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Distribution extensions of the milliped families Conotylidae and Rhiscosomididae (Diplopoda: Chordeumatida) into northern coastal British Columbia and Southern Alaska

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Abstract. Two samples of the chordeumatidan family Rhiscosomididae (*Rhiscosomides mineri* Silvestri, 1909) and 35 of the Conotylidae establish these taxa in the Alexander Archipelago and continental parts of the Alaskan Panhandle, USA, and northern coastal British Columbia (BC), Canada. *Rhiscosomides mineri* is also recorded from southwestern BC and, for the first time, from Washington State, USA. Two conotylids were recovered, a juvenile male of *Bollmanella* Chamberlin, 1941, and 3 males and 33 females of a possibly parthenogenetic form of *Taiyutyla* Chamberlin, 1952, conforming generally to *T. shawi* and *T. lupus*, both by Shear, 2004, on Vancouver Island. Diplopoda are predicted to inhabit the southern Yukon Territory.

Introduction

The milliped order Chordeumatida is well represented in the Pacific Coastal region of the northwestern United States (US) and British Columbia (BC), Canada. Diversity increases to the south, and eight families occur in Oregon and Washington, USA (Shear 1971, 1972; Hoffman 1999; Shelley 2003; Shear and Leonard 2004). Shear and Shelley (2007) described *Tingupa tlingitorum* (Tingupidae) from Haines, Alaska, USA, which constituted astonishing familial and generic range extensions of around 1,690 km (1,050 mi) from the Columbia River in northwestern Oregon. Similarly, Shelley et al. (2007) recorded *Opiona columbiana* Chamberlin, 1951 (Caseyidae), from the Queen Charlotte Islands (QCI), BC, and Wrangell Island, Alaska, in the Alexander Archipelago and Alaskan Panhandle, a northward range ex-

tension for both the genus and species of around 1,014 km (630 mi) from the previous northern limits, near Vancouver and Victoria, BC. Here we document significant northern range extensions in the chordeumatidan families Rhiscosomidae and Conotylidae.

During the summers of 2006 and 2007, RMS and MFM spent 12 weeks sampling millipeds in forested, coastal environments of southern Alaska and northern coastal BC on expeditions supported by the National Geographic Society; KO, KJW, and EIH participated in BC, and KO accompanied them to the Tongass National Forest on Revillagigedo and Prince of Wales (POW) islands, Alaska. Specimens were deposited in the NCSM, North Carolina State Museum of Natural Sciences, Raleigh, USA, and a few additional samples are in other repositories: CNIC, Canadian National Collection, Ottawa, Ontario, Canada; FSCA, Florida State Collection of Arthropods, Gainesville, USA; and WASC, private collection of W.A. Shear, Hampden-Sydney, Virginia, USA. Missing data were not recorded on vial labels, and except where indicated, all samples are deposited in the NCSM.

Rhiscosomidae

Shear (1972) incorporated Rhiscosomidae and its lone genus, *Rhiscosomides* Silvestri, 1909, into his reclassification of New World chordeumatidans, described a new species from the central California coast, and depicted the few known occurrences on a map of the “lower 48” US states. The next year, he provided synoptic accounts of the four established species, described three new species, and mapped occurrences in coastal Oregon (Shear 1973). The familial distribution was characterized as the “Pacific coast region of the United States from the Monterey Peninsula north to the Columbia River,” and the northernmost congener, *Rhiscosomides mineri* Silvestri, 1909, occupied the northern one-third of coastal Oregon, from near Portland to Linn County (Co.) east of Corvallis. Despite the absence of records, Kevan (1983) and Kevan and Scudder (1989) reported the family from Washington state and considered it a potential inhabitant of BC. Speculating that the species was *R. mineri*, Shelley (1990) recorded the family and genus from west of Sooke on southern Vancouver Island, thereby establishing occurrences north of the Columbia River and in both BC and Canada. Hoffman (1999) summarized known records but missed the record from BC.

