

## Scientific Note

**PHYTOSEIID MITE FAUNA ON GORSE, *ULEX EUROPAEUS* L., IN WESTERN OREGON, USA WITH NEW RECORDS FOR *PHYTOSEIULUS PERSIMILIS* ATHIAS-HENRIOT AND *AMBLYSEIUS GRAMINIS* (CHANT) (ACARI: PHYTOSEIIDAE)**

Gorse, *Ulex europaeus* L. (Fabaceae), is a spiny evergreen shrub native to western Europe. The plant was intentionally introduced into coastal regions of southern Oregon (USA) in the late 1800s. Since its introduction, *U. europaeus* has escaped cultivation and aggressively invaded natural and disturbed habitats in western North America, including British Columbia, Washington, Oregon, northern California, and Hawaii. In an effort to suppress this weed, the European native spider mite *Tetranychus lintearius* Dufour (Acari: Tetranychidae) was introduced into gorse-dominated habitats of western Oregon in 1994 (Rees, N. E., P. C. Quimby, Jr., G. L. Piper, E. M. Coombs, C. E. Turner, N. R. Spencer & L. V. Knutson. 1996. Biological Control of Weeds in the West. Western Society of Weed Science, Bozeman, Montana).

Establishment, persistence, and efficacy of weed suppression by an introduced biological control agent can be affected by mortality from predators, parasites or pathogens acquired in the adventive range of the agent (Goeden, R. D. & S. M. Louda. 1976. Annu. Rev. Entomol., 21: 325-342). Predatory mites (Phytoseiidae), for instance, suppress spider mites in managed and unmanaged ecosystems worldwide (Helle, W., & M. W. Sabelis. 1985. Spider Mites: Their Biology, Natural Enemies and Control. Elsevier, Amsterdam). Unfortunately, the phytoseiid fauna in most natural habitats is poorly known. Therefore, we sought to determine which predatory mites are associated with the invasive weed *U. europaeus* and its biological control agent *T. lintearius* in western Oregon.

Surveys for phytoseiids were performed at six (four coastal and two inland) sites in western Oregon: near Astoria, Baker Beach, Bandon, Clackamas, Elk River, and Sutherlin (Table 1). Monthly surveys were performed at Baker Beach, Bandon, and Sutherlin from March 1998 through March 1999 and single surveys were conducted at the remaining sites. Surveys consisted of sampling *U. europaeus* branches every 10 m along a randomly selected 100 m transect. A total of 20 samples were collected from each transect by randomly selecting two independent terminal *U. europaeus* branches at each sampling point and excising ca. 25 cm of foliage from each branch. Each sample was placed into a polyethylene bag, transported to the laboratory, and branches were individually washed to extract arthropods within 48 h. The extraction method entailed placing individual *U. europaeus* branches in separate one-liter jars and adding 300 ml of 70% ethanol (Pratt, P. D. & B. A. Croft. 2000. Environ. Entomol., 29: 1034-1040). Lids were placed on the jars and shaken manually for 30 sec, left to rest for 1 min, and then shaken again for 30 sec. Plant material was removed with forceps and slowly rinsed with 70% ethanol over jars. The ethanol and associated contents were poured into a Whatman No. 4 filter paper funnel, gravity filtrated, and examined

Table 1. Phytoseiid mites collected from *Ulex europaeus*.

Species	Life style type <sup>1</sup>	Research site	GPS coordinates <sup>2</sup>
<i>Amblesius andersoni</i> (Chant)	III	Baker Beach	44.0915 N 124.1158 W
<i>Neoseiulus fallacis</i> (Garman)	II	Baker Beach	44.0915 N 124.1158 W
<i>Typhlodromus pyri</i> Scheuten	III	Sutherlin	43.3970 N 123.2974 W
<i>Amblyseius graminis</i> (Chant)	III <sup>3</sup>	Astoria	46.2783 N 123.9970W
<i>Typhlodromus arboreus</i> (Chant)	III	Baker Beach, Bandon, Elk River	(see above and below)
<i>Phytoseiulus persimilis</i> Athias-Henriot	I	Bandon	43.0543 N 124.4083 W
<i>Galendromus occidentalis</i> (Nesbitt)	II	Clackamas	45.2391 N 122.4268 W

<sup>1</sup> Type I = specialized predators of *Tetranychus* species; Type II = selective predators of tetranychid mites, particularly with those that produce copious webbing; Type III = generalist predators.

