal horns (fig. 14) \textit{purcellana} ..........................................................\textit{purcellana}

\textit{Paraleuctra} Hanson

Type Species.—\textit{Leuctra occidentalis} Banks 1907:329, by original designation, Hanson 1941:57.

The seven remaining Nearctic species currently placed in \textit{Paraleuctra} represent three distinct species groups. Baumann et al. (1977) proposed the \textit{P. sara} (Claassen) group for those species ‘...characterized by a simple elongate titillator’ and the \textit{P. occidentalis} (Banks) group for species having ‘...a titillator with an enlarged variable apex.’ Nelson (1977) independently recognized the \textit{P. sara} species complex, although without a formal name, and included three Asian species and \textit{P. divisa} (Hitchcock) in the group. We regard \textit{P. divisa} as sufficiently different from other \textit{Paraleuctra} to be placed in a separate group. The following key will permit separation of Nearctic \textit{Paraleuctra} species.

Key to males of Nearctic \textit{Paraleuctra} species

1. Caudal and lateral aspects of subanal probe swollen (figs. 22, 40); posterior margin of sternum nine bilobed (fig. 23) .................................2

– Caudal and lateral aspects of subanal probe apex not swollen (figs. 24-25); posterior margin of sternum nine truncate to slightly emarginate ....4

2. Lateral aspect of subanal probe apex without posteriorly projecting lobe (fig. 42); dorsal aspect of subanal probe not conspicuously narrowed at apex (fig. 43) .............................................\textit{projecta}

– Lateral aspect of subanal probe apex with posteriorly projecting lobe (fig. 44); dorsal aspect of subanal probe notched at apex (fig. 45) .......................3

3. Dorsal aspect of subanal probe abruptly constricted subapically (fig. 41); lateral aspect of subanal probe apex with little development of anterior lobe (fig. 40) .............................................\textit{jewetti}

– Dorsal aspect of subanal probe gradually narrowed to apex (fig. 45); lateral aspect of subanal probe apex with large anterior lobe (fig. 45) ....

...........................................................................\textit{occidentalis}

4. Cerci simple, apex undivided (fig. 24) \textit{divisa}

– Cerci deeply bifurcate (fig. 25) ...........................................5

5. Vesicle at base of sternum nine well developed and densely hirsute (fig. 38); lower prong of cerci without secondary projection (fig. 26) \textit{vershina}

– Vesicle at base of sternum nine obsolete, usually with few setae (fig. 37); lower prong of cerci typically with a secondary projection (fig. 25) .....6

6. Cercal prongs subequal in size, tips somewhat convergent (fig. 27); western North America ....

...........................................................................\textit{jewetti}

– Lower cercal prong larger than upper, tips strongly divergent (fig. 25); eastern North America ..... \textit{andersoni} ..........................................................\textit{andersoni}

Key to females of Nearctic \textit{Paraleuctra} species

1. Subgenital plate produced into a narrow, tongue shaped structure, rounded or slightly emarginate at apex (fig. 46) \textit{divisa} ..........................................................\textit{divisa}

– Subgenital plate broad, with shallow apical notch (fig. 30) ..........................................................2

2. Subgenital plate base at least partially fused to sternum seven (fig. 32); basolateral membranous lobes usually present on sternum eight (fig. 32)...

...........................................................................\textit{jewetti}

– Subgenital plate base not fused to sternum seven (fig. 30); basolateral membranous lobes absent from sternum eight .................3

3. Eastern North America ...........................................\textit{sara}

– Western North America ...........................................\textit{forcipata} ..............................................\textit{forcipata}

4. Shelf along margins of subgenital plate notch irregularly toothed (fig. 30); lateral membranous areas on sternum eight unpigmented .... \textit{divisa}

– Shelf along margins of subgenital plate notch rel-
atively smooth (fig. 31); lateral membranous areas on sternum eight with light pigmentation ....

The P. divisa Group
Members of this group are characterized by (1) simple unmodified male cerci, (2) a short, thick male subanal probe, and (3) a narrow, tongue shaped female subgenital plate. Only one species P. divisa (Hitchcock) is currently included in the group.

**Paraleuctra divisa** (Hitchcock)
*Leuctra divisa* Hitchcock 1958:77. Holotype \( \delta \), Woodacre, Marin Co., California (CAS).


Diagnosis. – Males, redescribed by Nelson (1977), are recognized by virtue of the simple cerci (fig. 24). The previously undescribed females have forewing lengths of 6-8 mm and differ from other *Paraleuctra* in the subgenital plate structure and in the shape of the ninth abdominal sclerite (fig. 46). The subgenital plate as suggested by Hitchcock (1958) is a narrow, tongue shaped structure with a truncate, rounded, or slightly emarginate apex. Sternum nine bears a strap-like sclerite that is not conspicuously excavated across the sternum as in other members of the genus.

Distribution. – Currently known from the Coast Range of northern California.

The P. occidentalis Group
Members of this group are characterized by (1) an apically swollen subanal probe, (2) bifurcation of male cerci at about the apical 4th of cercal length, (3) apex of male sternum nine bilobed, and (4) female sternum eight partially fused to sternum seven. This group includes three Nearctic and several Asian species (Shimizu unpublished).

**Paraleuctra jewetti** Nebeker & Gaufin
*Paraleuctra jewetti* Nebeker & Gaufin 1966: 255. Holotype \( \delta \), Big Cottonwood Creek, Salt Lake Co., Utah (USNM).

