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Whitebark pine (*Pinus albicaulis* Engelm.) seed production in natural stands

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Abstract

The mature cones of whitebark pine from two high-elevation natural stands in central Idaho and western Nevada were analyzed in 2004 to determine the seed numbers and quality. It has the typical 2-year pine reproductive cycle. Cones are indehiscent and deciduous at maturity and the seeds lack seed wings. Cones averaged 62 scales, 75% of which were fertile with a seed potential of 96 seeds per cone. Total seeds per cone averaged 66 of which 46 were filled. Other potentially filled seeds were lost for different causes including abortion before pollination, abortion soon after pollination due to a lack of pollination or self-pollination, abortion about the time of fertilization due to self-fertilization, abortion during early and late-embryo development, and damage by insects or disease during development. About 70% of total seeds were filled and likely viable, which is high for conifers in natural stands especially at high elevations.

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1. Introduction

Whitebark pine (*Pinus albicaulis* Engelm.) has an extensive but very scattered distribution at high elevations from 1000 m in coastal areas of British Columbia (B.C.), 1700–2200 m in the Cascade Mountains of Oregon and Washington up to 3600 m in the Sierra Nevada of northern California to 2200 m in elevation in the interior of B.C. and 1900–2300 m in western Alberta and from 1900 to 3300 m the Inland Empire forest regions of eastern Washington, Northern Idaho, western Montana and northwestern Wyoming (Critchfield and Little, 1966; Hosie, 1979; Farjon, 1998). The most accurate distribution map is given by Critchfield and Little (1966). It grows on thin soils near the upper tree line often on rocky faces and cliffs. Under such conditions it grows slowly and trees often have several tops and considerable top-damage due to wind and snow (Fig. 1). It seldom forms pure stands, however, it may on deep well-drained soils where it grows well (Hosie, 1979).

Whitebark pine is a five-needle white pine, belonging to the Subgenus *Strobus*, Section *Strobus*, Subsection *Cembrae*, the stone pines. Cones are indehiscent and deciduous at maturity (Fig. 2), and seeds lack wings (Little and Critchfield, 1969). Well-known related species are *P. siberica* Du Tour (Siberian stone pine) and *P. cembra* L. (Swiss stone pine) of Asia and Europe (Little and Critchfield, 1969; Farjon, 1998). Whitebark pine is the only stone pine native to North America, but there are several North American white pines.

White pines are susceptible to white pine blister rust (*Cronartium ribicola*), which lives part of its life cycle on *Ribes* shrubs. The fungal spores infect the pine needles and the fungal hyphae grow to the branch, often reaching the trunk of young trees where it may girdle and kill the tree. All four North American white pines (*P. monticola*, *P. flexilis*, and *P. albicaulis* in the west and *P. strobus* in the east) are classed as susceptible to very susceptible, whereas many Eurasian and a few other North American white pines are considered immune or resistant (Bingham, 1983). The susceptibility of whitebark pine to the rust coupled with the threat from the mountain pine beetle (*Dendroctonus ponderosae*) and catastrophic fire may cause the species to soon be listed under the Endangered Species Act

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