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Oregonanura cascadensis, a new genus and species of Paranurini from North America (Collembola: Neanuridae: Neanurinae)

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Abstract. *Oregonanura cascadensis*, a new genus and species of Paranurini from North America is described and illustrated. Taxonomic remarks are given.

Among the six subfamilies included in the family Neanuridae, Neanurinae is the most species-rich, widespread and diverse (Hopkin 1997). In 1989, Cassagnau erected six tribes within subfamily Neanurinae, namely Lobellini, Neanurini, Morulodini, Sensillanurini, Paleonurini and Paranurini. Members of all outlined have been recorded from North America. However, it seems that mostly species of Morulodini, Sensillanurini and Paranurini constitute a dominant group of Neanurinae on the continent (Fjellberg 1985, Christiansen & Bellinger 1998). The last mentioned tribe, Paranurini, currently comprises 37 members, placed in two genera: *Paranura* Axelson, 1902 and *Nahuanura* Palacios-Vargas et Najt, 1986 (Palacios-Vargas & Najt 1986, Deharveng 1989, Cassagnau 1991, Christiansen & Bellinger 1992, Palacios–Vargas & Penaranda-Parada 2005, Palacios–Vargas & Simón Benito 2007). Up to now four representatives of the genus *Paranura* were known from North America (Fjellberg 1984, 1985; Christiansen & Bellinger 1998).

During ecological investigations of old–growth forest springtails at the H. J. Andrews Experimental Forest Long Term Ecological Research site and its surroundings (western Cascade Range of Oregon, USA), a new species belonging to the tribe Paranurini was discovered. It exhibits remarkable and unique features in the presence of well developed tubercles and reticulations on all segments, easily separating it from the other Paranurini and supporting proposal of a new genus. Its description and taxonomic remarks are presented below.

Materials and Methods

Specimens were collected from litter samples (from two study areas ''Mona Creek'' and ''Cougar 1'', see Type material). Each sample was carefully cut with an entrenching tool from ground to a depth of circa 5 cm. Organisms were extracted from the samples using a Tullgren apparatus. The specimens thus obtained were cleared in potassium hydroxide and chloral phenol, then mounted on slides in Swan's medium (distilled water, chloral hydrate, glacial acetic acid, glucose, Arabic gum) and observed using a Nikon Eclipse 80i phase contrast microscope. All drawings were prepared using the camera lucida. Terminology and abbreviations used in text and tables are those of Deharveng (1983), Deharveng and Weiner (1984) and Greenslade and Deharveng (1990). The following abbreviations are used; general morphology: abd.–abdomen, ant.–antenna, Cx–coxa, Fe–femur, Scx2–subcoxa 2, T–tibiotarsus, th.–thorax, Tr–trochanter, VT–ventral tube; groups of setae: Ag–antegenital, Fu–furcal, Ve–ventroexternal, Vi–ventrointernal, Vl–ventrolateral; tubercles: Af–antenno–frontal, Cl–clypeal, De–dorsoexternal, Di–dorsoin-

ternal, Dl–dorsolateral, L–lateral, Oc–ocular, So–subocular; types of setae: Ml–long macroseta, Mc–short macroseta, Mcc–very short macroseta, me–mesoseta, mi–microseta, ms–s–microseta, S– or s–seta sensualis or sensillum, or–organite of antenna IV, i–ordinary seta on antenna IV, mou–thin cylindrical sensilla on ant. IV (''soies mousses''), x–labial papilla x.

Oregonanura gen.nov.

Type species. Oregonanura cascadensis sp. nov.