<sup>2</sup> Global positioning system in decimal degrees (Elk River: 24.7648 N 124.4626 W).

<sup>3</sup> Probable classification, life history studies needed to quantify life style type.

within 5 min under a binocular microscope at 40× magnification. All phytoseiid mites that were washed from branches were mounted on glass slides in Hoyer's media and identified according to morphological characters (Schuster, R. O., and A. E. Pritchard. 1963. *Hilgardia*, 34: 191–194).

In preliminary samples, the predatory mite *Phytoseiulus persimilis* Athias-Henriot was collected at the Bandon survey site. This phytoseiid is a specialist predator that feeds primarily on spider mites that belong to the genus *Tetranychus* (McMurtry, J. A. & B. A. Croft. 1997. *Annu. Rev. Entomol.*, 42: 291–321) and it is the most common biological control agent released for suppression of pest mites in agricultural and horticultural systems throughout the world (Helle & Sabelis 1985). Because of the potential for *P. persimilis* to suppress the beneficial *T. lintearius*, we sought to assess the geographic range of this predatory mite in southern Oregon. This was done on 15 Sept. 1998 by sampling foliage of *U. europaeus* (as described earlier) every 1.6 km along a N-S transect radiating from the epicenter at each study site. To increase the probability of collecting *P. persimilis* and accurately measure its geographic distribution, only *U. europaeus* foliage containing colonies of *T. lintearius* was selected at each survey point. Transects were extended north and south until three consecutive samples failed to

Table 2. Dominant predatory mite species collected at each survey site.

Site name	Species	Peak density <sup>1</sup>	Month <sup>2</sup>
Astoria	<i>Amblyseius graminis</i>	0.45 (0.13)	April <sup>3</sup>
Baker Beach	<i>Typhlodromus arboreus</i>	2.28 (0.52)	May
Bandon	<i>Phytoseiulus persimilis</i>	2.75 (2.02)	October
Clackamas	<i>Typhlodromus arboreus</i>	0.51 (0.28)	September <sup>3</sup>
Elk River	<i>Typhlodromus arboreus</i>	1.50 (1.19)	July <sup>3</sup>
Sutherlin	<i>Typhlodromus pyri</i>	4.65 (0.90)	July

<sup>1</sup> Peak densities of phytoseiid mites per sample, mean (SE).

<sup>2</sup> Month when peak density was recorded.

<sup>3</sup> Because only a single sample was collected from these sites, Peak density and Month may not accurately describe the population densities.

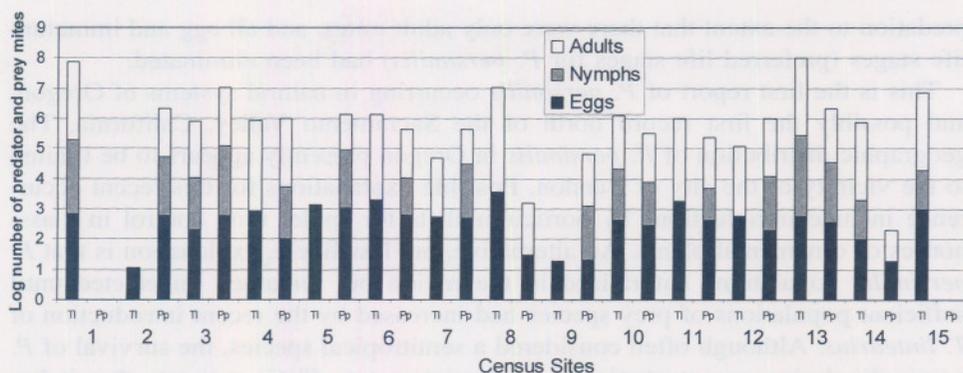


Figure 1. Predator-prey ratios and age distribution for *Tetranychus lintearius* (Tl) and *Phytoseiulus persimilis* (Pp) along a north (15) to south (1) transect (7 = initial spider mite release site) during a 1999 survey of the invasive weed *Ulex europaeus* in Bandon, Oregon (U.S.A.).

produce the predatory mite or *T. lintearius* populations were no longer present. Extraction and identification of arthropods was performed as described above.