Material. – Colorado: Grand Co., Frazier River, Hwy 40, Midland Campground, 27 June 1962, 1 \( \overset{\text{♀}}{\text{♀}} \) (BPS). Utah: Salt Lake Co., Mill Creek, top of canyon, 23 May 1966, R.W. Baumann, 4 \( \overset{\text{♀}}{\text{♀}} \), 1 \( \overset{\text{♀}}{\text{♀}} \) (BYU). Utah Co., Stewart Creek, above Sundance, 30 April 1981, S.W. Szcztyko, 1 \( \overset{\text{♀}}{\text{♀}} \) (SWS).

Diagnosis. – The distinctive features of the male of this species are well illustrated by Nebeker & Gaufin (1966) and Baumann et al. (1977). The male is most easily recognized from the dorsal aspect of the titillator (fig. 41); in this aspect the swollen apex is abruptly narrowed and in lateral aspect (fig. 40), the caudal projection is greater than the anterior projection. The stem of the probe is sparsely armed with spines (fig.
51) and the cercal arms are usually small and convergent (fig. 52). Females are indistinguishable from those of *P. occidentalis* and *P. projecta* (Frisson). The holotype, originally at the University of Utah, is now at the USNM (Baumann & Gaufin 1974).

**Distribution.** – Currently known from Colorado, Montana and Utah.

**Paraleuctra occidentalis** (Banks)


**Diagnosis.** – Males of this species are distinguished from those of *P. jewetti* and *P. projecta* by comparing the subanal probe apex in dorsal and lateral aspect (Nebeker & Gaufin 1966; Baumann et al. 1977). In dorsal aspect the swollen apex is gradually constricted to a rounded tip (fig. 45), and in lateral aspect the apex projects in both anterior and caudal directions from the stem; the anterior projections are often recurved as flaps (fig. 44). The subanal probe stem is armed with long, slender spines (fig. 49) and the cercal arms are usually divergent and often bear a projection on the ventral arm (fig. 50). Females are indistinguishable from those of *P. jewetti* and *P. projecta*.

**Comments.** – Ricker (1965) suggested the *P. dubia* holotype might be a ‘gynandromorphic specimen of *P. occidentalis*’ and later (Ricker 1992) stated in reference to this specimen, ‘it is actually a gynandromorph, probably of *occidentalis* or *vershina.*’ The figures given by Ricker (1965) certainly support the interpretation of the holotype as a gynandromorph, and the strongly bilobed ninth sternum shown in those figures suggests the correct synonym is *P. occidentalis*.

**Distribution.** – Western mountains from Alaska to southern California and New Mexico.
**Leuctra projecta** (Frison), sp. rev.


**Paraleuctra rickeri** Nebeker & Gaufin 1966:258. Syn. n.


Diagnosis. – The male subanal probe distinguishes this species from closely related congeners (Nebeker & Gaufin 1966, Baumann et al. 1977). In dorsal aspect (fig. 43) the swollen apex is little constricted and in lateral aspect there is only a slight caudal projection at the apex (fig. 42). Stem armature consists of relatively dense clusters of long thin spines (fig. 47); the ventral cercal arm is typically truncate or bifid (fig. 48). Females are indistinguishable from those of *P. jewetti* and *P. occidentalis*.

Comments. – *Paraleuctra projecta* has languished in the synonymy of *P. occidentalis* since Ricker (1954) dealt with the tangled nomenclature surrounding that species. Subsequently the holotype of *P. projecta* seems not to have been examined even though Frison’s (1942) cercal figure strongly suggests that either *P. jewetti* or *P. rickeri* might be a synonym. Our study of the male holotype indicates it is of the *P. rickeri* type with only slight apical constriction of the subanal probe, consequently *P. rickeri* becomes a junior synonym of *P. projecta*.

Distribution. – Western mountains from Washington and Montana to New Mexico.

The *P. sara* Group

Members of this group are characterized by (1) a slender subanal probe, (2) deeply bifurcate male cerci, (3) apex of male sternum nine truncate or slightly emarginate, and (4) female sternum eight not fused to sternum seven. The *P. sara* Group includes three Nearctic and at least four Asian species (Kawai 1967; Zhiltzova 1974; Harper 1977; Yang & Yang 1995).

**Leuctra forcipata** (Frison)


Diagnosis. – Males of this species are recognized by the approximately equal upper and lower cercal prongs (fig. 27) and by the extreme reduction of the vesicle (fig. 36). Females have the subgenital plate notch margin irregularly dentate and the lateral membranous areas of sternum eight are unpiugmented (fig. 30).

Distribution. – Western North America from Alaska to Montana and northern California.

**Paraleuctra sara** (Claassen)


Diagnosis. – *Paraleuctra sara*, the only member of the genus in eastern North America, is most similar to *P. vershina* Gaufin & Ricker in male cercal structure
but the lower prong typically bears a basal knob (fig. 25) and the vesicle is poorly developed (fig. 37). Females cannot be reliably distinguished from Paraleuctra vershina females except on a geographical basis.

**Distribution.** Eastern North America from the Maritime Provinces and Ontario to South Carolina and Tennessee.

*Paraleuctra vershina* Gaufin & Ricker

*Paraleuctra vershina* Gaufin & Ricker 1974:285. Holotype \( \delta \), City Creek, Salt Lake Co., Utah (USNM).


**Fig. 46.** Paraleuctra divisa female terminalia.

Diagnosis. – Adults of *Paraleuctra vershina* are similar to the eastern species, *P. sara*, as noted above, and these can be separated on a geographical basis. In the northern Rocky Mountains, Cascades and Coast Ranges, *Paraleuctra vershina* may be taken with *P. forcipata*. Males of these species are separated by shape of the cercal prongs (fig. 26) and by the much reduced vesicle of *P. forcipata* (fig. 36). Females of these species are separated by the irregular teeth found along the notch margin in *P. forcipata* (figs. 30-31).

**Distribution.** Western mountains from Alaska and South Dakota to southern California and New Mexico.

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