Rhiscosomidids were discovered in both southern Alaska and northern BC in 2007, and a sample in the FSCA confirms occurrence in Washington. We now identify the species as *R. mineri* and report two localities from southern coastal BC based on samples in the NCSM and CNIC. The Oregon samples of *R. mineri* reported by Shear (1973) were obtained from berlesates of litter, grass, and decaying wood, and from “mixed conifer and deciduous duff.” Those from northern BC were found in temperate rain forests in association with decaying logs under thick layers of moss, and the Alaska individuals were crawling on a Sitka Spruce [*Picea sitchensis* (Bongard) Carrière] twig; habitat was not indicated for the samples from Vancouver and Vancouver Island. These records extend the known ranges of the family, genus, and species some 966 km (600 mi) northward and establish their presences in the southern extremity of the Alaskan Panhandle and Alexander Archipelago (Fig. 1). Illustrations and anatomical details are provided by Shear (1973:194-196, figs. 1-3).

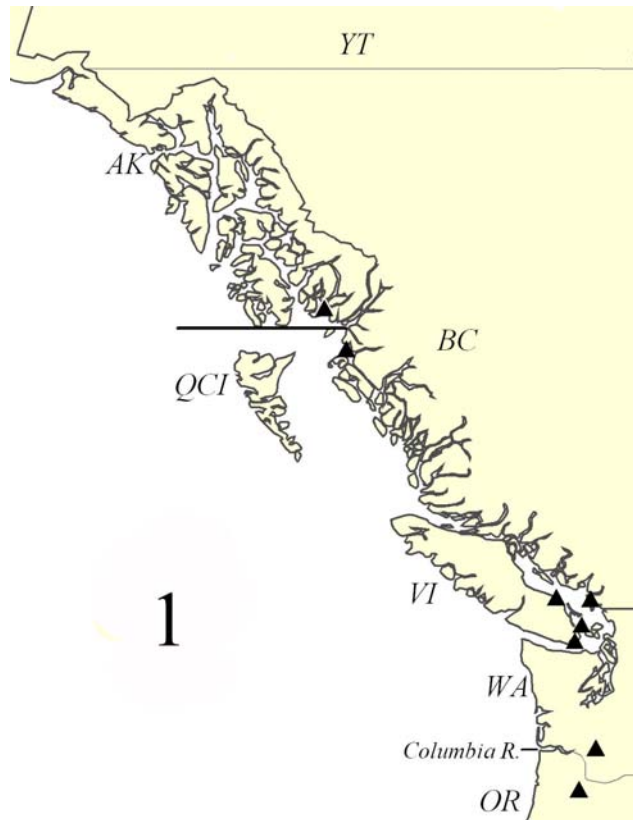


Figure 1. Distributions of the Rhiscosomidae, *Rhiscosomides*, and *R. mineri* along the Pacific Coast of northwestern North America. AK, Alaska; BC, British Columbia; OR, Oregon; QCI, Queen Charlotte Islands; VI, Vancouver Island; WA, Washington; YT, Yukon Territory.

***Rhiscosomides mineri* Silvestri, 1909**

USA: Alaska: POW/Outer Ketchikan Borough (Bor.), Alexander Archipelago, Annette I., Metlakatla, woods behind water plant (N55° 07' 01.2"; W131° 7.32', 50.5"), M, F, 2 August 2007, RMS, MFM, **New State Record**. Washington: Cowlitz Co., near Castle Rock, M, 11 February 1941, J.C. Chamberlin (FSCA) **New State Record**.

CANADA: British Columbia: Southern Coastal Region, Vancouver, Pacific Spirit Park, Pt. Gray, M, F, 22 April 1993, C.L. Whitney. Vancouver I., Bowser, F, 25 June 1935 (CNIC). Saturna I., Lyall Cr., 3M, F, 5 October 2004, KO. Northern Coastal Region, Ridley I., 10 km (6.3 mi) E Prince Rupert (N54° 13', 17.6"; W130° 19', 43.8"), disturbed forest edge with alder by sound, near gravel parking lot and container loading site, M, 2F, 2 juvs., 9 and 18 August 2007, MFM, KO.