Among the Phytoseiidae collected during 1998 and 1999, 57% of the species were generalists (Type III) species, which feed on various mites, insects, and pollens (Table 1, McMurtry & Croft 1997). These generalist predators were also the dominant (most abundant) species at five of the six survey sites (Table 2). At the Bandon site, however, the specialist Type I predator of *Tetranychus* species, *P. persimilis*, was the most common natural enemy collected from *T. lintearius* colonies.

To our knowledge, this is the first detailed survey of phytoseiid mites along the coastal regions of Oregon. Findings from this survey included the first collection of *Amblyseius graminis* (Chant) in North America. This predatory mite is endemic to the Old World and explanations for its adventive geographic distribution in the Pacific Northwest remain unclear. Although collected from *T. lintearius* colonies, attempts to establish a laboratory culture of *A. graminis* when held with the spider mite were unsuccessful, suggesting that the predator may not readily feed on this spider mite and thus is unlikely to interfere with biological control.

The distribution of *P. persimilis* in southern Oregon appears to be limited to a 20.8 km transect centered in the city of Bandon. Census site 7 in Fig. 1 represents the Bandon study site, with the predatory mite distributed 11.2 km north and 8 km south. *Phytoseiulus persimilis* densities along the sampled transect were similar to those of *T. lintearius* ( $t = 0.46$ ,  $df = 24$ ,  $P = 0.65$ ), when the extreme sample locations 1 and 15 are excluded from the analysis. Predator-prey ratios and age distributions at each census site are also presented in Fig. 1. These data reflect a distribution of life stages of a predator population that was rapidly increasing over most of the range of sample sites. It should be noted that, at sites 1 and 15, there were prey mites but no predator mites. *Phytoseiulus persimilis* had not yet expanded into these outer limits and thus the distribution of prey life stages reflected the reproduction of the spider mite without major predation influences. Also note that, within the area where *P. persimilis* is distributed, there were three sites (2, 5, and 9; Fig. 1) where prey mite populations were decreased by

predation to the extent that there were only adult mites, and all egg and immature life stages (preferred life stages for *P. persimilis*) had been eliminated.

This is the first report of *P. persimilis* occurring in natural systems of Oregon, and possibly the first record north of the Sacramento Valley, California. The geographic distribution of *P. persimilis* in Oregon presently appears to be limited to the vicinity of the city of Bandon. Possible explanations for this recent occurrence include introductions by horticulturalists for spider mite control in glass-houses or ornamental plants. An alternative, but less likely, explanation is that *P. persimilis* populations naturalized in the region but remained undetected until sufficient populations of prey species had increased by the recent introduction of *T. lintearius*. Although often considered a semitropical species, the survival of *P. persimilis* during recent atypically cool winters ( $< -5^{\circ}\text{C}$ ) suggests that it has extended its geographic range to include coastal regions of western Oregon.

In general, these findings suggest that *T. lintearius* has developed new associations with generalist and specialist predatory mites. However, association among these mites is not sufficient evidence to conclude that phytoseiids are negatively impacting *T. lintearius*, and thus biological control of gorse. Additional data describing prey suitability and field-based exclusion tests are needed to quantify the impacts of phytoseiids on the biological control agent *T. lintearius*.

**Records.**—OREGON. CLATSOP Co. Astoria, 4 Apr 1998, E. M. Coombs, *Amblyseius graminis*, branches of *Ulex europaeus*.

COOS Co. Bandon, 17 Mar 1998, P. D. Pratt, *Phytoseiulus persimilis*, branches of *Ulex europaeus*.

**Acknowledgment.**—We thank J. A. McMurtry (of Oregon State University) for identification of the phytoseiid mites and comments on the manuscript. This research was funded, in part, by a grant from Oregon Department of Agriculture.

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Received 29 June 2001; Accepted 8 May 2002.