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DESCRIPTION AND PROVISIONAL TAXONOMIC DESIGNATION OF AN UNASSOCIATED LARVAL STONEFLY FROM LINN COUNTY, OREGON (PLECOPTERA: PERLODIDAE: *ISOPERLA* SP. A)

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ABSTRACT

An unassociated female stonefly larva from Marion Creek, near Marion Falls, Linn County, Oregon, is described under a provisional designation and compared with larvae of other western Nearctic *Isoperla* species. The lacinia is distinct from the known western larval species.

Keywords: Plecoptera, *Isoperla* larval description, lacinial morphology

INTRODUCTION

In May 2001, Kenneth W. Stewart, Bill P. Stark and the author came together for a memorable western North American stonefly excursion. One of the streams visited was Willis Creek, a tributary of Marion Creek, near Marion Falls, Oregon. Our objective then, was to collect and describe the larva of *Megaleuctra complicata* Claassen (Stewart & Sandberg 2004). After successfully collecting three *Megaleuctra* larvae from adjacent spring seeps of Willis Creek, the author ventured downstream to collect additional larvae from Marion Creek stream margins, near the confluence with Willis Creek. A single female *Isoperla* Banks larva with a distinctive lacinia was collected. The identity of this larva, and a single exuviae collected during several subsequent visits, was not associated with an adult despite extensive rearing and larval association efforts by Sandberg (2011) and Sandberg & Kondratieff (2013). The purpose of this description is to encourage continued efforts to rear and associate this larva to one of the known western species whose larva remains undescribed (Table 1, see question marks), or to describe a new *Isoperla* species when all life stages become available.

MATERIALS & METHODS

The left and right maxillae (lacinia, galea and maxillary palp) from one female larva were dissected and mounted following the methods of Sandberg (2011). Color photomicrographs were taken following Sandberg & Kondratieff (2013) except that only a 0.5x camera adapter was used for the larval head, pronotum, thorax and abdomen. The current larval description used taxonomic character definitions and illustrations in Sandberg (2011, Results & Figure 1). Additionally, the systematic list in Sandberg (2011, Table 1), incorrectly characterized the male of *I. laucki* Baumann & Lee with a membranous aedeagus instead of a sclerotized process (Sandberg & Kondratieff 2013). Specimens are deposited in the J.B. Sandberg collection (JBSC), Paradise, California.

Table 1. Systematic list and larval lacinia primary characters of 28 western Nearctic *Isoperla* species, and one provisional taxon (*Isoperla* species A) arranged within adult species complexes.

Species Complex	Western Nearctic Species	Larval Lacinia Primary Character				
		Apical ventral setae	Sub-marginal Row (SMR)	Thin Marginal Seta (TMS)	Dorsal Setae (DS)	Dorsal Surface Setae (DSS)
		R/B	**C/I**	**P/A**	**P/A**	**P/A**
I. quinquepunctata	*I. acula* Jewett	R	I	P	P	P
	I. jewetti Szczytko & Stewart	?				
	I. longiseta Banks	?				
	I. mormona Banks	R	I	P	P	P
	I. quinquepunctata (Banks)			P		
I. phalerata	*I. phalerata* Needham	R	I	?		
	I. pinta Frison			P	P	P
I. sobria	*I. baumanni* Szczytko & Stewart	R	I	P	P	P
	I. gravitans (Needham & Claassen)	?				
	I. miwok Bottorff & Szczytko	R	I	P	P	P
	I. sobria (Hagen)			P		
	I. tilasqua Szczytko & Stewart			P		
I. marmorata	*I. fulva* Claassen	R	I	P	P	P
	I. marmorata Needham & Claassen			P		
	I. roguensis Szczytko & Stewart			P		
I. sordida	*I. adunca* Jewett	R	C	P	P	A
	I. bifurcata Szczytko & Stewart		I	P		P
	I. denningi Jewett			P		A
	I. fusca Needham & Claassen	?				
	I. petersoni Needham & Christenson	R	I	?		
	I. rainera Jewett			?		
	I. sordida Banks			P	P	P
	I. umpqua Szczytko & Stewart			P	A	
Unassigned	*I. decolorata* (Walker)	?				
	I. katmaiensis Szczytko & Stewart	?				
	I. marlynia (Needham & Claassen)	R	I	?		
	I. laucki Baumann & Lee			P	P	P
	I. transmarina (Newman)			?		
	Isoperla species A	B	N/A	P	A	P

R = arranged into marginal & submarginal rows, B = band of setae, C = continuous submarginal row, I = interrupted submarginal row, P = present, A = absent, ? = not described or incompletely described.