Conotylidae

Shear (1971, 1972, 1976) established the Conotylidae in south-central and southeastern BC; Shelley (1990) provided additional localities and extended the family as far north as Pine Pass, 129 km (80 mi) west of Dawson Creek and ca. 483 km (300 mi) south of the Yukon, where no millipeds have been collected. All prior records were summarized by Hoffman (1999). Kevan (1983) and Kevan and Scudder (1989) cited a number of conotylid genera as potential inhabitants of western Canada, and Shear (2004) confirmed *Taiyutyla* Chamberlin, 1952, for this region by describing *T. shawi* and *T. lupus* from northern and southern Vancouver Island, respectively. Sampling by RMS in 2006 and the authors in 2007 establish Conotylidae in the Alexander Archipelago, northern coastal BC, the continental land mass as far north as Gustavus, Alaska (only ca. 182 km [113 mi] south of the Yukon), and also near Hyder, Alaska, and Stewart, BC (Fig. 2), at roughly the same latitude as Pine Pass. These records constitute a familial range extension of approximately 1,054 km (655 mi), the northernmost previous site being the type locality of *T. shawi* (Shear 2004). However, the northernmost continental locality for both the class and order in western North America is that of the female caseyid provisionally assigned to *Opiona columbiana* Chamberlin, 1951, by Shelley et al. (2007) -- the confluence of the Tatsshenshini and O'Connor Rivers in the "Haines Triangle" region of BC, around 30 km (19 mi) south of the Yukon. As Diplopoda are known from so proximate a site, it seems a foregone conclusion that millipeds inhabit at least the southern periphery of the Yukon Territory, and substantiation is warranted.

Two body forms of conotylids were encountered that we interpret as representing distinct genera. The first is an immature male that we provisionally assign to *Bollmanella* Chamberlin, 1941, because of its small size and advanced maturity; a genus of small-bodied conotylids (Shear 1974), *Bollmanella* is one of the potential west Canadian genera cited by Kevan (1983) and Kevan and Scudder (1989). The second, *Taiyutyla*, a large-bodied taxon, is represented by 3 males and 33 females that are anatomically similar to the Vancouver Island species; seven females were discovered on a single log on "20 mi Spur Trail" on POW. The ?*Bollmanella* juvenile was encountered ca. 160 km (100 mi) inland under bark of a decaying log at a moderately moist locality, but *Taiyutyla* was solely in coastal rain forests in association with decaying *P. sitchensis* logs and stumps, usually under thick layers of moss. Thirty-four individuals is a

