

Fleas (Siphonaptera) from sciurid and murid rodents on the eastern slope of the Cascade Range, Kittitas County, Washington

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ABSTRACT

Eight species of rodent fleas [Ctenophthalmidae: *Megarthroglossus procus* Jordan & Rothschild; Leptopsyllidae: *Peromyscopsylla selenis* (Rothschild); Ceratophyllidae: *Ceratophyllus ciliatus protinus* Jordan, *Eumolpianus eumolpi eumolpi* (Rothschild), *Malaraeus telchinus* (Rothschild), *Opisodasys vesperalis* (Jordan), *Orchopeas agilis* (Rothschild) and *Oropsylla idahoensis* (Baker)] were collected in 1993 and 1995 from seven species of rodents [*Neotamias amoenus* (J.A. Allen), *N. townsendii* (Bachman), *Spermophilus saturatus* (Rhoads), *Glaucomyx sabrinus* (Shaw), *Neotoma cinerea* (Ord), *Clethrionomys gapperi* (Vigors) and *Microtus longicaudus* (Merriam)] live and snap trapped. There were four new county records for *M. procus*, *P. selenis*, *O. vesperalis* and *O. idahoensis*, and there were five new host records for the state with *M. procus* and *C. ciliatus protinus* ex *G. sabrinus*, *P. selenis* and *M. telchinus* ex *C. gapperi* and *P. selenis* ex *M. longicaudus*. Distribution patterns and host preferences in the Pacific Northwest are discussed.

Key words: fleas, Siphonaptera, rodents, Washington State

INTRODUCTION

The flea fauna of Washington is less well known than its neighbors British Columbia and Oregon, with only 80 species of fleas recorded while British Columbia has 98 species and Oregon has 110 (Holland 1985; Lewis *et al.* 1988). The number of publications concerning fleas is smaller for Washington than for Oregon (Lewis *et al.* 1988). The number of locality/county symbols on distribution maps is fewest for Washington (Haddow *et al.* 1983; Holland 1985; Lewis *et al.* 1988). Washington ranks last, at least in part, because of its comparatively small land area (172,266 km²). Oregon is 76,858 km² larger, and British Columbia (948,600 km²) is 2.25 times larger than Oregon and Washington combined. Danks (1995) considered range of habitats as well as comparative land areas and found the same lower ranking for Washington in his tabulations from

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published species records in the order Dictyoptera and according to selected families and genera in the orders Hemiptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera.

As Lewis *et al.* (1988) concluded from their review of literature, the flea faunas of the states contiguous with Oregon "... are in much need of additional study." In the present study, we contribute new data for eight rodent fleas in Kittitas County, central Washington, with five new flea-host associations for the state.

MATERIALS AND METHODS

All flea specimens were received from the University of Alaska (Fairbanks) Museum mammalogy section, preserved in alcohol. All were collected by one of us (MKM) in Wenatchee National Forest, Kittitas County, Washington during 1993 and 1995. Hosts were collected with snap traps (woodrats) and Havahart® and Sherman® live traps and snap traps (flying squirrels, chipmunks and voles). Host specimen number (AF number) for the University of Alaska mammal collection is designated in brackets. Fleas were permanently mounted on microscope slides by standard techniques (Lewis *et al.* 1988). All flea specimens were deposited in the US National Museum insect collection. The western chipmunk genus *Neotamias*, as proposed by Jameson (1999), is adopted here.

SPECIES ACCOUNTS

Ctenophthalmidae

Megarathroglossus procus Jordan & Rothschild, 1915

South Fork Taneum Creek, 1.6 km west of South Fork Meadows, 47°5'49.08"N, 121°0'37.68"W (1150m), 23 Aug 1995 [AF 13631], 1♀ *ex Glaucomys sabrinus* (Shaw) (northern flying squirrel).

The specimen is identified as *M. procus*, although "... a definite identification is possible only if male specimens are available" (Tipton *et al.* 1979). Characters such as the spermathecal form and the lack of a noticeable sinus on the posterior margin of sternum VII, plus the known host associations, are consistent with this identification. The morphologically similar *M. jamesoni* Smit occurs in California and Nevada (Lewis *et al.* 1988). *Megarathroglossus procus* is known from Skagit, Whatcom and Yakima Counties (Tipton *et al.* 1979). Our specimen adds Kittitas County and a new host for the state.