RESULTS

Twenty-three western Nearctic larval species placed into five species complexes proposed by Szczytko & Stewart (1979) and six other unassigned western species are listed with the four primary lacinia characters used in this study (Table 1). Eleven of these western species remain without complete larval or lacinia descriptions.

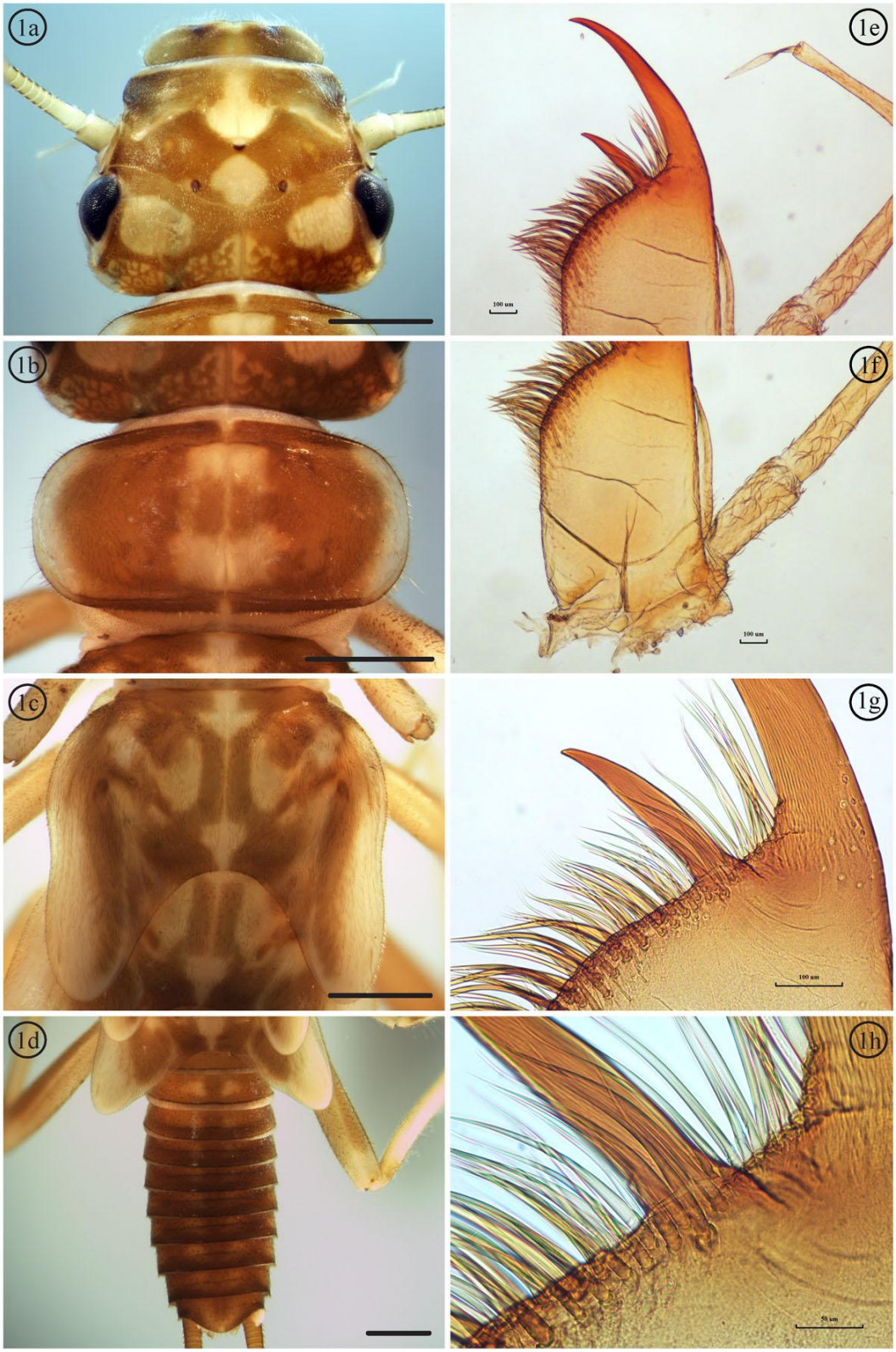
Isoperla species A
(Figs. 1a-h)

Material examined. OR: Linn County, Marion Creek, near confluence with Willis Creek, 44.60186°N, 121.93892°W, 17/V/2001, K.W. Stewart, B.P. Stark, J.B. Sandberg, 1♀ Larva; Marion Creek, Hwy 22 bridge, Marion Forks, 44.61457°N, 121.94859°W, 09/VI/2011, J.B. Sandberg, 1♀ Exuvia.

