

Northwest Science Notes

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The Status of the 'Red-Listed' *Bombus occidentalis* (Hymenoptera: Apiformes) in Northeastern Oregon

Abstract

The western bumble bee, *Bombus occidentalis*, is included on the red list of bees by The Xerces Society. It was once a common bumble bee west of the Cascades but in the late 1990s it experienced a dramatic decline along coastal regions. The cause was speculated to be due to the introduction of pathogens from captive-bred bumble bees used for pollination of greenhouse crops. In extensive surveys conducted in western and southern Oregon, 10 individuals have been recorded since 2000. In this note, we report the collection of 49 individual *B. occidentalis* over two years in the Zumwalt Prairie Preserve of northeastern Oregon. This finding shows that *B. occidentalis* persists in northeastern regions of the Pacific Northwest, either because of geographic isolation from or potential resistance to the pathogens that decimated populations in the western part of the region. Further research is needed to determine its occurrence in other regions of its historical range to assess the extent of its decline. In addition, conservation efforts are critical for protection of this species in both agricultural ecosystems and in native habitats.

Introduction

Globally, there are concerns about range contraction and declines in the local abundances of bumble bees, social bees that provide vital pollination services in natural and agricultural habitats (Buchmann and Nabhan 1996, Beismeyer et al. 2006). In North America, seven bumble bee species are reported to be in decline (Committee on the Status of Pollinators in North America 2007) including the western bumble bee, *Bombus occidentalis* Greene, which is also one of four bumble bee species on the Red-list of bees compiled by The Xerces Society (<http://www.xerces.org/pollinator-redlist/>; accessed May 12, 2010).

Historically, the geographic range of *B. occidentalis* included the west coast of North America from central California north to Alaska, east through Alberta and western South Dakota, and southward into Arizona and New Mexico (Milliron 1971, Koch and Strange 2009). The species was abundant in the Pacific Northwest (PNW) (Stephen 1957). However, in the late 1990s, it disappeared from coastal valleys of its range (Thorp 2003, Evans et al. 2008). Although anthropogenic activities such as land-use changes that led to reductions in availability of food plants and/or nesting sites are believed to have caused declines in some bumble bee species (Goulson et al. 2008, Williams and Osborne 2009, Williams et al. 2009), *B. occidentalis* is speculated to have declined due to pathogens acquired during commercial rearing (Thorp 2003). It was reared for pollination of greenhouse toma-

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toes and other crops, and spillover effects from colonies in greenhouses to wild populations are hypothesized to have resulted in local extinction of *B. occidentalis* along coastal regions (Evans et al. 2008, Otterstatter and Thomson 2008). The geographic extent of the decline of *B. occidentalis* is, however, not known.

Here, we report the highest number of *B. occidentalis* observed at a single location in Oregon since the late 1990s. The bees were detected in a high-elevation prairie in northeastern Oregon during a study on native bee diversity. The finding is encouraging as it suggests that the cause of population decimation along the PNW coast has not extended to eastern Oregon populations, or is not as severe as in western Oregon.

Study Area and Methods

The study was conducted in the Zumwalt Prairie Preserve (45° 3' N, 116° 6' W) owned and maintained by The Nature Conservancy (TNC) in northeastern Oregon. The Preserve is one of the last large relicts of the Pacific Northwest Bunchgrass Prairie, the once extensive Idaho fescue (*Festuca idahoensis* Elmer; Poaceae)-dominated grasslands, which formerly covered approximately 800,000 ha in the northwestern United States and Canada (Tisdale 1982). The Zumwalt Prairie Preserve is dominated by native grasses and forbs, although exotic plants are present in some areas (Kennedy et al. 2009).

Bees were trapped over two years using fluorescent blue vane traps (SpringStar LLC, Woodinville, WA, USA) (Stephen and Rao 2005) placed over a 640 ha area that ranged in elevation from 1372 to 1499 m. Traps were separated by at least 200 m. In 2007, traps were set up for two days; 16 traps were set up on June 18 and 64 traps between July

9 and 21. In 2008, 64 traps were each set up for a single day between June 7-16, July 10-18, and August 25-29.

Results and Discussion

In all, 49 *B. occidentalis* were collected in The Zumwalt Prairie Preserve between 2007 and 2008 (Table 1). This represents a new record for *B. occidentalis* (Figure 1). It has been collected earlier from neighboring locations in northeastern Oregon including Aneroid Lake, Wallowa Lake, Halfway, Baker, Blue Mountains, Meacham and La Grande (Stephen 1957).

Bombus occidentalis collections varied across the two years of the study. Although more traps were set up in 2008, fewer individuals were collected compared to 2007 (Table 1). Although this could be due in part to the reduced sampling period (i.e., half that of the previous year), the number of individuals collected/trap/day was lower in 2008 compared with 2007. For instance, captures in July 2008 represented one-fifth the captures in July 2007 (Table 1). We speculate that this pattern was due to the cool conditions in spring and early summer of 2008, and not due to any negative effect of sampling the previous year. Other taxa that were not destructively sampled showed similar trends between years, including plants (Dingeldein et al. 2010) and grassland bird species, such as Savannah sparrow (*Passerculus sandwichensis*) (T. Johnson, Oregon State University, personal communication).

