REDESCRIPTION OF THE RARE GROUND SPIDER *GNAPHOSA SNOHOMISH* (ARANEAE: GNAPHOSIDAE), AN APPARENT BOG SPECIALIST ENDEMIC TO THE PUGET SOUND / GEORGIA BASIN AREA

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Abstract

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Existing descriptions and illustrations do not allow easy identification of the gnaphosid ground spider *Gnaphosa snohomish* Platnick and Shadab (Araneae: Gnaphosidae). It is apparently a truly rare, bog–associated species endemic to the Puget Sound / Georgia Basin area. The species is redescribed and illustrated from a significant series of mature males and females collected in an abandoned cranberry bog in Burnaby, British Columbia. An existing key to *Gnaphosa* species is revised to incorporate newly identified diagnostic characters. Few other museum specimens of *G. snohomish* exist and the Burnaby population is the only substantial population known. However, that population may no longer exist as the site has been redeveloped as a commercial cranberry bog and apparently little suitable habitat for this species now exists in the area.

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Introduction

The gnaphosid ground spiders are a relatively well known group largely because Norman Platnick and colleagues (references in Platnick 2006) have published over 60 papers on gnaphosid taxonomy and systematics. With 1,975 species recognized in 116 genera (Platnick 2006), Gnaphosidae forms the seventh largest of the 111 currently accepted families within Araneae. The Holarctic genus *Gnaphosa* Latreille accounts for 135, or roughly 7% of these species. Most are Palaearctic in distribution; only 20 species occur in the Nearctic region (Ubick 2005).

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Except for a small minority of species, most of the Nearctic *Gnaphosa* are relatively widespread, fairly common species and specimens are often abundant in open or partially open habitats. Pitfall–collected samples from such habitats may produce significant numbers of *Gnaphosa* specimens (e.g. Bennett and Salomon unpublished data; Dondale and Redner 1994; Troubridge et al. 1998). Most notable among the uncommon species of *Gnaphosa* is *G. snohomish* Platnick and Shadab (Fig. 1) which was described on the basis of a single specimen of each sex; no other verified specimens were known to us prior to the work of Troubridge et al. (1998). This species appears to be a truly rare, bog specialist endemic to a small area of the Puget Sound / Georgia Basin area of northwestern Washington State and southwestern British Columbia.

In 1998, as part of an arthropod study in cranberry bogs, two of us (JT and SF) initiated a pitfall trapping program in a former commercial bog (49º11'43"N, 122º58'35"W) in Burnaby, BC that had been abandoned for at least 15 years. The site, part of an area known locally as the "Marshlands," is located on the north shore of the north arm of the Fraser River adjacent to the southwest corner of the intersection of Marine Drive and North Fraser Way. The Marshlands area, originally an extensive peat (*Sphagnum fimbriatum* Wils. in Wils. and Hook. (Sphagnidae)) bog, was heavily developed for agricultural purposes during the 20th century.

Traps at the site were checked weekly from mid May until early September. Among the spider specimens collected were 211 gnaphosids unidentifiable by us beyond "*Gnaphosa* sp." Given that the Nearctic *Gnaphosa* species are well known (and that the spider fauna of the Puget Sound / Georgia Basin area has been reasonably well sampled), we considered it odd that we could not place these specimens. They seemed closest to *G. snohomish* and *G. antipola* Chamberlin but we could not reliably assign the specimens to either species.

We sent a sample of males and females of the unidentified *Gnaphosa* species to the American Museum of Natural History for identification by N. Platnick. He determined that the spiders were specimens of *G. snohomish* and furthermore that the published descriptions and illustrations (Platnick and Shadab 1975; Platnick and Dondale 1992) of the single known specimen of each sex were flawed in ways that became apparent only through the examination of our specimen series (Platnick pers. comm.).

Accurate identification of *G. snohomish* specimens is difficult using existing taxonomic literature. It is important that specimens be easily identified because this spider may be a good candidate for protection under federal endangered species legislation in both Canada and the United States. For these reasons a redescription of the species (including modifications to two couplets in the key to *Gnaphosa* species published in Platnick and Dondale (1992)) and a discussion of its apparently obligate association with peatlands in the Georgia Basin and Puget Sound area are presented here.

