

BALSAM FIR CHALCID CAUSES LOSS OF FRASER FIR SEED

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Forest tree seed are often attacked by tiny chalcids which destroy the developing embryo and endosperm. In the western United States up to 60 percent of Douglas-fir, true fir, spruce, and pine seed are consumed by various species of *Megastigmus* (Keen 1958). In Scotland, Hussey (1955) reported that up to 95 percent of the Douglas-fir seed was destroyed by *M. spermotrophus* Wachtl. Losses of from 22 to 57 percent of balsam fir seed in Canada were reported by Hedlin (1956) due to *M. specularis* Walley.

Insect-caused losses of seed from Fraser fir, *Abies fraseri* (Pursh) Poir., have never been evaluated; but, because of increased interest in growing this species for Christmas trees, information about the effect of insects on the limited seed source was needed. During the past few years, we have established that *M. specularis* attacks Fraser fir seed in the Southern Appalachians and may cause serious losses.

Fraser fir cones were collected from Roan Mountain, North Carolina, in September of 1964 and 1965 when the cones were fully mature. After air-drying for about 2 weeks, the seed was extracted and stored in cheesecloth sacks at room temperature for about 1 month. The seed was then transferred to polyethylene bags and refrigerated at 0°F. until removed for examination. Each year, 10 lots of 100 seeds each were dissected under a microscope to determine the degree of insect infestation. To determine the feasibility of a nondestructive method of seed examination, X-rays of seed stored in 1964 and 1965 were taken in April 1966.

Seed Losses-3.5-29 Percent

Fraser fir generally has a good cone crop every other year with a poor crop in the intervening year. In 1963 an extremely heavy crop of cones was produced throughout the Southern Appalachians. In 1964 very few cones were produced except in a localized area on Roan Mountain. Cones were collected from this area in September 1964 and processed

in October. One thousand seeds from 10 samples were dissected. Average loss due to insect damage was 29 percent, ranging from 22 to 36 percent.

Larval specimens of the insect causing the damage were submitted to the Insect Identification and Parasite Introduction Branch of the U.S. Department of Agriculture and identified by B. D. Burks as *Megastigmus* sp. When the adults emerged in the spring of 1965, he was able to make specific identification as *M. specularis*.

In 1965 a good crop of cones was produced, and collections were made from Roan Mountain as in the previous year and handled similarly. Seed losses resulting from attack by *Megastigmus* averaged 3.5 percent per 1,000 seeds and ranged from 0 to 7 percent per 100-lot sample. X-rays of the 1964 and 1965 seed lots (fig. 1) illustrate the insect conditions in the two seed years.

Range and Life History

The insect species *Megastigmus specularis* was originally described by Walley in 1932 from specimens found in balsam fir seed gathered in New Brunswick. Since then, this species has been collected in Canada from Saskatchewan to Nova Scotia. In the United States, *M. specularis* is found from Minnesota to Maine and south through Massachusetts. It has not been collected from Pennsylvania, Virginia, or West Virginia; but since it occurs in North Carolina, it probably is also present in fir in the intervening States.

The life history and habits of this species were studied by Hedlin (1956) at Indian Head, Saskatchewan; no additional information has been published since. Our preliminary observations indicate that the life history of *M. specularis* in North Carolina is similar to that in Canada.

Adults emerge in the spring from seed which have overwintered on the ground. Oviposition occurs the latter part of June in the seed embryo of newly developing cones. The larval period lasts for 11 months, pupation occurs, adults emerge about 2