Megarathroglossus procus is widely distributed in western North America, from the Pacific Northwest and as far east as western Nebraska. There is an apparent void east of the Cascades in Washington and Oregon (Mendez 1956; Tipton *et al.* 1979). *Megarathroglossus divisus* (Baker) is known to replace *M. procus* in nests of *G. sabrinus* in northeastern Oregon (Wilson and Bull 1977; Whitaker *et al.* 1983).

Records from British Columbia, Oregon and California convinced Holland (1949b, 1985) that the true host of *M. procus* is *Tamiasciurus douglasii* (Bachman) (Douglas' squirrel). From the wide variety of recorded hosts, Lewis *et al.* (1988) were inclined to name *T. hudsonicus* (Erxleben) (red squirrel) as a preferred host. More collecting from *G. sabrinus* and especially its nests will probably establish it as another preferred host of *M. procus*.

Leptopsyllidae

Peromyscopsylla selenis (Rothschild, 1906)

South Cle Elum Ridge, along US Forest Service road 3350, 47°8'20.10"N, 120°58'12.24"W (1172m), 21 Sep 1995 [AF 5504], 1♀ *ex Microtus longicaudus* (Merriam) (long-tailed vole). South Fork Taneum Creek, 1.6 km west of South Fork Meadows, 47°5'49.08"N, 121°0'37.68"W (1150m), 17 Aug 1995 [AF 5499], 1♀ *ex*

Clethrionomys gapperi (Vigors) (southern red-backed vole). Same locality but 25 Aug 1995 [AF 13640], 1 ♀ *ex C. gapperi*.

Peromyscopsylla selenis is a common flea found on arvicoline rodents and accidentally on other hosts in many areas of the western United States and Canada (Johnson and Traub 1954) but sparsely recorded in Washington State. The earliest collections in the state were in 1935 from *Microtus richardsoni* (DeKay) (water vole) in Skamania County and in 1938 from *M. townsendii* (Bachman) (Townsend's vole) in Skagit County (Hopkins and Rothschild 1971). Hubbard (1943, 1947) recorded a 1943 collection from *M. richardsoni* in Klickitat County. Johnson and Traub (1954) added a record from a *Microtus* sp. in Spokane County. The distribution map of Lewis *et al.* (1988) has marks for three of these counties plus Whitman County. Our two hosts, *C. gapperi* and *M. longicaudus*, are new for the state in a county not previously known for *P. selenis*.

Ceratophyllidae

Ceratophyllus ciliatus protinus Jordan, 1929

South Fork Taneum Creek, 1.6 km west of South Fork Meadows, 47°5'49.08"N, 121°0'37.68"W (1150m), 17 Aug 1995 [AF 13575], 1 ♂, 3 ♀♀ *ex Neotamias townsendii* (Bachman) (Townsend's chipmunk). Same date and locality [AF 13574], 2 ♂♂ *ex N. townsendii*. Same date and locality [AF 13573], 1 ♂, 3 ♀♀ *ex N. townsendii*. Same date and locality [AF 13626], 1 ♂, 1 ♀ *ex N. townsendii*. Same locality but 18 Aug 1995 [AF 13599], 1 ♂ *ex G. sabrinus*. Same date and locality as previous [AF 13601], 1 ♀ *ex N. townsendii*. South Fork Taneum Creek, 0.8 km west of South Fork Meadows, 47°5'51.96"N, 121°0'6.00"W (1152m), 16 Aug 1995 [AF 5474], 1 ♂, 2 ♀♀ *ex N. townsendii*. Same date and locality as previous [AF 5481], 1 ♂ *ex N. townsendii*. Same locality but 24 Aug 1995 [AF 14912], 1 ♀ *ex N. townsendii*.

This taxon is well known from tree squirrels, chipmunks and some associated small mammals in western Washington, Oregon and British Columbia (Hubbard 1947; Johnson 1961; Haddow *et al.* 1983; Holland 1985). The earliest record for Washington is from Carson, Skamania County, 1939 (Hubbard 1940), and since then King, Kittitas, Pierce and Yakima Counties were added (Lewis *et al.* 1988). Lewis and Maser (1981) and Lewis *et al.* (1988) reported large numbers of *C. ciliatus protinus* on Townsend's chipmunk in Oregon. All but one of our 19 specimens came from this host. The exception came from *G. sabrinus*, a host record that is new for the state.

Eumolpianus eumolpi eumolpi (Rothschild, 1905)

South Cle Elum Ridge, 1.6 km southwest of Peoh Point along USFS road 3350, 47°8'31.74"N, 120°57'42.54"W (1411m), 21 Sep 1995 [AF 14925], 2 ♀♀ *ex Neotamias amoenus* (J.A. Allen) (yellow-pine chipmunk).