Body length of mature female larva 12.5 mm. Dorsum of head with contrasting pigment pattern and a mixture of fine light and dark clothing setae, anterior frontoclypeus margin unpigmented; light M shaped pattern anterior to median ocellus with median longitudinal light band extending almost to light frontoclypeus area, separated by thin light brown pigment band, lateral thin arms with nearly parallel margins connected to median light band, directed posteriorly and extending to antennal bases; posterior ocelli with completely enclosed small light areas along outer lateral margins; interocellar area partially light, somewhat triangular and completely enclosed by dark pigment, light area extending past posterior ocelli, not reaching dark pigment below the arms of the epicranial suture; occiput with irregular spinule band extending from behind eye to near median epicranial suture, completely enclosed by light brown pigment (Fig. 1a). Lacinia bidentate, total length 1619-1640 µm (Figs. 1e-h, Tables 1-2); apical ventral setae not arranged in rows like other western species, size ranging from long stout and striated to short and fine, concentrated apically forming a patch ranging from a thin continuous row to a wide concentrated band (Figs. 1 e-f); 18–20 setae begin as a single stout row along the outer ventral apical lacinia margin between AT inner margin and SAT outer margin, continuing as a submarginal band (2-3 setae wide) in front of SAT, plus 1 thin marginal seta (TMS) adjacent to AT inner margin (Figs. 1 g-h), dorsal seta (DS) absent; ventral apical setal band widening past the SAT inner margin (Figs. 1g-h); ventral apical setal band thickest and individual setae longest near the junction of apical and inner palm margins (Figs. 1e-f); ventral apical setal band continues toward base along inner lacinia margin, setae abruptly decrease in size and concentration before reaching the middle of inner margin, and the smallest sparsely concentrated setae end at approximately ¾ the inner lacinia margin length (Figs. 1e-f); dorsal surface setae (DSS) form a thin sparse band projecting at a slight angle from the apical margin, the first DSS located below SAT inner

Table 2. *Isoperla* species A (1 female larva) lacinia and galea seta counts, lacinia length and angle measurements, and galea-maxillary palp length measurements from the left and right maxillae. Submarginal - (A+B), A, and B; marginal - C; ventral surface setae (VSS) - D; and galea surface (S) and apical (A) setae from Sandberg (2011, Figure 1a, Table 2). TL = total length, ATL – apical tooth length, SATL = subapical tooth length, PL = palm length, PWA = apical palm width, PA° = palm angle, PWB = basal palm width from Sandberg (2011, Figure 1a, Table 3). GL = galea length, PL 1–5 = palp segment length 1–5 from Sandberg (2011, Figure 1a, Table 4).

Lacinia & Galea Setae Counts						
Submarginal			**Marginal**	**VSS**	**Galea**	
(A+B)	**A**	**B**	**C**	**D**	**S**	**A**
Not applicable - continuous band of numerous setae					42	2
Range of Lacinia Character Lengths (µm) & Angle						
TL(ATL+PL)	**ATL**	**SATL**	**PL**	**PWA**	**PA°**	**PWB**
1619-1640	627-639	305-308	979-1012	358-444	64-68	551-572
Range of Galea & Maxillary Palp Segment Lengths (µm)						
GL	**PL 1**	**PL 2**	**PL 3**	**PL 4**	**PL 5**	
713	01-104	85-463	785	742-760	316-331	



Figs. 1a-h. Provisional taxon *Isoperla* species A, nymph and ventral maxillae, Marion Creek, Linn County, OR. Larval black bars = 1 mm, (Figs. 1a & c = 32x, Fig. 1b = 40x, Fig. 1d = 20x, Figs. 1e-f = 40x, Fig. 1g = 100x, Fig. 1h = 200x).