Methods

This work is based upon examination of 103 males, 49 females, and 59 juveniles collected in Burnaby, BC and a single male collected in Saanichton, BC. Specimens were examined and illustrated using a Zeiss dissecting microscope (illustrations of male structures

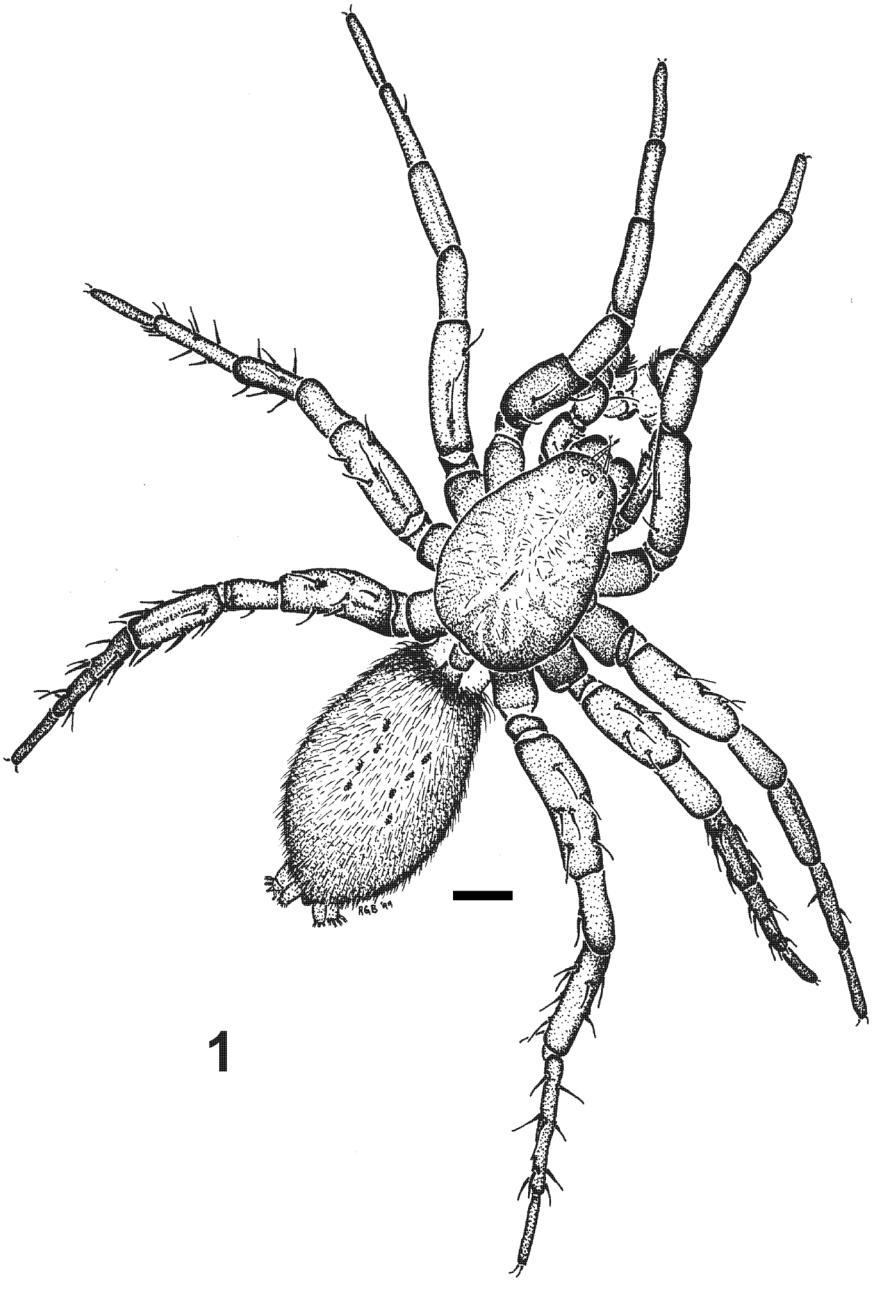

FIGURE 1. *Gnaphosa snohomish*, male habitus, Burnaby, British Columbia, dorsal. Scale bar=1.0 mm.

