

Sustained Natural Infestation by the Mountain Pine Beetle in Seven New *Pinus* and *Picea* Hosts¹

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During 1967 we investigated a natural infestation of the mountain pine beetle, *Dendroctonus ponderosae* Hopkins (= *monticolae* Hopkins), in 7 new hosts: *Pinus banksiana* Lambert, *P. nigra* Arnold, *P. resinosa* Aiton, *P. rigida* Miller, *P. strobus* L., *P. sylvestris* L., and *Picea abies* (L.) Karsten. These trees were planted between 1916 and 1943 in Shattuck Arboretum at the University of Idaho. None of these species is native to Idaho, and only *P. banksiana* occurs naturally within the range of the beetle.

The infestation was unaided by any disturbance or experimentation and has persisted for 3 consecutive generations of the beetle. Our observations may be useful in judging the danger of infestations in other western plan-

tations of these 7 tree species. They may also interest geneticists seeking to breed native *P. monticola* with *P. strobus* for the latter's greater resistance to white pine blister rust, *Cronartium ribicola* J. C. Fischer ex Rabenhorst. Finally, the successful infestation of *P. banksiana*, a tree species that hybridizes with *P. contorta* in Alberta, Canada, raises the question of why *D. ponderosae* has not bridged eastward in *P. banksiana*. The similarly polyphagous red turpentine beetle, *Dendroctonus valens* LeConte, probably reached the east in such a fashion, though apparently utilizing other coniferous hosts.

Wood (1963) reported the following species of *Pinus* as hosts for *D. ponderosae* (asterisks denote species native to Idaho): **albicaulis* Engelm., *balfouriana* Greville & Balfour, **contorta* Douglas (= *murrayana* Greville & Balfour), *coulteri* D. Don, *edulis* Engelm., **flexilis* James, *jeffreyi* Greville & Balfour, *lambertiana* Douglas, *monophylla* Torrey & Fremont, **monticola* Douglas, **ponderosa* Lawson, *strobiformis* Engelm.

Wood (1963) and Hopkins (1921), also listed *Picea engelmannii* Parry as a host of *D. ponderosae* during an

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Table I.—Relation of approximate age of trees and success of beetle attack. Shattuck Arboretum, Moscow, Idaho. 1965-67.

Host species	Years since planting	No. trees attacked ^a		
		Successful	Unsuccessful	Total
<i>Pinus</i>				
<i>sylvestris</i>	24-51	30	28	58
<i>strobus</i>	51	31	9	40
<i>resinosa</i>	26	21	2	23
<i>banksiana</i>	51	9	1	10
<i>nigra</i>	51	4	2	6
<i>rigida</i>	51	4	0	4
<i>Picea</i>				
<i>abies</i>	51	1	1	2
Total		100	43	143

^a Successfully attacked trees died within 1 year; beetle progeny matured and emerged from them. Unsuccessfully attacked trees survived beyond 1 year after attack and contained no surviving brood.

epidemic. However, it is not clear whether attacks were successful (trees killed in 1 year; beetle progeny matured and emerged from them) or whether progeny survived to maturity. We found attacks in 2 *Picea abies* trees in the vicinity of the successfully attacked pines. One of these trees was attacked unsuccessfully (tree survived and contained no surviving brood); in the other, very few progeny were produced. Such attacks in conifers of unrelated genera have been recorded for other *Dendroctonus* species. They apparently occur when beetles become abundant and when many natural hosts are being attacked successfully. Under these conditions, attractive odors that diffuse from successfully attacked host trees may cause flying beetles to arrest their flight and attack intermingled "non-host" trees. Survival of some progeny in the latter may have led to development of host races in the past and may have aided in speciation of *Dendroctonus*.

A total of 143 trees in the Arboretum was attacked during 1965-67 (Table I.) The number of attacked trees of each species of pine (but not spruce) was roughly proportional to the abundance of each of those tree species in the Arboretum. We gathered additional data from the 2 most commonly infested species, *P. sylvestris* and *P. strobus*. The latter may be more susceptible to the beetle although perhaps no more attractive to initial attacks. That is, proportionally more *P. strobus* succumbed to attacking beetles, as shown in Table I, although more *P. sylvestris* were attacked. Even in successfully attacked trees, we found that *P. sylvestris* contained a larger proportion of galleries having a resinous condition, fewer emergence holes, and fewer egg galleries (2.5/ft² in *P. sylvestris* vs. 6.6/ft² in *P. strobus*). Reid (1963) reported an average of 7.5 egg galleries/ft² in lodgepole pine, *P. contorta*, in Alberta.

In *P. strobus*, an average of 91 beetles/ft² emerged from 12 sections cut from 3 trees. (Reid (1963) reported 50 from *P. contorta* and Bedard⁴ reported 14 from *P. monticola*). Survival of so many brood in *P. strobus* indicates that it is a very suitable host for the beetle; but the circumstance that natural enemies were few may have contributed to their survival. The Arboretum is isolated from surrounding forests by cropland, and the beetle may have arrived there relatively free of enemies, thereby enabling more of its progeny to survive to the time of our observations.

The only predators found were a few larvae, including a clerid, an ostomatid, and a dolichopodid. Hymenoptera were conspicuously lacking. Newly emerged *D. ponderosae* adults were infested externally with the mite *Proctolaelaps subcorticalis* Lindquist and internally with the nematodes *Contortylenchus reversus* (Thorne) Ruhm and *Aphelenchoides* sp. Secondary insects of the family Scolytidae that were present in these trees included *Orthotomicus latidens* (LeConte) in *P. sylvestris* and *Gnathotrichus retusus* (LeConte) in *P. strobus*.

Two native hosts, *P. ponderosa* and *P. monticola*, approximately 50 years old, also occur in the Arboretum, but none was attacked in the interval reported. It seems remarkable that such a strong preference existed for exotic species in the presence of these native hosts. We believe that this was not due solely to chance. Risk of loss from infestation by the beetle would be worthy of consideration should large-scale planting of the 6 exotic pine species be contemplated within the range of the beetle.

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⁴W. D. Bedard. A study of mountain pine beetle infestations in western white pine. Unpublished Rep., Forest Insect Lab., USDA Bur. Entomol. Plant Quar., Coeur d'Alene, Idaho. 47 p. 1959.

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