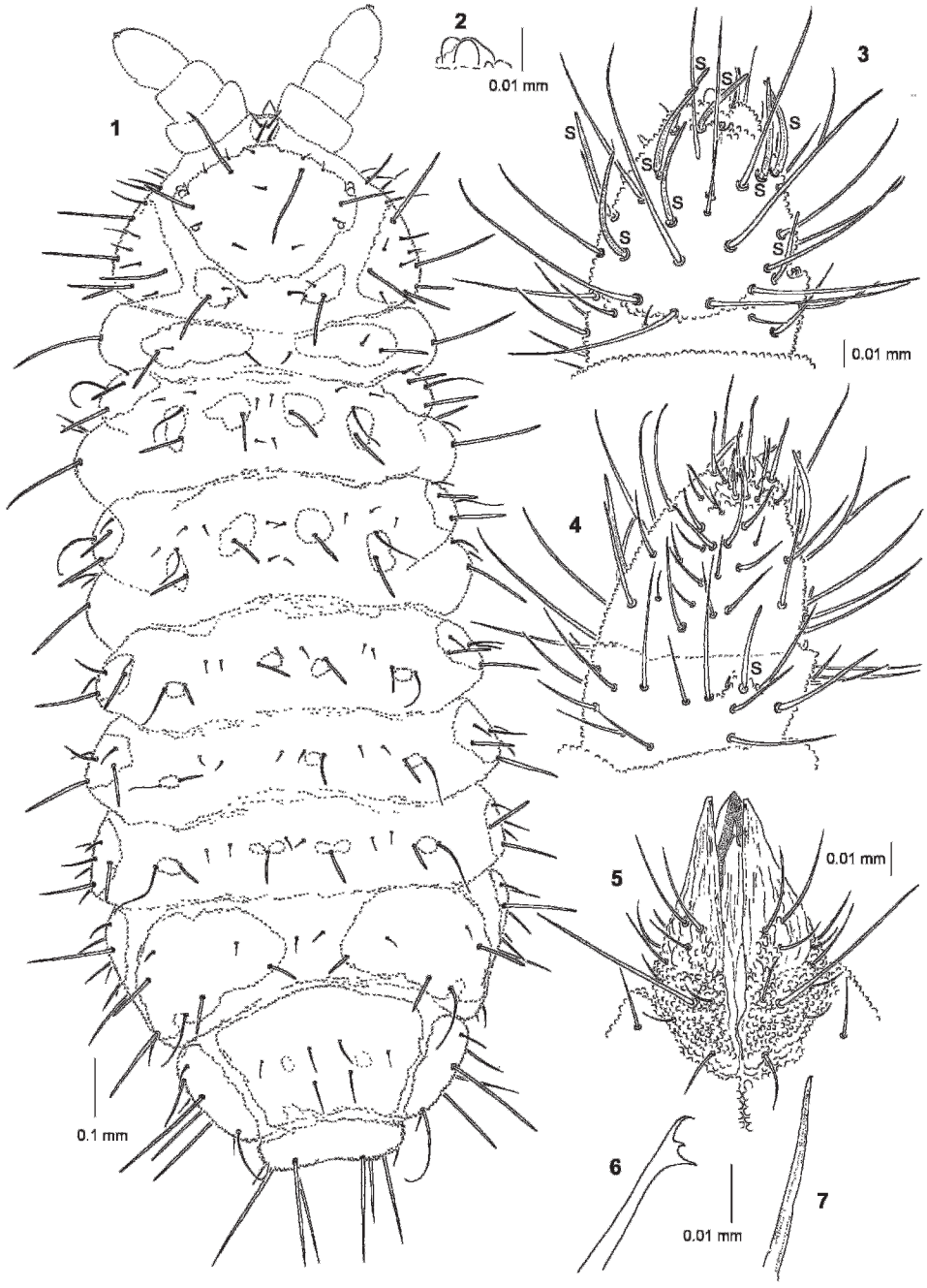
Etymology. Genus is named after state of Oregon, USA.

Diagnosis. Collembola, Neanurinae, Paranurini. Blue hypodermic pigment present on whole body; 3+3 dark pigmented eyes, included in tubercle (Af+2Oc). Dorsal tubercles and reticulations present, strongly developed. Ant. IV with 8 subequal S–setae. Labral chaetotaxy 4/2, 4. Mouth part reduced; maxilla styliform, mandible slender. Tubercles Af and Oc on head fused into a large single mass. Setae A on head distinctly shorter than setae B. Lateral tubercles Dl, L and So on head fused. Chetal groups Di and De on head separate. Tubercles Di on head not differentiated. The line of setae Di2–De2 crosses the line Di1–De1 on head (the cross–type, Deharveng 1983). Tubercles Di and De on thorax I fused. Tubercles Dl and L on abdominal segments I–III fused. Tubercles Di, De and Dl on abdomen IV fused into a large mass. Tubercles Di on abd. V separate or fused along midline. Furca rudimentary with 8 microsetae. Cryptopygy absent, abdomen VI not bilobate. Tibiotarsal chaetotaxy 19, 19, 18. Claw untoothed.