and female epigynum, all measurements) or a Nikon phase contrast compound microscope (illustrations of cleared female genitalia). Measurements are expressed in mm and are presented as sample range (mean ± standard deviation). Within the descriptive text, the following abbreviations are used: measurements: CL=carapace length, CW=carapace width, SL=sternum length, SW=sternum width. Acronyms of depositories: AMNH=American Museum of Natural History, New York, New York; DJB=private collection of D. J. Buckle, Saskatoon, Saskatchewan; CNC=Canadian National Collection, Ottawa, Ontario; RBCM=Royal British Columbia Museum,Victoria, British Columbia; UWBM=University of Washington, Burke Museum, Seattle, Washington.

Modified key to species. Platnick and Dondale (1992: 170, Fig. 256 and key couplet 8(7)) described and figured the embolus of *G. snohomish* as enlarged basally and then gradually narrowing distally. In reality, the embolus narrows abruptly distal to the enlarged base (this paper, Figs. 2, 4, 5). A corrected version of couplet 8 is presented below. Female key couplets in Platnick and Dondale (1992) are generally sufficient for identifying *G. snohomish*; couplet 16 is slightly reworded below for clarity.

8 (7) Embolus with variably sized spine on distal margin of embolus base (this paper, Figs. 2, 4, 5) .....***G. snohomish* Platnick and Shadab**

– Embolus lacking spine on distal margin of embolus base (Platnick and Dondale 1992, Fig. 260) .....***G. antipola* Chamberlin**

16 (14) Spermathecal head short and slender (Platnick and Dondale 1992, Fig. 255) ....***G. clara* (Keyserling)**

– Spermathecal head longer, usually stouter (this paper, Figs. 8, 9; Platnick and Dondale 1992, Figs. 259, 263, 267) 17

***Gnaphosa snohomish* Platnick and Shadab** (Figs. 1-9)

Gnaphosa snohomish Platnick and Shadab, 1975: 52, Figs. 123-126; Crawford, 1988: 30; West et al., 1988: 84; Platnick and Dondale 1992: 170, Figs. 256-259; Bennett et al., 2006.

Types. Male holotype (and female paratype) from Chase Lake (Edmonds, 47º47’51”N, 122º20’48”W), Snohomish County, Washington, USA; collected April 1957 (B. Malkin); in AMNH, not examined (vouchers from this study compared with holotype and paratype and identity confirmed by N. I. Platnick, AMNH).

Diagnosis. *Gnaphosa snohomish* was placed within the *lugubris* species group by Platnick and Shadab (1975) but, more probably, it is a member of the *lucifuga* group (*sensu* Ovtsharenko et al. 1992): those *Gnaphosa* species possessing an embolus situated prolaterally on the genital bulb, denticles ventrally on the embolus base, and epigynum with divided lateral margins. Among such species, *G. snohomish* is only likely to be confused with *G. antipola* Chamberlin. It is distinguished from *G. antipola* by its possession of a single large spine (in addition to the denticles) ventrally on the embolus base (Figs. 4, 5)