The collection of 49 individuals in the current study contrasts greatly with recent captures of *B. occidentalis* in other regions in Oregon. Only six specimens were recorded from several studies conducted between 2004 and 2007 that included visual observations and > 500 comparable traps,

TABLE 1. *Bombus occidentalis* captures in fluorescent blue vane traps in the Zumwalt Prairie Preserve in northeastern Oregon relative to captures of other bumble bee species.

| Sampling Period | Number of traps | # bumble bee species collected | # bumble bees collected | # <i>B. occidentalis</i> collected | Relative abundance of <i>B. occidentalis</i> (%) |
|-----------------|-----------------|--------------------------------|-------------------------|------------------------------------|--|
| 2007 | | | | | |
| June | 16 | 9 | 56 | 3 | 5.36 |
| July | 64 | 12 | 2224 | 37 | 1.66 |
| 2008 | | | | | |
| June | 64 | 9 | 83 | 4 | 4.82 |
| July | 64 | 10 | 266 | 4 | 1.50 |
| August | 64 | 10 | 38 | 1 | 2.63 |

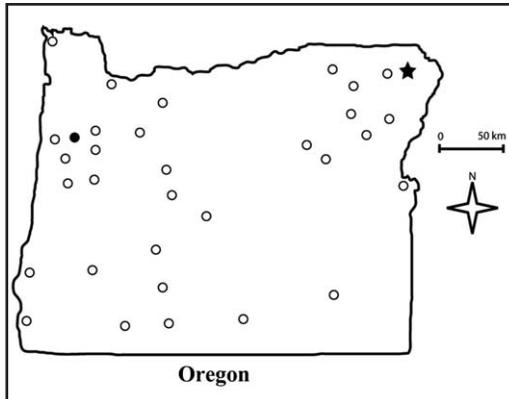


Figure 1. Historical native range of *Bombus occidentalis* in Oregon (modified from Stephen 1957). Sampling occurred in the Zumwalt Prairie Preserve (black star) where it was captured in blue vane traps in 2007 (40 specimens) and 2008 (9 specimens). Also shown is Polk County site (filled circle) where it was recovered in 2006 (3 specimens) and 2007 (3 specimens).

set up for 2-day periods each, in agricultural fields in western Oregon (Stephen and Rao 2005, 2007; Rao and Stephen 2007, 2009; Rao et al. 2009; unpublished data). In 2008-2009, while several thousand bumble bees belonging to 12 other species were captured, no *B. occidentalis* was detected in >100 traps placed at various locations in the same region (SR and WPS, unpublished data). Also, in yearly surveys by Robbin Thorp in southern Oregon and northern California, only 13 *B. occidentalis* were observed or collected since 1999 (Evans et al. 2008). Of those, only one specimen was collected since 2003, even though >12,000 bumble bees of other species were collected or observed in the same time period. In a more widespread survey by James Strange, that covered Utah, northeastern California, southern Oregon, and Nevada, *B. occidentalis* was recovered in only a quarter of the historical sites (Evans et al. 2008).

The collection of *B. occidentalis* at the Zumwalt Prairie Preserve over two consecutive years is encouraging, and highlights the importance of future monitoring studies to determine if the severe decline in the PNW is limited to the coast

and coastal valleys. The distance from greenhouse production areas, and spatial isolation of populations across its range could well account for its greater abundance in the east compared to western Oregon. The 49 individuals collected in the current study contrasts with collections of other North American bumble bee species that have declined. For instance, a single *Bombus affinis* Cresson was collected from 18 sites in eastern Canada and none from 25 sites in the United States (Colla and Packer 2008). In another study in Illinois, *B. borealis* Kirby, *B. ternarius* Say, *B. terricola* Kirby and *B. variabilis* (Cresson) were not detected in a state-wide survey in their native range (Grixti et al. 2009).

Given the presence of isolated populations of *B. occidentalis* in certain areas such as the Zumwalt Prairie Preserve, conservation efforts are critical for its protection. Early signs of its decline along the coast led bee researchers to approach the Oregon Department of Agriculture with their concerns which resulted in a ban on the purchase of commercial non-native bumble bee species in Oregon (http://www.oregon.gov/ODA/PLANT/IPPM/appr_insects.shtml; accessed May 12, 2010). A group of scientists and conservation agencies have petitioned the federal government for establishments of similar regulations nationwide (<http://www.xerces.org/bumblebees/>; accessed May 12, 2010). This will protect existing populations of *B. occidentalis* in the Zumwalt Prairie Preserve from potential disease transmission from commercial bumble bees that are currently being introduced for crop pollination in neighboring regions in eastern Washington and western Idaho.

Acknowledgments

We thank The Nature Conservancy for allowing us to conduct research in the Zumwalt Prairie Preserve, M. Dođramacı, A. Madsen, and K. Tanner for their help in field collection, and R. Thorp for bumble bee identification. This research was supported by USDA National Research Initiative grant # 2006-35101-16572, a General Research Fund grant from Oregon State University, and a TNC Oren Pollak grant awarded to CK.

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Received 11 February 2010

Accepted for publication 4 August 2010