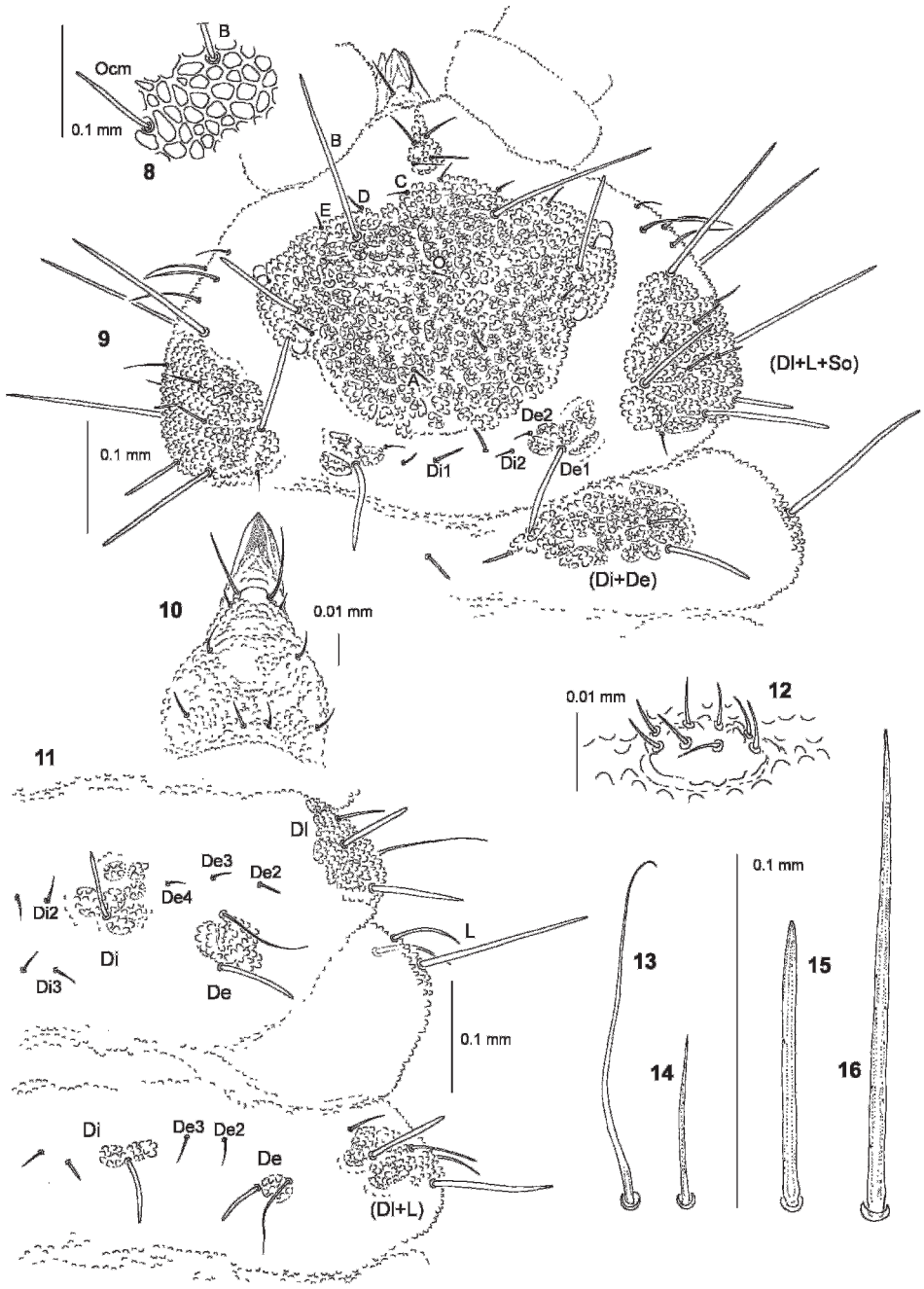
Discussion. Oregonanura gen.nov. differs from both Paranurini genera, *Paranura* Axelson, 1902 and *Nahuanura* Palacios-Vargas et Najt, 1986, by having strongly developed tubercles on dorsal and lateral side of all body segments. According to Cassagnau (1986, 1989), Neanurinae species without or with a poorly (incomplete) developed tubercles are the most primitive. The new genus is, so far, the most tuberculated taxon of Paranurini and therefore can be conisdered as a representative of the most advanced and specialized lineage of the tribe. The remaining above–mentioned genera have a incomplete or absent somatic tuberculation. At present the close taxonomic relationships between *Oregonanura* gen nov. and other Paranurini remain unclear and necessarily need further studies. However, the new genus appears to be related to *Nahuanura ome* Palacios–Vargas et. Simón Benito, 2007, described recently from Mexico (Palacios–Vargas & Simón Benito 2007). The Mexican species has like *Oregonanura* developed tubercles (the presence of reticulations and enlarged granules) dorsally, but they are poorly developed and only on dorsal side of head, thorax and abdominal segments IV–V. Besides these characters, they differ in some other essential features: position of eyes (located in central tubercle in *Oregonanura*, not in *Nahuanura ome*), differentiation of shape and length of dorsal ordinary setae (present in *Oregonanura*, absent in *Nahuanura ome*), number of microsetae on furcal remnant (8 in *Oregonanura*, 6 in *Nahuanura ome*) and the length of abdominal segments IV and V (same length in *Oregonanura*, abd. V markedly shorter than IV in *Nahuanura ome*).