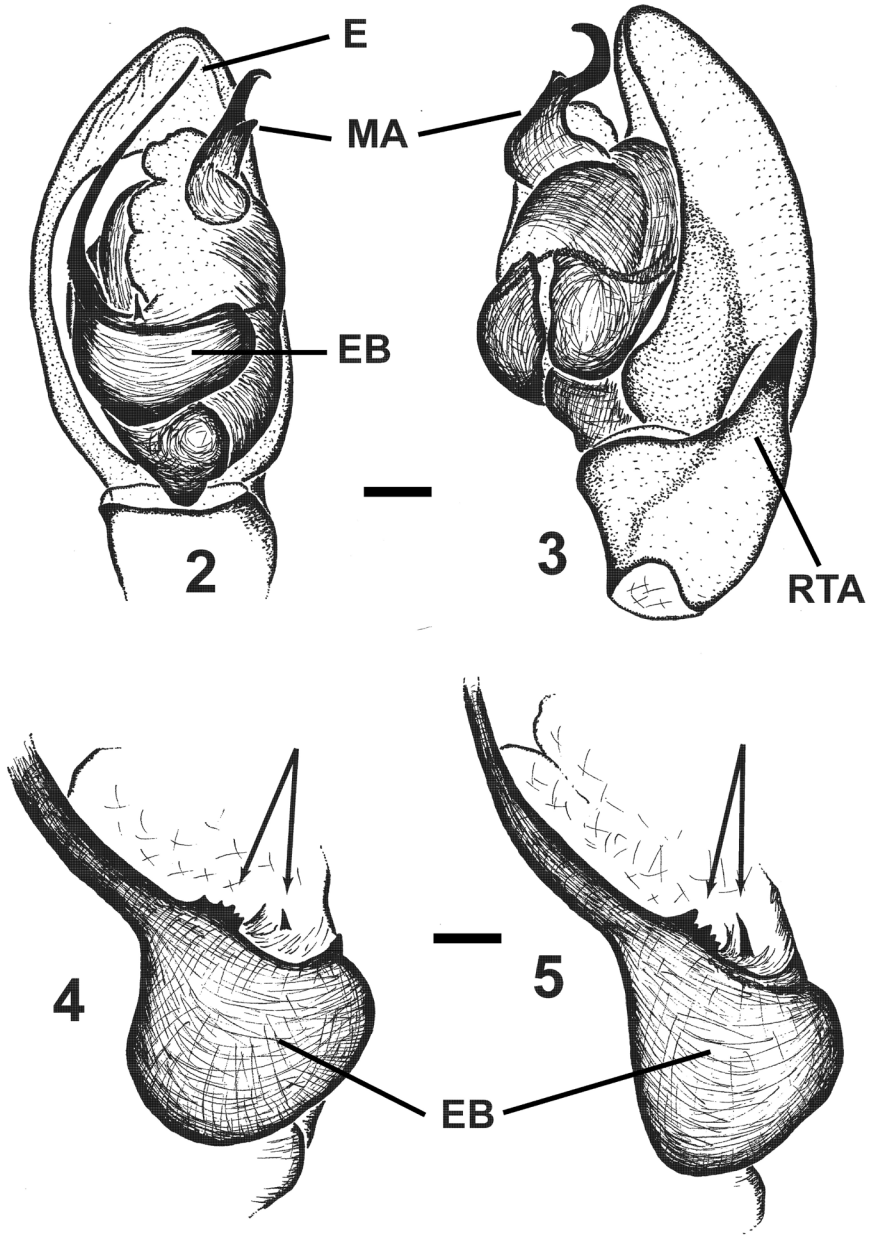

FIGURE 2-5. *Gnaphosa snohomish*, male palpal characters, Burnaby, BC. 2–left palpus, genital bulb, ventral; 3–same, retrolateral; 4 & 5–bases of left emboli of two specimens showing variation in basal spine and denticles, prolateral. Scale bars=0.2 mm (Figs. 2, 3) and 0.1 mm (Figs. 4, 5). Unlabelled arrows indicate spine and denticles on embolus base. E=embolus, EB=embolus base, MA=median apophysis, RTA=retrolateral tibial apophysis.

