Wound Periderm Formation in Larix laricina in response to Arceuthobium pusillum

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The eastern dwarf mistletoe (*Arceuthobium pusillum* Peck) is a frequently encountered parasite on black spruce (*Picea mariana* [Mill.] B.S.P.), but is infrequently found on eastern larch (*Larix laricina* [DuRoi] K. Koch), although the latter species grows intermingled with infected black spruce in centers of heavily infested trees. Reasons for the low incidence of dwarf mistletoe on eastern larch are unknown. While determining the extent of development of the endophytic system in witches' brooms on eastern larch, I have observed what may be one factor accounting for resistance in this host.

Infected larch were collected from an infection center in Itasca State Park, Minn., in 1968 (4). Killing, fixing, and sectioning techniques were essentially as reported previously (3).

Infection of larch usually occurs on or at the base of spur shoots (Fig. 1-A). The leaves are deciduous, and any seeds adhering to them are lost in September. The major portion of bark surface of young twigs is rather smooth as compared to the fissured and pubescent young twigs of black spruce, and seeds presumably are washed off easily by rain. The spur shoots, however, are covered with many tiny scales and leaf scars, and provide a good surface for the viscin to adhere. In many cases following infection, the endophytic system ramifies throughout the spur shoots, yet never enters the stems.

Occasionally, apparently established and successful infections on eastern larch were "corked off" by periderm formation. Figure 1-B and C illustrate how the entire endophytic system has been separated from host tissue by wound periderm. The parasite thrived for a time and produced at least one aerial shoot, judging from remains of a basal cup. The formation of the wound periderm might explain the premature shriveling of aerial shoots noted earlier on these same trees (4).

Although eastern larch is of minor importance economically, the possibility that such a defense mecha-

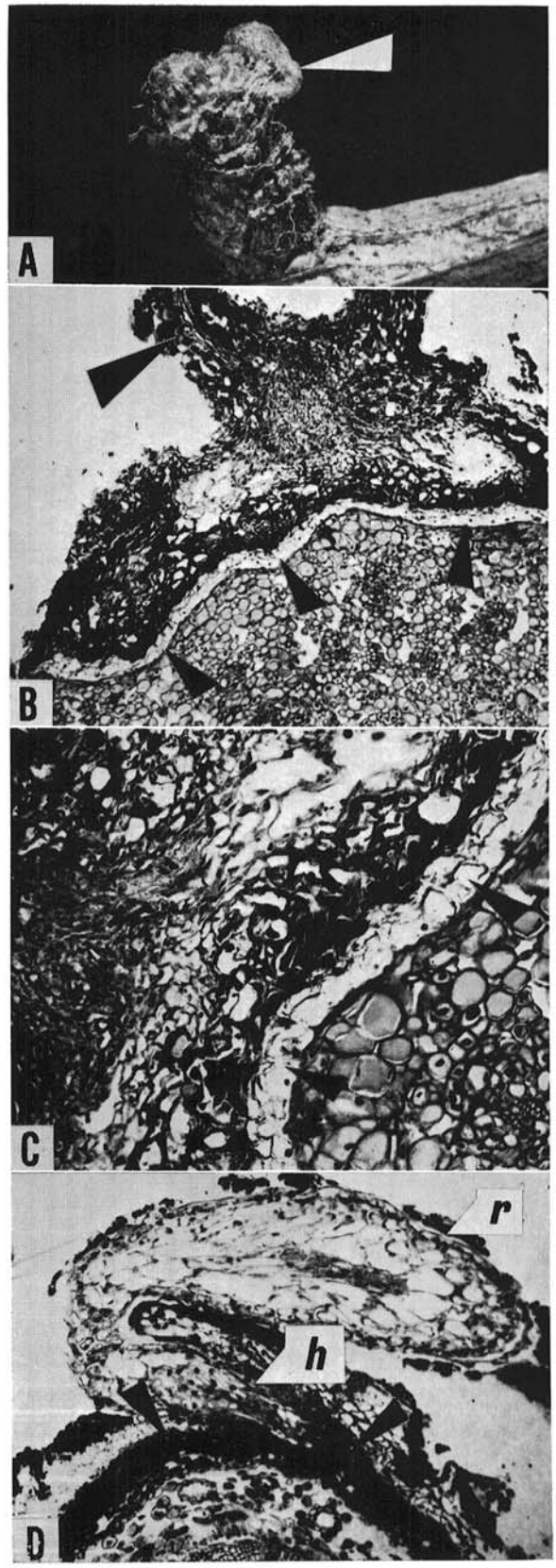

Fig. 1. A) Dormant spur shoot of eastern larch with germinating dwarf mistletoe seed (arrow) attached. **B, C)** Transverse sections of portion of spur shoots of eastern larch, showing formation of wound periderm (small arrows) around the endophytic system of dwarf mistletoe. Large arrow marks a basal cup of the mistletoe in Fig. 1-B. In both figures, the parasitic tissue is located to the upper left of the band of lightly stained wound periderm marked by arrows. **D)** Transverse section of branchlet of black spruce showing thick layer of taniniferous cells (arrows) [illegible] haustorium (h) of dwarf mistletoe that has penetrated the outer bark, [illegible] radicle (r) and penetrated the outer bark, [illegible] stopped by the resistant layer.

nism might exist in the commercially valuable black spruce suggests an approach for forest tree geneticists attempting to breed for dwarf mistletoe resistance in black spruce. In following the penetration of *A. pusillum* into black spruce, the invading primary haustorium was occasionally unable to rupture the thick layer of taniniferous cells which develop in the phellogen of older twigs (Fig. 1-D). Formation of protective layers of periderm in black spruce appears promising and deserves further attention.

There are several reports mentioning the possible association of wound periderm and mistletoe infection. Greenham & Leonard (1) quoted a communication from Frank Hawksworth's report of the initiation of a hypersensitive reaction on *Abies lasiocarpa* following invasion by radicles of *Arceuthobium americanum* (F. Hawksworth, *personal communication*). Thoday (5) reported that the cork formation which seals off the penetrating haustorium of *Viscum album* in *Fagus sylvatica* is a rare phenomenon. Leafy mistletoes (*Loranthus* spp.) germinate readily on any surface on which they happen to fall, and haustoria often penetrate non-hosts, and in some cases even to the xylem (Menzies [2]). Further development is prevented in some way, but Menzies (2) does not mention whether wound periderm was involved.

LITERATURE CITED

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