Oregonanura cascadensis sp. nov.
(Figs. 1–20)

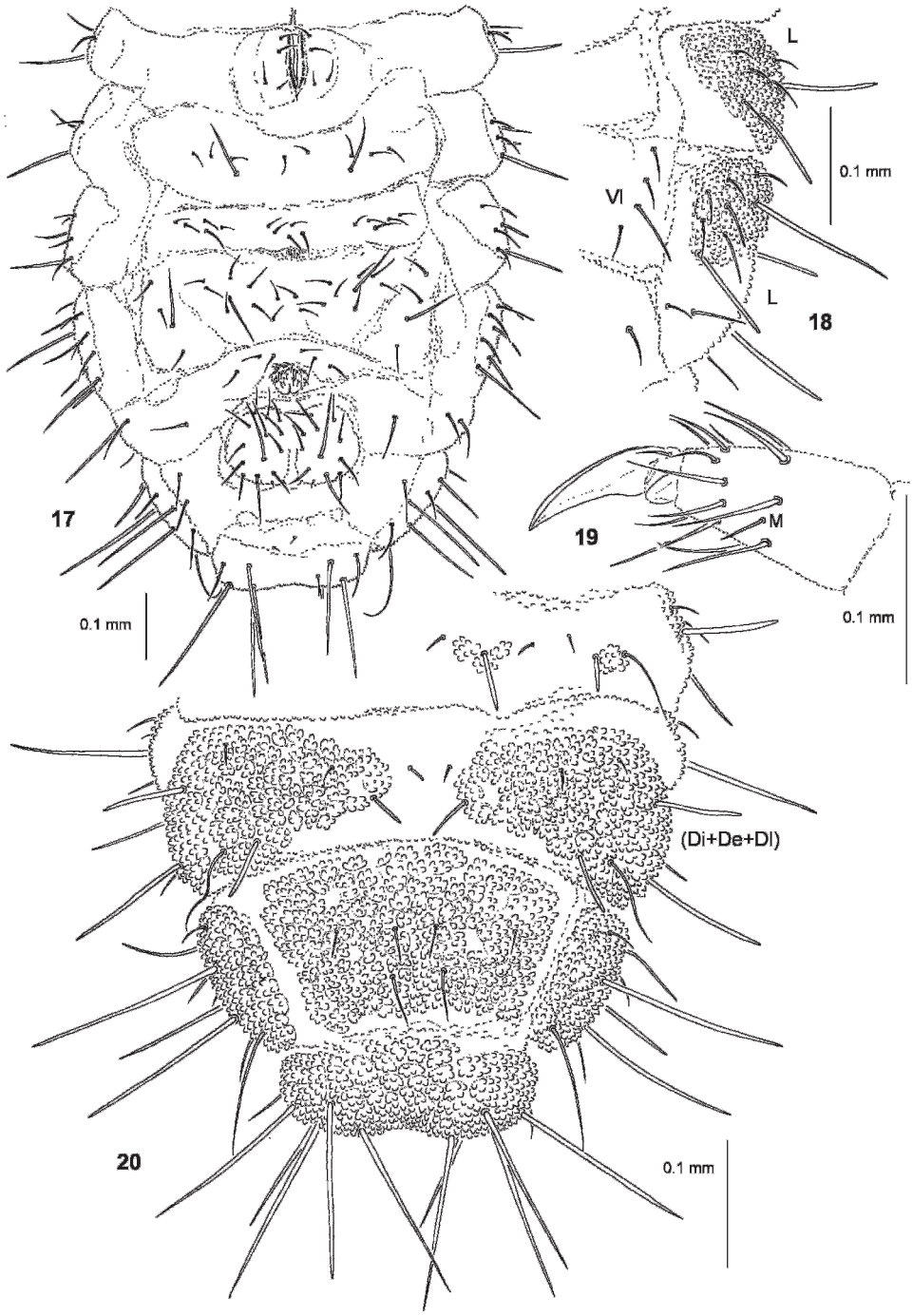
Material examined (all on slides). Holotype: male, USA, Oregon State, western Cascade Range, Blue River Ranger District of Willamette National Forest, neighborhood of H. J. Andrews Experimental Forest, 6.5 km East of Blue River