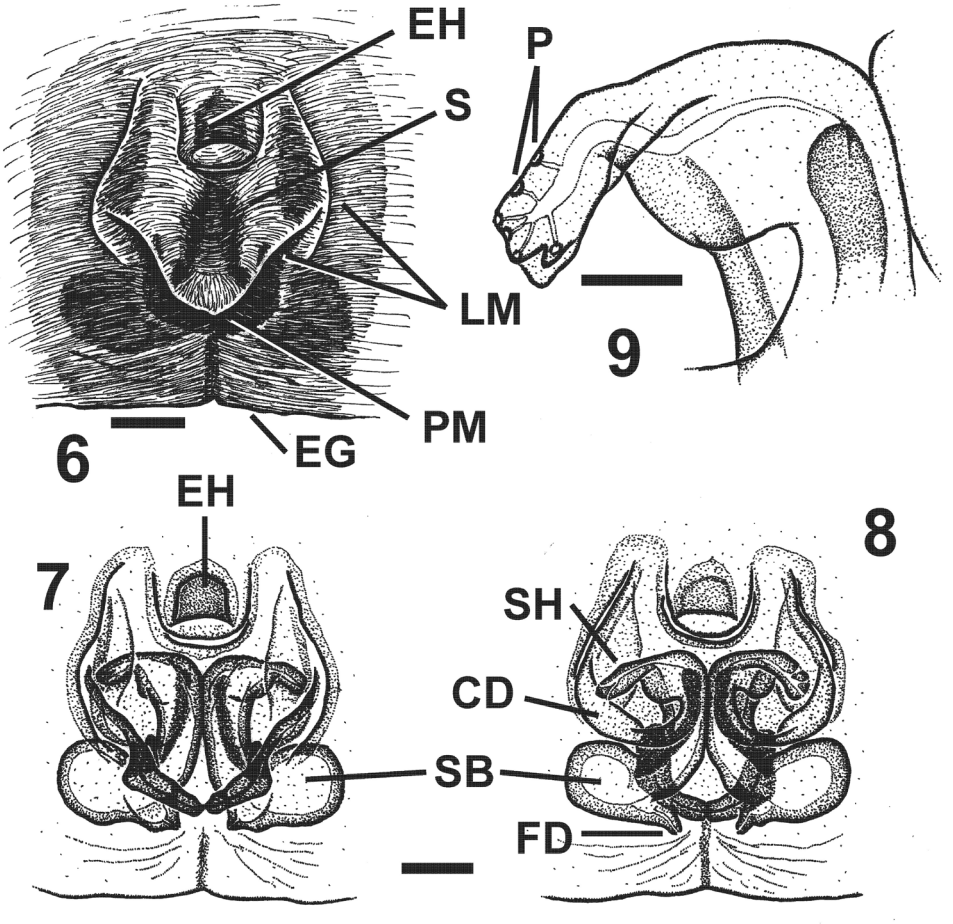

FIGURE 6-9. *Gnaphosa snohomish*, female genitalic characters, Burnaby, BC. 6–epigynum, ventral; 7–cleared vulva, ventral; 8–same, dorsal; 9–same, detail of Fig. 8 (spermathecal head), dorsal. Scale bars=0.1 mm (Figs. 6-8) and 0.05 mm (Fig. 9). CD=copulatory duct, EG=epigastric groove, EH=epigynal "hood," FD=fertilization duct, LM=lateral margins of epigynum, P=simple spermathecal pores, PM=posterior margin of epigynum, S=epigynal "septum," SB=spermathecal base, SH=spermathecal head.

and by the relatively smaller epigynal "hood" (Figs. 6-8, also compare Platnick and Shadab 1975, Figs. 121 and 125).

Description. A medium–sized, moderately dark species of *Gnaphosa* (Fig. 1) with little size difference between the sexes; see Platnick and Shadab (1975) and Ovtsharenko et al. (1992) respectively for descriptions of the genus (and, also, species characteristics not described below) and the *lucifuga* species group.

Male. N=20. Total length 7.44-9.92 (8.62 ± 0.78). CL 2.75-4.09 (3.67 ± 0.35), CW 2.05-2.98 (2.72 ± 0.25), SL 1.36-1.98 (1.81 ± 0.15), SW 1.24-1.74 (1.57 ± 0.12). Holotype total length 6.62, CL 2.85, CW 2.27 (Platnick and Shadab 1975). Retrolateral tibial apophysis (Fig. 3) simple, acuminate, about as long as palpal tibia; median apophysis (Figs. 2, 3) distally located on genital bulb, bifurcate, sickle–shaped in retrolateral view (Fig. 3); embolus (Figs. 2, 4, 5) originating proximally on genital bulb, enlarged basally, abruptly narrowed distally, with single, variably sized spine on distal edge of embolus base and variable series of denticles ventrally at beginning of narrowed part of embolus.

