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FIRST REPORT OF TWO CONE AND SEED INSECTS ON *PINUS FLEXILIS*

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Limber pine (*Pinus flexilis* James) ranges in latitude from 33°N to 51°N and in elevation from 870 m above sea level (asl) in North Dakota to ~3400 m asl in Colorado (Burns and Honkala 1990). In the central Rocky Mountains, limber pine co-occurs with many tree species due to its broad elevational range (Peet 1981). Limber pine seeds are large, generally wingless, and dispersed by birds (Lanner and Vander Wall 1980). While it is known that seeds of limber pine in Colorado are eaten by animals such as Clark's Nutcrackers (*Nucifraga columbiana* Wilson), black bears (*Ursus americanus;* McCutchen 1996), and small rodents, little information is available on insect utilization of cones and seeds of limber pine for food and habitat.

In July 1999 we encountered 2nd-year limber pine cones that were host to lepidopteran larvae at several sites (Table 1). As a result of larval feeding, limber pine cones were brown, fragile, and full of coarse, reddish brown frass pellets. The point of insect entry was frequently at the base of the appressed side of the cone. Upon incubation of cones at room temperature, a number of larvae completed pupation, and a moth emerged after ca 10 days. The moth was identified as *Dioryctria auranticella* (Grote) (Lepidoptera: Pyralidae), the ponderosa pine coneworm, by its characteristic markings in the forewings and confirmed by comparison with voucher specimens from the entomology collection at Rocky Mountain Research Station (Fort Collins, CO). During a subsequent field trip in late September 1999, we found numerous cones that contained vacated pupae from *D. auranticella.* Pupation inside cones is the common habit of *D. auranticella* in ponderosa pine in north central Colorado. *Dioryctria auranticella* has previously been reported on knobcone (*Pinus attenuata* Lemm.), ponderosa (*Pinus ponderosa* Dougl. ex Laws.), radiata (*Pinus radiata* D. Don), and Austrian (*Pinus nigra* Arnold) pines (Keen 1958); this is the 1st report of it on limber pine. *Dioryctria auranticella* has a broad distribution that includes most of the western U.S., north into British Columbia, Canada, and south into north central Mexico (Hedlin et al. 1981).

The most severe infestation of *D. auranticella* that we encountered was at Dave's Draw Research Natural Area (1630 m asl). This site is the southern end of an escarpment on the Pawnee Grasslands in north central Colorado; to the north the escarpment is occupied by a mix of limber and ponderosa pines. We also observed limber pine cones of similar condition to those at Dave's Draw at a 2652 m asl site in North Park, west of Walden, Colorado (Table 1). At this site, limber pine is growing with quaking aspen (*Populus tremuloides* Michx.) on a knoll surrounded by dry sagelands and irrigated hay fields.

Dioryctria auranticella may impact limber pine seed availability for regeneration and possibly food for rodents and birds at Dave's Draw Research Natural Area. It is currently unclear whether Clark's Nutcrackers frequent Dave's Draw Research Natural Area; we have never seen nutcrackers at this site, and they are reported to be rare on the northeastern plains of Colorado (Andrews and Righter 1992). Inspection of more than 50 cone-bearing trees at this site in late July 1999 revealed that all of them exhibited lepidopteran damage. Of 96 limber pine cones collected that produced any

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TABLE 1. Summary of cone and seed insects found on limber pine during the summer of 1999 along an elevational gradient east of the Continental Divide in northern Colorado and southern Wyoming. For a more complete description of each site, see Schoettle and Rochelle (2000). Presence is noted by +, absence by –.

Site	Elevation (m)	Female cones	*Dioryctria auranticella*	*Leptoglossus occidentalis*
Dave's Draw RNA	1630	+	+	+
Woods Landing (WY)	2609	+	–	–
Jelm View (WY)	2646	+	–	–
Lake John	2652	+	+	–
Pond View	2963	+	–	–
Lawn Lake	3084	–		
Crown Point	3133	–		
Mid-Rollins Pass	3170	+	–	–
Jenny Lake	3328	+	–	–

seeds, 78% had some insect-caused damage reducing seed yield. This is a conservative description of the impact of the insect population since numerous cones were destroyed completely and were not collected.

During the September site visit to Dave's Draw Research Natural Area, we also collected numerous specimens of the western conifer seed bug, *Leptoglossus occidentalis* Heidemann (Hemiptera: Coreidae). The seed bug was abundant on the tips of current-year needles and conelets (1st-year cones), predominantly on the south side of limber pine trees. *Leptoglossus occidentalis* has a broad distribution that includes all of the western U.S. into southern Canada (Hedlin et al. 1981). It has been reported on numerous species, but this is the 1st report of it on limber pine. We have not observed the presence of *L. occidentalis* at any of our other limber pine sites (Table 1).

At 2 mid-elevation sites (2609 and 2646 m asl), limber pine cones were host to beetles, the impact of which was consistent with that caused by *Conophthorus contortae* Hopkins (Coleoptera: Scolytidae) previously reported on numerous western pines including limber, lodgepole (*Pinus contorta* Dougl. ssp. *latifolia* Bailey), and ponderosa (Hedlin et al. 1981). The point of attack was the base of the cone. Infested cones were small and cone expansion appeared to have been arrested after the 1st year of development. Infested cones produced no seed. Several trees had a partially infested cone crop, but more frequently the damage was isolated to individual trees that experienced destruction of their entire cone crop. Both beetle-affected limber pine stands are within an extensive forest dominated by lodgepole pine.

We observed no signs of insects in maturing cones at 3 higher-elevation sites dominated by limber pine (2963, 3170, and 3328 m asl); and we could not find any maturing cones at 2 other sites (3084, 3133 m asl; Table 1).

Limber pine appears to be an alternate host for several cone and seed insects that affect co-occurring species. Limber pine co-occurs with ponderosa pine in its lower-elevation range; in this area we report that it is host to *D. auranticella* and *L. occidentalis*, which are commonly found on ponderosa pine. Where limber pine grows with lodgepole pine, it is host to *C. contortae*, an insect that is often associated with lodgepole pine.

These new records purport the need to further investigate the arthropod fauna that is associated with cones and seeds of limber pine. Voucher insect specimens collected have been placed in the entomological collection located at the Rocky Mountain Research Station, Fort Collins, Colorado.

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