Figures 1–7. *Oregonanura cascadensis* sp. nov. 1, habitus and dorsal chaetotaxy (holotype); 2, apical bulb; 3, dorsal chaetotaxy of ant. III–IV; 4, ventral chaetotaxy of ant. III–IV; 5, chaetotaxy of labium; 6, mandible; 7 maxilla.



Figures 8–16. *Oregonanura cascadensis* sp. nov. 8, dorsal reticulations; 9, dorsal chaetotaxy of head and thorax I; 10, chaetotaxy of labrum; 11, dorso–lateral chaetotaxy of th. III and abd. I; 12, furca rudimentary; 13, sensillum of tubercle De on abd. III; 14, seta Di1 of abd. V; 15, seta Ocm on head; 16, seta of tubercle L on abd. IV.



Figures 17–20. *Oregonanura cascadensis* sp. nov. 17, ventral chaetotaxy of abdomen (holotype); 18, chaetotaxy of tubercle L and group Vl of abd. III–IV; 19, claw and tibiotarsus of the first pair of legs; 20,dorsal chaetotaxy of abd. III–VI.

Table 1. Chaetotaxy of *Oregonanura cascadensis* sp. nov. Cephalic chaetotaxy.

Tubercle or group of setae	Number of setae	Types of setae	Names of setae
Cl	4	me	F, G
(Af+2 Oc)	17	Ml	B, Ocm
		Mcc	A
		me or mi	C, D, E, Ocp, Oca, O
Di	1	Mcc	Di1
De	3	Ml	De1
		me or mi	Di2, De2
(Dl+L+So)	16	Ml	Dl1, Dl5, L1, L4, So1
		Mc	Dl4
		Mcc	Dl3, L2, L3
		me or mi	Dl2, Dl6, So2–So6

Number of other cephalic setae: Vi, 6; Ve, 11; labrum, 4/2, 4; labium, 11, 0×; ant. I, 7; ant. II, 12; ant. III, 17–18 + 5 s; ant. IV, 8S + i + or + 12 mou.

town, c. 520–550 m above sea level, ''Cougar 1'' site, old–growth forest of *Tsuga heterophylla* Zone, litter, 27.IX.2006, leg. A. Smolis. Paratypes (female, male and 3 juveniles), same locality as holotype, 22–27.IX.2006, 3.X.2006, leg. A. Smolis. Other material. Female, male and 2 juveniles, USA, Oregon State, western Cascade Range, Blue River Ranger District of Willamette National Forest, H. J. Andrews Experimental Forest, 7 km North–East of Blue River town, c. 400–650 m above sea level, ''Mona Creek'' site, valley of Mona Creek, mixed forest of *Tsuga heterophylla* Zone, litter, 23.IX.2006, 3.X.2006, 26.IX.2007, leg. A. Smolis. Type specimens are deposited in the U.S. National Museum of Natural History, Washington, D.C., USA and the entomological collection of Zoological Institute, Wrocław University, Poland.