The genus *Eumolpianus* was erected by Smit (1983) to include the distinctive chipmunk fleas of the "eumolpi group," genus *Monopsyllus*, of Traub and Johnson (1952) (see also Johnson 1961). The range of the genus *Eumolpianus* is roughly that of its preferred hosts, chipmunks of the genus *Neotamias* in Canada, the western and northern United States and Mexico (Johnson 1961; Haddow *et al.* 1983; Holland 1985). Of the two nominal subspecies, *E. e. eumolpi* occurs in the Pacific Northwest and is one of the most common fleas of Washington east of the Cascade crest. Since the early collection of 1920 in Adams County (Jellison and Senger 1976), it has been reported from the following 11 counties: Asotin, Chelan, Ferry, Grant, Kittitas, Klickitat, Lincoln, Spokane, Stevens, Whitman and Yakima (Hubbard 1943; Miller and Drake 1954; Johnson 1961; Jellison and Senger 1976; Lewis *et al.* 1988). Nonetheless, distribution maps continue to show no records in the moister areas west of the Cascades (Johnson 1961; Haddow *et al.* 1983; Lewis *et al.* 1988).

Malaraeus telchinus (Rothschild, 1905)

South Fork Taneum Creek, 1.6 km west of South Fork Meadows, 47°5'49.08"N, 121°0'37.68"W (1150m), 24 Aug 1995 [AF 13616], 1♂ *ex C. gapperi*. South Cle Elum Ridge, 1.2 km east of USFS road 214 along USFS road 3350, 47°8'20.10"N, 120°58'12.24"W (1172m), 21 Sep 1995 [AF 5504], 1♀ *ex M. longicaudus*.

This is the more commonly collected species of *Malaraeus* in the Pacific Northwest; *M. sinomus* is unknown in Washington. *Malaraeus telchinus* is recorded from Clark, Grant, Klickitat, Lincoln, Skamania, Whitman and Yakima Counties (Hubbard 1947; Jellison and Senger 1976; Lewis *et al.* 1988). *Malaraeus telchinus* is found on a variety of mice and voles in mesic habitats; however, there are no published records from *Clethrionomys* in the State of Washington.

Opisodasys vesperalis (Jordan, 1929)

All *ex G. sabrinus*. South Fork Taneum Creek, 0.8 km west of South Fork Meadows, 47°5'51.96"N, 121°0'6.00"W (1152m), 10 Aug 1995 [AF 5466], 1♀. Same locality but 18 Aug 1995 [AF 13588], 1♀. Same locality but 23 Aug 1995 [AF 35114], 2♀♀. South Fork Taneum Creek, 1.6 km west of South Fork Meadows, 47°5'49.08"N, 121°0'37.68"W (1150m), 23 Aug 1995 [AF 13622], 2♀♀. Same date and locality [AF 13631], 4♂♂, 2♀♀.

Glaucomyx sabrinus is the preferred host of this flea in the Pacific Northwest. *Opisodasys vesperalis* is also found on *G. volans* (L.) (southern flying squirrel) in other areas of North America. Sparse collection records in British Columbia (Holland 1985) and Washington (Lewis *et al.* 1988) probably reflect the need to examine more *G. sabrinus* and their nests for fleas. It was previously unknown from Kittitas County, being known in the state only from Clallam, Cowlitz and Lincoln Counties (Jellison and Senger 1976; Lewis *et al.* 1988). The presence of *Opisodasys pseudarctomys* (Baker), another true *Glaucomyx* flea that is unknown from the state (Haddow *et al.* 1983), may also be established by further collections from *G. sabrinus* or especially their nests.

Orchopeas agilis (Rothschild, 1905)

All *ex Neotoma cinerea* (Ord) (bushy-tailed woodrat). S Fork Taneum Creek, USFS road 135, in abandoned cabin, 47°6'11"N, 120°57'1"W (900m), 25 Sep 1993 [AF 5405], 1♂, 6♀♀. 12 Oct 1993 [AF 5427], 1♂. [AF 5428], 2♂♂, 4♀♀. [AF 5429], 1♂, 1♀.

This parasite of *Neotoma* spp. was originally described as *Ceratophyllus agilis* by Rothschild (1905) from a type series collected from *N. cinerea* in Banff, Alberta and other mammals from other localities in Alberta and British Columbia (Holland 1985). Jordan (1929) reduced this taxon to a subspecies of *C. sexdentatus* (Baker). Jordan (1933) published the genus name *Orchopeas* to replace the preoccupied genus name *Bakerella* Wagner. In his review of the fleas of British Columbia, Wagner (1936) listed this flea as *Orchopeas sexdentatus agilis*.