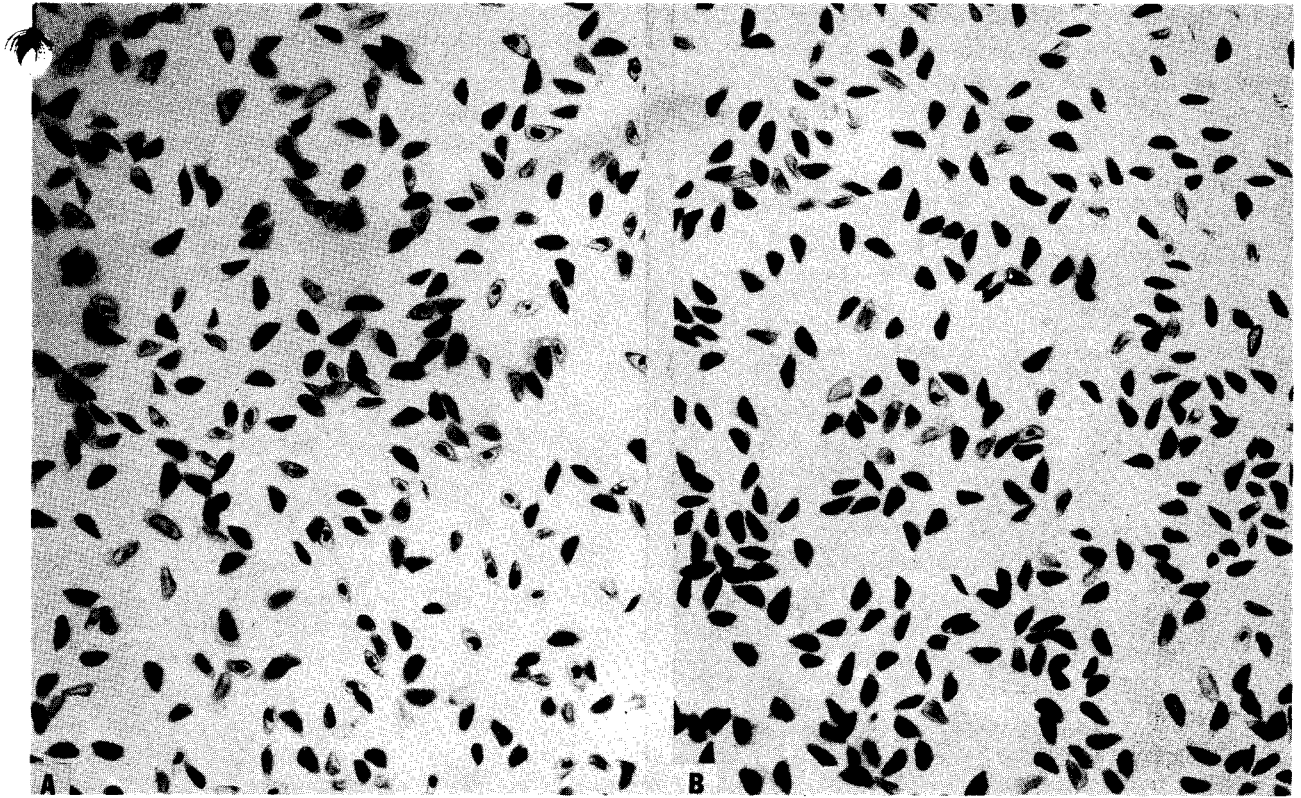


Figure 1.—X-ray of Fraser fir seed collected on Roan Mountain, North Carolina, showing chalcid infestation. (A) Average infestation of 29 percent in 1964. (Note that several of the seeds contain more than one larva). (B) Average infestation of 3.5 percent in 1965. (x4)

weeks later, and the cycle is repeated. Some larvae remain in diapause at least another 12 months to carry on the species in case of a complete crop failure.

Feeding is confined to the one seed in which the egg or eggs were deposited. External appearance of the seed is not affected, and normal seed cannot be visually distinguished from infested seed.

In the studies of *M. nigrovariegatus* by Milliron (1949) and *M. specularis* by Hedlin (1956), it was observed that, although multiple infestations in a seed are common, only one larva matures. Milliron observed that, although several larvae might develop through the third instar in the same seed, eventually they were forced into close contact and cannibalism resulted.

Our X-ray examinations in 1966 of seed gathered in 1964 (fig. 1) demonstrate that in many seeds cannibalism did not occur. Dissection of seeds which suffered multiple infestation confirmed the

X-ray observations and disclosed that up to seven partially developed larvae were alive at the time of *Megastigmus* emergence. Because of their small size, however, it is probable that none of these larvae could have matured or emerged.

Parasites of Chalcids

Following extraction of the first seed lot in 1964, large numbers of minute insects started to emerge on October 17. These were attracted to light and made short flights over the surface of the seed. Emergence holes in the seed were similar in appearance but smaller than those made by *Megastigmus*. These tiny parasitic insects of *Megastigmus* were identified as *Platymesopus* sp. Examination of 1,000 seeds from 10 sample lots in December 1964, as determined by emergence holes in the seed, revealed an average parasitism of 1 percent, with a range of 0 to 2 percent per sample. A few specimens were also recovered following emergence in the spring. A

second parasite, *Tetrastichus sp.*, emerged in the laboratory in small numbers in May 1965 at the same time as did *Megastigmus*.

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