PACIFIC SOUTHWEST
Forest and Range
Experiment Station

FOREST SERVICE
U.S.DEPARTMENT OF AGRICULTURE
P.O. BOX 245, BERKELEY, CALIFORNIA 94701

# Dwarf mistletoe does not increase trunk taper in released red firs in California

Robert F. Scharpf

*USDA Forest Service*
*Research Note PSW-326*
1977

Scharpf, Robert F.
1977. **Dwarf mistletoe does not increase trunk taper in released red firs in California.** USDA Forest Serv. Res. Note PSW-326, 3 p. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

Dwarf mistletoe had no noticeable effect on trunk taper of young, dominant and codominant red firs 4 to 22 inches (10.2 to 55.9 cm) d.b.h. Also, taper was not influenced by live crown ratio of infected and uninfected trees. Trees less than 7 inches d.b.h. had significantly more taper than larger trees, irrespective of dwarf mistletoe.
*Oxford:* 442.1:176.1 *Arceuthobium abietum:* 174.7 *Abies magnifica* (794):181.64.
*Retrieval terms:* red fir; California; parasites; dwarf mistletoe; growth loss; taper.

The literature on dwarf mistletoe includes much information on tree volume losses caused by the parasite. Mortality, reduced radial growth rate, reduced height growth, tree deformation, and cull are among the effects described.

A potential source of volume loss that has not been well investigated is increased trunk taper resulting from dwarf mistletoe infection. In their studies of the effect of dwarf mistletoe on southwestern ponderosa pine, Korstain and Long[1] imply that greater taper occurs in infected than uninfected trees. On the other hand, for ponderosa pine in the Pacific Northwest, Childs and Edgren[2] found that dwarf mistletoe had little if any effect on trunk form, and Shea[3], working with Douglas firs in the Pacific Northwest, concluded that dwarf mistletoe "affects the increment of the bole uniformly. . . ." In Alberta, Canada, however, "infected [lodgepole pine] trees had comparable diameters at stump height but had greater taper than those of their healthy counterparts. Volume comparison of healthy and infected trees in a stand based on d.b.h. and height measurements do not express fully the true differences, because only one component of the volume, height, has a significant bearing." (Baranyay and Safranyik).[4]

Apparently the effect on trunk taper varies for different host-dwarf mistletoe combinations in different regions in western North America. This study was undertaken to determine the effect of dwarf mistletoe *(Arceuthobium abietinum* f.sp. *magnificae)* on trunk taper in young-growth red firs *(Abies magnifica)* of different d.b.h. and live-crown-ratios.

## METHODS

Studies were conducted in pure red fir stands on four different plots in the Stanislaus National Forest in the central Sierra Nevada of California. The plots were site classes I and II for fir[5] and each contained trees that had been released by logging from about 5 to 15 years previously. All dominant and codominant trees 4 to 22 inches (10.2 to 55.9 cm) d.b.h. (at 4.5 ft—1.4 m—height) were selected for study on the plots, except that trees badly damaged by logging—such as those with broken tops, badly damaged crowns, or large trunk scars — were excluded. Information on dwarf mistletoe ratings and live crown ratio was taken for each tree.

### Dwarf Mistletoe Rating

The living crown was divided in three equal parts—lower, middle, and upper crown — and intensity of dwarf mistletoe infection was rated for each part. Ratings were light, 1 to 10 percent of the major branches infected; moderate, 11 to 50 percent of the branches infected; and heavy, more than 50 percent of the branches infected. Each rating was given a numerical value: light=1, moderate=2, and heavy=3.

The overall tree infection rating was the combined numerical value of each of the three parts of the crown, so that overall ratings ranged as follows:

Noninfected trees—0
Lightly infected—1 to 3
Moderately infected trees—4 to 6
Heavily infected trees—7 to 9

If the light and moderate classes are combined, this method of rating dwarf mistletoe is comparable to the six-class system described by Hawksworth and Lusher[6].

### Live Crown Ratio

The live crown ratio was an estimate in percent

Table 1 — *Relation of trunk taper ratios to level of dwarf mistletoe infection, in red fir, by (a) diameter class and (b) live crown ratio class (central Sierra Nevada, California)*