Female. N=20. Total length 7.44-11.78 (9.70 ± 1.24). CL 2.67-4.46 (3.73 ± 0.43), CW 1.92-3.22 (2.67 ± 0.33), SL 1.36-2.05 (1.82 ± 0.18), SW 1.18-1.92 (1.59 ± 0.17). Paratype total length 8.14, CL 3.10, SW 2.30 (Platnick and Shadab 1975). Epigynum (Fig. 6) with shallow "hood" anteriorly, paired lateral margins (heavily sclerotized posteriorly), and broad "septum" with medial longitudinal trough; copulatory ducts (Fig. 8) difficult to differentiate, apparently leading posteriorly from lateral epigynal margins then arching anteriorly along vulval midline to connect with spermathecal heads; spermathecal heads (Figs. 8, 9) directed towards lateral epigynal margins and bearing simple pores; broad duct connecting each spermathecal head and base; spermathecal bases (Figs. 7, 8) rounded with fertilization ducts exiting from posterior medial margins.

Material examined (Fig. 10). CANADA, **British Columbia:** Burnaby "Marshlands", SW of Marine Dr. & North Fraser Way, 49º11'43"N, 122º58'35"W, all by J. Troubridge and deposited variously among AMNH, CNC, and RBCM, 21 May 1998, 18♂, 5♀, 29 May 1998, 19♂, 12♀, 7 juv., 5 June 1998, 16♂, 6♀, 12 juv., 28 June 1998, 9♂, 5♀, 15 juv., 8 July 1998, 12♂, 8♀, 21 juv., 5 September 1998, 29♂, 13♀, 4 juv.; Island View Beach, Saanichton, BC, 48º34'57"N, 123º22'19"W, RGB, 26 May–29 June 2003, ♂, RBCM.

Other material (Fig. 10). CANADA, **British Columbia:** Haney, UBC Research Forest, Maple Ridge, ~49º17'48"N, 122º34'37"W, ~360 m, 20 June 1968, ♀, DJB, 30 June 1968, ♀, ♂, DJB. **UNITED STATES, Washington: Clallam Co.**, Pat's Prairie, 47º59' N, 123º13' W, 815 m, R. Crawford, 16 May 1992, ♂, UWBM; **Grays Harbor Co.**, Carlisle Bog, 47º08' N, 124º05'W, 27 m, R. Crawford, 30 May 1992, 3♀, 3 juv., UWBM; **King Co.**, Kings Lake Bog, 47º35' N, 121º46'W, 293 m, R. E. Nelson, 21 July 1981, 2♀, 1 juv., UWBM; **Skagit Co.**, Big Lake Bog, 48º20'N, 122º11'W, 128 m, R. Crawford, 9 October 1994, ♂, 2♀, 4 juv., UWBM; **Thurston Co.**, marsh on Green Cove Creek, 47º04'N, 122º57'W, 43 m, September–December 1992, ♂, UWBM.

Discussion

Collection records suggest a one year life cycle with overwintering of sub–adults and maturation beginning late the following spring.

Gnaphosa snohomish is probably endemic to the Puget Sound / Georgia Basin region where it is known only from nine localities: six in northwestern Washington (the type locality as well as five other sites around or near Puget Sound (R. L. Crawford pers. comm.)) and three in southwestern British Columbia (Bennett et al. 2006). West et al. (1988) listed Haney, BC as the locality for specimens of *Gnaphosa* "near *snohomish*" collected by D. Buckle and R. G. Holmberg. Buckle (pers. comm.) has confirmed these specimens to be "true" *G. snohomish*. All the collection sites feature substantial wetlands and at least seven of these are peat bogs.

In British Columbia, the Burnaby collection is from an extensive historical peat bog site occurring near sea level along the north shore of the Fraser River estuary. The collection site was characterized by hummocks of peat and other mosses overlain with cranberry (*Oxycoccus macrocarpus* (Ait.) Pursh (Ericaceae)), sundew (*Drosera rotundifolia* L. (Droseraceae)), rushes (*Juncus* spp. (Juncaceae)), and various grasses. A detailed listing