margin, sparse band continuing along apical and inner palm margins, ending before posterior-most ventral surface setae, best observed un-mounted under dissecting microscope. Galea with 42 setae in thick ventral row, apex with 2 setae. Maxillary palp segments 2–3 with curved, apically rounded setae. Pronotum with median longitudinal light area bisected by central irregular brown bands and bordered by wide dark bands typical of the *I. marmorata* complex; discs each with a few variable dark rugosites concentrated along inner margins of dark brown bands and fine dark clothing setae distributed mostly upon dark pigment, lateral margins with broad light bands (Fig. 1b). Meso and metanotum with contrasting pigment pattern and fine dark clothing setae (Fig. 1c). Legs with numerous fine golden clothing setae and scattered erect spines on outer surface of femora, erect spines longest and concentrated along dorsal and two longitudinal ventral surfaces; fine silky setae sparse on dorsal surface of femora, numerous and continuous on tibia; distal femora with light transverse band, proximal tibia with dark transverse band. Abdominal terga with three longitudinal dark stripes (Fig. 1d); a pair of sub-median light areas enclosed by dark pigment form a wide light median longitudinal band bisected by median dark pigment; lateral pair of dark longitudinal stripes extending to lateral abdominal margins; scattered fine light clothing setae and erect spines dorsally; posterior margin with scattered long and numerous short spines in a concentrated row.

Distribution. Oregon, near eastern Mt. Jefferson Wilderness.

Diagnosis. There is no other known western *Isoperla* species with setae arranged in a large and continuous patch on the ventral lacinia surface. The known western Nearctic species have marginal and submarginal ventral setae arranged in a continuous or interrupted row along the apical or inner margins of the larval lacinia (Table 1).

Remarks. *Isoperla* species A larvae co-occurred with *I. marmorata* Needham & Claassen, *I. sobria* (Hagen), and an unidentified *Isoperla* species female without an extended subgenital plate.

DISCUSSION

The current western Nearctic *Isoperla* larval key (Sandberg 2011) includes 15 species in California plus two species from Oregon and Colorado, but remains incomplete for 11 other western Nearctic species (Table 1). These species require additional descriptive studies with larval rearing and laboratory everted adult males so that a better understanding of their taxonomic and systematic positions can be assessed. Successful live larval collection for rearing involves revisiting streams several times before adult emergence begins (from 1 to 4 months) to ensure sufficient numbers of male larvae are collected (Sandberg 2011).

In this study, the *Isoperla* species A lacinia is distinct from all known western larval species with published descriptions (Table 1) (Sandberg 2011, Szczytko & Stewart 1979; 2002; 2004; 2013). The ventroapical setae are tightly packed into a band which extends the entire width of the angled apical lacinia margin, continuing along the longitudinal inner lacinia margin, and ending before reaching the basal lacinia margin. *Isoperla* species A also lacks the stout dorsal seta (DS). All other western larval *Isoperla* species with published and complete descriptions have lacinia with apical ventral setae arranged in marginal and submarginal rows and most possess the dorsal seta (DS) except *I. umpqua* Szczytko & Stewart.

Sandberg (2011) characterized 17 western North American *Isoperla* larvae within three morphological groups based upon the arrangement of apical ventral setae of the lacinia submarginal row. *Isoperla* species A lacinia setae are not strictly arranged into marginal and submarginal rows, however, there is a short close set section of 18–20 setae between the apical and subapical teeth (Figs. 1g-h) that is similar to the second group "..with 2–7 close set submarginal row (A) setae.." in Sandberg (2011, Figures 5h, 19h, *I. sobria* complex in part). A second character shared by three of the five species in the *I. sobria* complex and the female *Isoperla* sp. A larva is the long curved apically rounded setae on maxillary palp segments 2–3 (Sandberg 2011). And lastly, based only upon the pronotal pigment pattern, *Isoperla* sp. A with wide dark bands on each disc, may also align with the *I. marmorata* complex (Sandberg 2011).

From these comparisons, the female *Isoperla* species A larva may belong to either the *I. marmorata* or *I. sobria* complex representing either a new

western species or an undescribed (or incompletely described) larva of an existing western species (possibly *I. gravitans* Needham & Claassen). During the first attempts to determine this larva's generic identity, the lacinia was found be similar in shape and setation to *Calliperla luctuosa* (Banks) and the two known *Cosumnoperla* Szczytko & Bottorff species (Bottorff 2007, Szczytko & Bottorff 1987, Szczytko & Stewart 1984). *Isoperla* species A is distinct from these Perlodidae genera by possessing an apical fringe of fine silky setae on the cerci and possessing straight mesosternal Y-arms. Although the larval *Isoperla* species A currently keys to genus *Isoperla* (Stewart & Stark 2002), it is also possible that it may represent a new isoperline genus based upon the distinctiveness of the lacinia setal band. Only a reared and associated adult male will confirm its identity.

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