Recently, Lewis (1998, 2000) reviewed the genus *Orchopeas* Jordan and elevated to species each of the six taxa that had been subspecies of *O. sexdentatus*. Lewis (2000) also noted that *O. agilis* is the member of the *O. sexdentatus* group with the widest distribution, ranging from the Yukon Territory through British Columbia and western Alberta, eastern Washington, Oregon and California, the Basin and Mountain states south into the Mojave Desert in Nevada, Utah and Arizona, and into the Rio Grande watershed of New Mexico (Haddow *et al.* 1983; Holland 1985; Lewis *et al.* 1988).

Orchopeas agilis is known from several *Neotoma* spp., but *N. cinerea* is the only species in Washington and Canada (Cowan and Guiguet 1965; Ingles 1965; Banfield 1974). Locality records of *O. agilis* are especially numerous in southern British Columbia (Holland 1985). In Washington there are records of collections of either *O. sexdentatus* or *O. s. agilis* (both = *O. agilis*) in eight counties: Benton, Douglas, Franklin, Grant,

Klickitat, Lincoln, Spokane and Yakima (Hubbard 1940, 1943, 1947; Bacon 1953; O'Farrell 1975; Jellison and Senger 1976; Lewis *et al.* 1988). Our new records of *O. agilis* confirmed Kittitas County.

In a survey of wild animal diseases in five counties in the Columbia Basin, Miller and Drake (1954) found *O. agilis* only on *Peromyscus maniculatus* (Wagner) (deer mouse). Only a small, unspecified number of specimens were collected in one or more unnamed counties. The counties surveyed were Adams, Franklin, Grant, Kittitas and Lincoln.

The nine contiguous counties with records occupy much of the state east of the Cascades. *Orchopeas cascadiensis* Jordan, the other member of the *O. sexdentatus* group in Washington, is known only from west of the Cascades in Clark County (Hubbard 1947; Lewis *et al.* 1988; Lewis 2000).

Oropsylla idahoensis (Baker, 1904)

South Fork Taneum Creek, 1.6 km west of South Fork Meadows, 47°5'49.08"N, 121°0'37.68"W (1150m), 16 Aug 1995 [AF 5484], 1♂, 2♀♀ *ex Spermophilus saturatus* (Rhoads) (Cascade golden-mantled ground squirrel).

This is the only flea known to parasitize *S. saturatus*. Early records from this host for Washington are in three counties: Skamania (1935), Yakima (1938) and Klickitat (1939, 1943) (Hubbard 1940, 1943, 1947). Hubbard (1947) also mentioned locality records in Skamania and Yakima Counties without giving collection dates and numbers of specimens. Holland (1949a) recorded early collections from *S. saturatus* in British Columbia: Princeton (1939) and Manning Provincial Park (1945). Holland (1985) gave two additional records for Manning Provincial Park (1953 and 1955). Our new record is in a county that lies on the same longitude (121°) that runs through contiguous Yakima County to the south and Manning Provincial Park to the north.

The wider-ranging Pacific Northwest *Spermophilus* spp. are hosts to other species of fleas in addition to *O. idahoensis* (see Wagner 1936; Jellison 1945; Holland 1985; Lewis *et al.* 1988). The apparent absence of these fleas on *S. saturatus* could be a reflection of less collecting effort, as this ground squirrel has been classified by some authors as a subspecies of *S. lateralis* (Say), a common, wide-ranging western North American ground squirrel. *Spermophilus saturatus* is nowhere sympatric with *S. lateralis*, being restricted to a small range on the eastern slopes of the Cascades in Washington and British Columbia (Cowan and Guiguet 1965; Ingles 1965; Banfield 1974; Tomich 1982; Trombulak 1988).

CONCLUSION

Although no fleas were added to the Washington list, the five new host records suggest that future surveys should include rodents known to host fleas on the lists for British Columbia and Oregon. With only one species of flea known for the rodent *Spermophilus saturatus*, a thorough survey in this mammal's small Washington to British Columbia range is desirable. Mammals other than rodents, such as opossums, shrews, moles, bats, pikas and carnivores deserve more attention as do domestic mammals and birds, wild and domestic. Above all, nests of mammals and birds need to be examined for adult fleas and their poorly known larval stages.

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