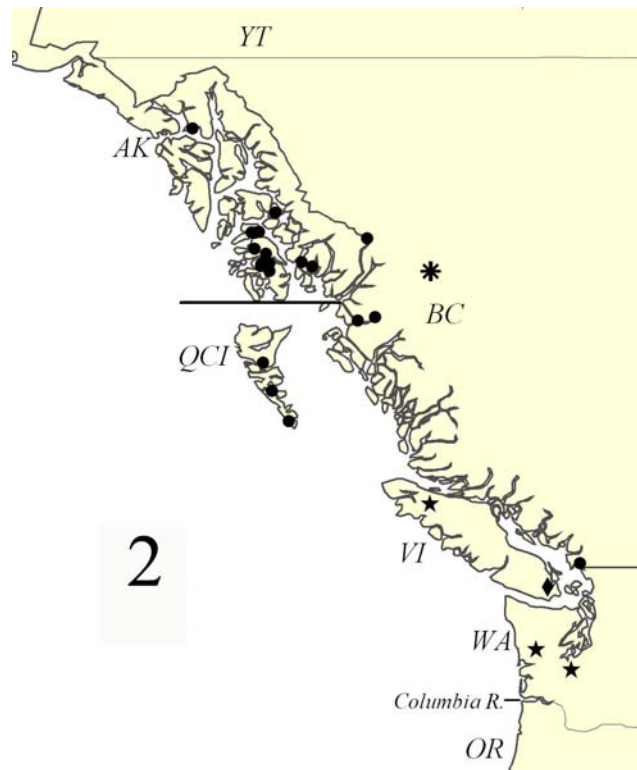


Figure 2. Distribution of the Conotylidae along the Pacific Coast of northwestern North America. Stars, *Taiyutyla shawi*; diamond, *T. lupus*; dots, *Taiyutyla* sp. nr. *T. shawi* and *T. lupus*; asterisk, ?*Bollmanella* sp. A few dots denote two closely proximate localities. Abbreviations as in Fig. 1.

sizeable sample, and for only three males to be collected, and none on the log with seven females, is striking. Cook and Collins (1895) collected 80 specimens of the parthenogenetic caseyid, *Underwoodia iuloides* (Harger, 1872) (= *Underwoodia polygama* Cook and Collins, 1895) on Long Island, New York, only two of which were males, yielding a sex ratio of 40 females: 1 male (Shelley 1992). With 33 females and 3 males, the sex ratio of our samplings in Alaska and adjacent BC suggests that parthenogenesis may be operative in *Taiyutyla* at higher latitudes.

Taiyutyla sp. near *T. lupus* Shear and *T. shawi* Shear

Samples from Ketchikan Gateway and POW/Outer Ketchikan Bors. were taken by RMS, MFM, and KO; KJW and EIH assisted in northern BC and around Hyder, Alaska.

USA: *Alaska: Skagway/Hoonah/Angon Bor.*, Gustavus, along Rink Cr. Rd. 7.8 km (4.9 mi) E Gustavus Rd. (N58°, 26', 18.7"; W135°, 40', 0.6"), 2F, 5 September 2006, RMS. *Wrangell/Petersburg Bor.*, Mitkof I., 26.4 km (16.5 mi) S Petersburg, Man Made Hole Rec. Area, Tongass Nat. For. (N56°, 35', 45.3"; W132°, 45', 42.8"), F, 28 August 2006, RMS. *Ketchikan Gateway Bor.*, Revillagigedo I., Signal Hill Cpgd., Tongass Nat. For., Ward Lake area, 2F, 11 August 2007; Settler's Cove, Lunch Cr. Trail (N55°, 30', 38.3"; W131°, 43', 33.5"), F, 31 July 2007. *Prince of Wales/Outer Ketchikan Bor.*, POW, Hollis (N55°, 29', 45.3"; W132°, 37', 09.9"), 2F, 11 August 2007; Tongass Nat. For. along USFS Rd. 21, 22.4 km (14 mi) E Hydaburg Rd. (N55°, 19', 32.7"; W132°, 34', 04.4"), F, 12 August 2007; One Duck Tr. on Hydaburg Rd., 3.7 km (2.5 mi) S jct. Hollis/Craig Rd. (N55°, 25', 37.8"; W132°, 50', 17.3"), F, 12 August 2007; "20 mi. Spur Tr." off USFS 2025 (N55°, 29', 05.2"; W132°, 49', 57.5"), 7F, 12 August 2007; Rio Roberts Tr. off hwy. 929 (N55°, 41', 34.3"; W132°, 46', 33.4"), F, 13 August 2007; old growth forest along Staney Cr. (N55°, 47', 59.9"; W133°, 06', 40.6"), F, 14 August 2007; Caverns Lake Tr. (N56°, 09', 29.8"; W133°, 10', 31.9"), 2F, 15 August 2007; USFS 30 at Exchange Cr. (N56°, 09', 58.8"; W133°, 06', 03.3"), F, 15 August 2007; El Capitan Cave parking lot (N56°, 09', 41.5"; W133°, 18', 06.2"), F, 16 August 2007; Beaver Falls Karst Tr. (N56°, 08', 38.8"; W133°, 13', 58.7"), F, 16 August 2007; and 13 km (8.1 mi) N Hyder, along Salmon Glacier Rd., 2 km (1.3 mi) S Canada/BC border (N56°, 01', 57.7"; W130°, 02', 40.0"), 4F, 12 August 2007 **New State Record for the Family and Genus.**