Diagnosis. Habitus typical of tribe Paranurini (Cassagnau 1989). 3+3 pigmented eyes. Buccal cone elongated, labrum distally ogival. Mandible thin with 3 teeth. Labium with 11+11 setae, papillae × absent. Head chaetotaxy with 3 setae Oc, setae A, B, C, D, E and O. Lateral tubercle (Dl+L+So) on head with 16 setae. Seta Di1 on head free. Tubercles De on th. II and III with 4 and 5 setae respectively, setae De2–4 free. Tubercle L on abd. IV with 9–11 setae. Abdomen V with 3+3 setae Di. Tibiotarsi with short setae.

Description. Body length (without antennae): 1.05–2.30 mm (holotype: 1.80 mm). Body blue. 3+3 rather small, dark pigmented eyes (Figs. 1, 9).

Types of dorsal ordinary chaetae: macrosetae Ml relatively long and thin, narrowly sheathed, feebly serrated, apically pointed (Figs. 1, 9, 11, 16–19); macrosetae Mc and Mcc short and thin, narrowly sheathed, feebly serrated, rounded at apex (Figs. 9, 15, 20); mesosetae and microsetae short, very thin and pointed (Fig. 14).

Head. Buccal cone elongate (Figs. 5, 9, 11). Labrum with ventral sclerifications ogival (Figs. 5, 10). Labrum chaetotaxy as Fig. 10. Chaetotaxy of labium as in Fig. 5. Mandible thin tridentate (Fig. 6). Maxilla styliform as in Fig. 7. Chaetotaxy of antennae as in Table 1 and in Figs. 3–4. Apical vesicle distinct, with 3 lobes (Fig. 2). Sensilla S on ant. IV long and thin (Fig. 3). Sensilla S on ant. III as in Figs. 3–4. Chaetotaxy of head as in Figs. 1, 9 and in Table 1. Setae G and F of the same length. Tubercle (Af+Cl+2Oc) with 17 setae, unpaired seta O present (Fig. 9).

Table 2. Chaetotaxy of *Oregonanura cascadensis* sp. nov. Postcephalic chaetotaxy.

	Terga				Legs				
	Di	De	Dl	L	Scx2	Cx	Tr	Fe	T
th. I	3		1	–	0	3	6	13	19
th. II	3	3+s	3+s+ms	3	2	7	6	12–13	19
th. III	3	4+s	3+s	3	2	8	6	11	18
							Sterna		
abd. I	2	3+s	5				VT: 4		
abd. II	2	3+s	6		Ve: 5		Vel–absent		
abd. III	2	3+s	6–7			Ve: 5–6		Fu:5–6 me	8 mi
abd. IV		6–8+s		9–11		Ve: 8–9		Vl: 4	
abd. V	(3+3)		9+s			Ag: 3		Vl: 1	
abd. VI			6–7			Ve: 11–14		An: 2 mi	

Setae C, D and E included in tubercle, not free. Seta A as mesoseta, distinctly shorter than seta B. Seta De2 free or included in tubercle De (Fig. 9).

Thorax, abdomen, legs. Chaetotaxy of th. and abd. as in Figs. 1, 9, 11–14, 17–18, 20 and in Table 2. Sensillar body formula: 022/11111. Body sensilla fine and smooth, slightly (on th.) or distinctly (on abd. I–IV) longer than proximal macrosetae (Figs 1, 11, 13, 20). Tubercles (Di+De) on th. I with 3 setae (Fig. 1). Setae Di2, Di3, De2–4 on th. II and III free (Figs. 1, 11). Tubercles L on th. II and III slightly developed, with 3 setae (Figs. 1, 11). Setae De2 and De3 on abd. I–III free (Figs. 1, 11). Tubercles Di on abd. V fused or separate, setae Di as mesosetae or microsetae (Figs. 14, 20). Furcal remnant consisting of 8 microsetae and 5–6 mesosetae (Figs. 12, 17). Tubercle L on abd. IV with 2 free setae (Figs. 17, 18). Seta Vl on abd. V present. Chaetotaxy of legs as in Table 2. Seta M present. Claw relatively short, without inner tooth (Fig. 19).

Remarks. The new species is resident in lower montane conifer or mixed forest of the *Tsuga heterophylla* Zone (Franklin & Dyreness, 1988). It inhabits humid thick litter near small streams, but was not found in soil samples. Despite intensive field investigations it was not recorded from upper elevation forests (from 700–1400 m) of both *Tsuga heterophylla* and *Abies amabilis* Zones.

Etymology. Species name derived from its *terra typica*—the Cascade range.

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