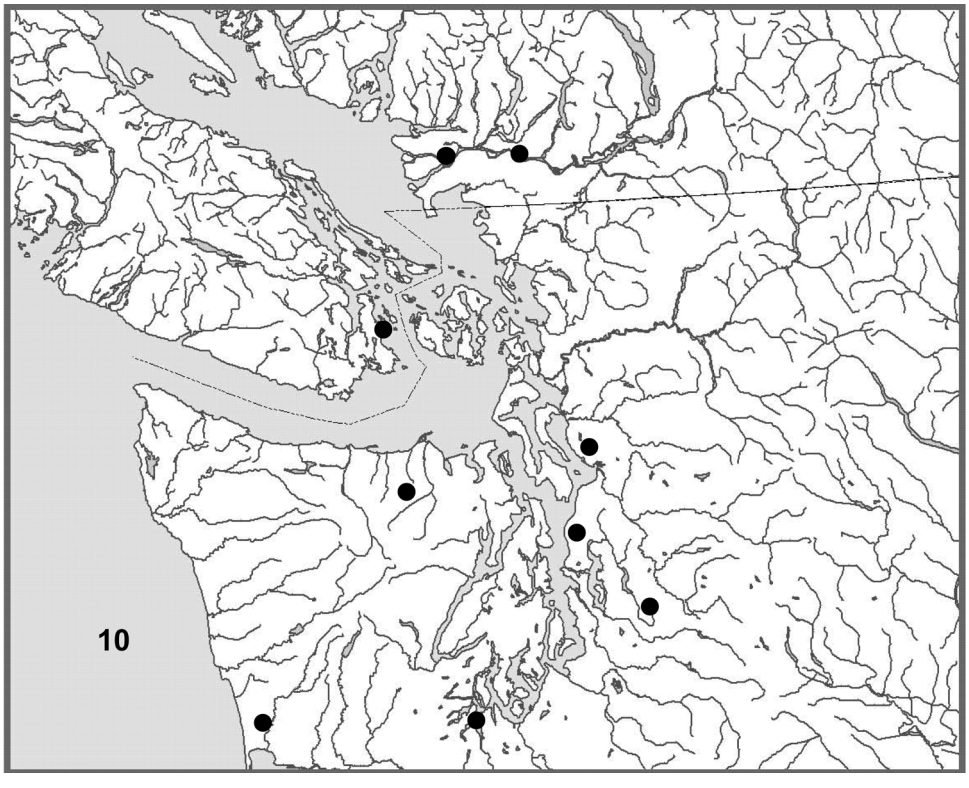

FIGURE 10. Southwestern British Columbia and northwestern Washington State: *Gnaphosa snohomish* collection localities.

of the plants associated with the site is contained in Troubridge et al. (1998). The Haney UBC Research Forest contains at least one well–established floating peat bog (L. Marczak and J. McLean pers. comm.); a popular collecting site, it is likely that the Haney specimens came from this bog. Other peatland sites are known in the Georgia Basin area such as Bowser Bog (Bowser, Vancouver Island), Burns Bog (Richmond, also situated in the Fraser River estuary just south of the Burnaby site), and Yellow Point Bog (Ladysmith, Vancouver Island). These sites are well known to entomologists and, although we are aware of no intensive sampling specifically for spiders at these sites, no specimens of *G. snohomish* have been collected from them or from other wetlands (other than the Saanichton site) elsewhere in British Columbia. The single Saanichton male came from a site that was extensively sampled for spiders in 2003 and 2004 (Bennett and Salomon unpublished data), although lacking nearby peatlands, the site is adjacent to a well established *Potentilla* (Rosaceae) marshland.

In Washington, all but one of the collections are from confirmed peatland sites (R. L. Crawford pers. comm.) in or near the Puget Sound area. The type locality is a small, low elevation floating bog in the heart of Edmonds and now completely surrounded by housing. Pats Prairie and Carlisle, Kings Lake, and Big Lake Bogs are sphagnum bogs occurring at a range of elevations from near sea level to over 800 m. No habitat details are available for the Green Cove Creek "marsh" site. Sampling of Washington peatland sites east of the Cascade Range (outside of the Puget Sound area) has produced no *G. snohomish* specimens (R. L. Crawford pers. comm.).