CANADA: CANADA: *British Columbia: QCI: Graham Island*, Sleeping Beauty Mtn. (53° 21' 08"N, 132° 13' 17"W), 2F, 22 September 2004, K. Ovaska, L. Sopuck (WASC). *Moresby I.* (52° 44' 49"N, 131° 50' 11"W), M, K. Ovaska (WASC). *Anthony Island*, Sgan Gwaii (52° 05' 49"N, 131° 13' 03"W), 2M, juvs., 15 September 2004, K. Ovaska, L. Sopuck (WASC). *Northern Coastal Mainland: BC Forestry Ministry Lachmach Rd.* (N54°, 15', 07.1"; W129°, 51', 51.0"), F, 10 August 2007; and Diana Lake Prov. Pk., F, 5 August 2007. *Southern Coastal Mainland: Deas Island Regional Park in Fraser River S of Richmond*, F, 16 July 1993, C.L. Whitney.

?*Bollmanella* sp.

CANADA: *British Columbia: Northern Coastal region: Rest stop on hwy. 37 at Moonlit Cr.* (N55°, 19', 19.7"; W128°, 05', 18.9"), juv. M, 9 August 2007.

Discussion

A general milliped distributional pattern throughout the Northern Hemisphere is decreasing diversity as one travels northwards into cooler overall climates. On the Pacific Coast of North America, this pattern is further refined into a proliferation of species with relatively restricted distributions south of the Columbia River, in coastal Oregon and northern California, and only one or two species with extensive north/south ranges farther north; the latter potentially extend through the Alexander Archipelago and Alaskan Panhandle into the "Haines Triangle" region of BC. *Rhiscosomides* illustrates this pattern as may *Taiyutyla* and the Conotylidae. Other examples are as follows:

Opiona Chamberlin, 1951 (Chordeumatida: Caseyidae) — 12 species in Oregon and California but only *Opiona columbiana* north of the Columbia River and ranging northward into the Alexander Archipelago and possibly the "Haines Triangle" of BC (Gardner and Shelley 1979, Shelley et al. 2007);

- Octoglena* Wood, 1864 (Polyzoniida: Hirudisomatidae) — four species in Oregon and California but only *Octoglena anura* (Cook, 1904) traversing the Columbia River and extending northward into southwestern “mainland” BC (Shelley 1990);
- Scytonotus* Koch, 1847 (Polydesmida: Polydesmidae) — four species in coastal Oregon and northern California with *Scytonotus insulanus* Attems, 1931, and *Scytonotus bergrothi* Chamberlin, 1911, spreading north of the Columbia River into southwestern BC, and only the former ranging into northern BC and Alaska where it extends to Yakutat (Shelley 1993:32, figs. 19-20);
- Nearctodesmus* Silvestri, 1910 (Polydesmida: Nearctodesmidae) — three species in coastal Oregon and northern California but only *Nearctodesmus insulanus* (Chamberlin, 1941) occurring north of the Columbia River and extending northward into the QCI and the northern coastal BC “mainland” (Shelley 1990, 1994; Shelley and Shear 2006);
- Harpaphe* Cook, 1904 (Polydesmida: Xystodesmidae) — three species, one divided into six subspecies, in northern and central California but only *H. h. haydeniana* (Wood, 1864) occurring from coastal Oregon northward and extending into the QCI and Dall, Forester, and other southernmost islands of the Alaska Panhandle (Buckett and Gardner 1968, Shelley 1990, plus unpublished records from museum repositories and the 2007 expedition).

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