| Diameter class and infection level | Number of trees | Mean trunk taper | | Live crown class and infection level | Number of trees | Mean trunk taper | |
|---|---|---|---|---|---|---|---|
| | | Ratio | S.D. | | | Ratio | S.D. |
| 4.1 to 7.0 in. d.b.h.: | | | | Poor (25 to 50%): | | | |
| None | 7 | 0.47 | 0.24 | None | 9 | 0.68 | 0.18 |
| Light | 31 | .48 | .16 | Light | 15 | .69 | .16 |
| Moderate | 39 | .54 | .17 | Moderate | 34 | .73 | .16 |
| Heavy | 12 | .47 | .10 | Heavy | 21 | .70 | .24 |
| 7.1 to 10.0 in. d.b.h.: | | | | Average (51 to 75%): | | | |
| None | 7 | .73 | .10 | None | 5 | .76 | .06 |
| Light | 33 | .73 | .10 | Light | 23 | .62 | .18 |
| Moderate | 43 | .71 | .13 | Moderate | 62 | .72 | .17 |
| Heavy | 11 | .73 | .14 | Heavy | 21 | .74 | .17 |
| 10.1 to 13.0 in. d.b.h.: | | | | Good (76 to 100%): | | | |
| None | 3 | .77 | .07 | None | 4 | .39 | .19 |
| Light | 14 | .77 | .10 | Light | 47 | .64 | .19 |
| Moderate | 29 | .82 | .08 | Moderate | 42 | .68 | .17 |
| Heavy | 6 | .86 | .07 | Heavy | 2 | .86 | .07 |
| 13.1 to 16.0 in. d.b.h.: | | | | | | | |
| None | 1 | .78 | | | | | |
| Light | 2 | .73 | .10 | | | | |
| Moderate | 12 | .83 | .06 | | | | |
| Heavy | 8 | .82 | .04 | | | | |
| 16.1 to 22.0 in. d.b.h. | | | | | | | |
| None | - | - | - | | | | |
| Light | 5 | .72 | .26 | | | | |
| Moderate | 15 | .85 | .05 | | | | |
| Heavy | 7 | .89 | .06 | | | | |

of the total height of the tree in living crown, after deduction of an appropriate percentage for dead branches and openings in the live crown.

### Trunk Taper

Trunk taper was determined from tape measurements of d.b.h. and caliper measurements of trunk diameter at a height of 16 feet (4.9 m), to the nearest 0.1 inch (0.3 cm). A taper ratio was then calculated by dividing diameter at 16 feet by d.b.h. The lower the ratio, the greater the taper.

## RESULTS AND CONCLUSIONS

Results indicate that dwarf mistletoe had no discernible effect on trunk taper. No evidence was found to suggest that dwarf mistletoe infection increased trunk taper in trees of any of the various d.b.h. and live-crown-ratio classes *(table 1)*. Mean trunk taper was apparently related to d.b.h., however; it was noticeably greater in trees less than about 7 inches (17.8 cm) d.b.h. than in larger ones, irrespective of dwarf mistletoe *(table 1)*. Live crown ratio had no noticeable effect on trunk taper at any rated level of infection. Trees with poor live crown ratios showed taper ratios similar to those trees with a full crown. The taper ratio for uninfected trees with good crowns was exceptionally low, probably because most trees in the small sample of uninfected trees were young, and averaged less than about 6 inches d.b.h.

Thus, in the released red firs studied, neither dwarf mistletoe nor live crown ratio had any noticeable effect on trunk taper. Calculations of volume for such trees, both healthy and infected, need only be concerned with measurements of tree height and d.b.h. Results obtained from these red firs in the central Sierra Nevada should be applicable to open-growing, dominant and codominant young-growth red fir in stands on good sites elsewhere in the State.

## NOTES

[1]Korstain, Clarence F. and W.H. Long, 1922. *The western yellow pine mistletoe.* USDA Bull. 1112, 35 p., illus.

[2]Childs, T.W., and J.W. Edgren, 1967. *Dwarf mistletoe effects on ponderosa pine growth and trunk form.* Forest Sci. 13(2):167-174.

[3]Shea, Keith R. 1963. *Marking guide evolved for mistletoe-hit Douglas-fir.* Forest Ind. 90(1):58-59.

[4]Baranyay, J.A., and L. Safranyik, 1970. *Effect of dwarf mistletoe on growth and mortality of lodgepole pine in Alberta.* Dep. Fisheries and Forestry, Can. For. Serv. Publ. 1285, 19 p., illus.

[5]Dunning, Duncan. 1942. *A site classification for the mixed-conifer selection forest of the Sierra Nevada.* USDA Calif. Forest and Range Exp. Stn. Res. Note 28, 21 p.

[6]Hawksworth, Frank F., and A.A. Lusher, 1956. *Dwarf mistletoe survey and control on the Mescalero Apache Reservation, New Mexico.* J. For. 54:384-390.

**The Author**

**ROBERT F. SCHARPF,** a plant pathologist, is studying problems in forest diseases and their control, with headquarters in Berkeley, Calif. He earned a forestry degree (1954) at the University of Missouri, and a master's degree in forestry (1957) and a doctorate in plant pathology (1963) at the University of California, Berkeley. He joined the Forest Service in 1960, and has been with the Station's research staff since then.


**The Forest Service of the U.S. Department of Agriculture**

. . . Conducts forest and range research at more than 75 locations from Puerto Rico to Alaska and Hawaii.

. . . Participates with all State forestry agencies in cooperative programs to protect and improve the Nation's 395 million acres of State, local, and private forest lands.

. . . Manages and protects the 187-million-acre National Forest System for sustained yield of its many products and services.

**The Pacific Southwest Forest and Range Experiment Station**

represents the research branch of the Forest Service in California and Hawaii.

☆U. S. GPO: 1978—793-116