The available collection data suggest that *G. snohomish* is a true tyrphobiont (an obligate peatland associate) with a very limited range. All but two of over 200 specimens were found in sphagnum bogs occurring as discrete and isolated habitat patches (as is typical of temperate peatlands (Spitzer and Danks 2006)) within the Puget Sound / Georgia Basin area and only at one of the bog sites (Burnaby) have significant numbers of specimens been noted. Tryphobiontic spider species are not well studied or numerous and, at least in Canada, appear to be dominated by linyphiids and lycosids (Dondale and Redner 1994). Only 9 probable tyrphobiontic species (all linyphiids and lycosids) were noted among 198 spiders recorded at 6 peatland sites in southern Ontario and southwestern Quebec (Dondale and Redner 1994). Although various species of gnaphosid genera, including *Gnaphosa*, can be common in bogs (e.g. see Blades and Marshall 1994; Dondale and Redner 1994; Platnick and Dondale 1992), members of the family are more typically associated with open, drier habitats (Ubick 2005).

We are aware of no probable tyrphobiontic gnaphosid in North America other than *G. snohomish*.

The Burnaby *G. snohomish* collection site has been extensively modified and reactivated as an operational commercial cranberry bog. A small (~9 ha) nature reserve is adjacent to the northeast corner of the cranberry bog but otherwise the area is dominated by agricultural and commercial development and heavy industry. The nature reserve is a damp site dominated by shrubby vegetation, especially birches (*Betula* sp. (Betulaceae)), scrubby pines (*Pinus* sp. (Pinaceae)), hardhack (*Spiraea douglasii* Hook. (Rosaceae)), Himalayan blackberry (*Rubus discolor* Weihe and Nees (Rosaceae)), and fireweed (*Epilobium angustifolium* L. (Onagraceae)). Although no further spider sampling has been undertaken in the immediate area, the nature reserve may be the only potential habitat remaining in the

immediate area available to support a population of *G. snohomish*. The current status of the species in the area is unknown and it may have been extirpated there.

Acknowledgements

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References

Bennett, R. G., D. Blades, D. Buckle, C. D. Dondale, and R. C. West. 2006. The spiders of British Columbia. http://www.efauna.bc.ca/. Accessed 1 September 2006.

Blades, D. C. A. and S. A. Marshall. 1994. Terrestrial arthropods of Canadian peatlands: Synopsis of pan trap collections at four southern Ontario peatlands. Memoirs of the Entomological Society of Canada 169: 221-284.

Crawford, R. L. 1988. An annotated checklist of the spiders of Washington. Burke Museum Contributions in Anthropology and Natural History 5:1-48.

Dondale, C. D. and J. Redner. 1994. Spiders (Araneae) of six small peatlands in southern Ontario or southwestern Quebec. Memoirs of the Entomological Society of Canada 169: 33-40.

Ovtsharenko, V. I., N. I. Platnick, and D. X. Song. 1992. A review of the north Asian ground spiders of the genus *Gnaphosa* (Araneae, Gnaphosidae). Bulletin of the American Museum of Natural History 212: 1-88.

Platnick, N. I. 2006. The World Spider Catalog, Version 7. The American Museum of Natural History. http://research.amnh.org/entomology/spiders/catalog/index.html. Accessed 1 September 2006.

Platnick, N. I. and C. D. Dondale. 1992. The insects and arachnids of Canada. Part 19. The ground spiders of Canada and Alaska (Araneae: Gnaphosidae). Agriculture Canada Publication 1875. 297 p.

Platnick, N. I. and M. U. Shadab. 1975. A revision of the spider genus *Gnaphosa* (Araneae, Gnaphosidae) in America. Bulletin of the American Museum of Natural History 155: 1-66.

Spitzer, K. and H. V. Danks. 2006. Insect biodiversity of boreal peat bogs. Annual Review of Entomology 51: 137-161.

Troubridge, J., S. Fitzpatrick, R. G. Bennett, and P. Catling. 1998. Pestiferous and predatory arthropods on an abandoned cranberry farm in British Columbia. Poster presented at the Annual General Meeting of the Entomological Society of Canada (Quebec City, PQ, October 1998) and the North American Cranberry Research and Extension Workers Conference (Long Beach, WA, September 1999).

Ubick, D. 2005. Gnaphosidae. pp. 106-111 *In* Spiders of North America: an identification manual. D. Ubick, P. Paquin, P. E. Cushing, and V. Roth (eds.), American Arachnological Society.

West, R. C., C. D. Dondale, and R. A. Ring. 1988. Additions to the revised checklist of the spiders (Araneae) of British Columbia. Journal of the Entomological Society of British Columbia 85: 77-86.