

DAMAGE TO CONIFERS BY THE JAPANESE BLACK BEAR

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Abstract: The Japanese black bear (*Selenarctos thibetanus japonicus Schlegel*) removes bark from both broad-leaved and coniferous trees in Japan. These injuries are predominantly inflicted on coniferous species over an extensive geographical area on Honshu and Shikoku islands. Seventeen conifer species are known to be attacked. The bark is typically removed at the base of the tree and the exposed sapwood is gnawed and presumably eaten by bears. Tree feeding occurs mainly between mid-June and mid-July. Japanese cedar (*Cryptomeria japonica*) and Japanese cypress (*Chamaecyparis obtusa*), the most useful timber species in Japan, sustain the most severe damage. Most Japanese cedar trees sustain bole circumference girdling of 10-40 percent without showing symptoms of distress, but trees with 50 percent or more girdling usually display evidence of serious weakening. Trees completely girdled eventually die. Tree wounds are subject to infections that can deteriorate wood quality. Prevention of bear damage is an imposing challenge to Japanese forestry.

The Japanese black bear is the mammal most injurious to conifers in Japan, especially to artificial regeneration of mature trees. Bears strip bark from trees, either completely or part way around the bole, on an extensive scale, and these injuries cause a substantial loss in wood volume. Prevention of bear damage is presently one of the most significant challenges in Japanese forestry. Bears are being vigorously controlled in an attempt to reduce damage, although the bear population is obviously declining as a result of habitat deterioration caused by developmental activities in remote areas and by expansion of forest regeneration.

This situation has created constant antagonism between proponents of bear conservation and proponents of bear damage prevention in forests. To help resolve this controversy, comprehensive information is being collected on the bear damage problem and on the biology and ecology of the Japanese black bear.

This paper presents information concerning the characteristics, distribution, and impact of bear damage in Japan. This damage is very similar to tree damage by black bears (*Ursus americanus* Pallas) in North America (Lutz 1951, Levin 1954, Glover 1955, Zeedyk 1957, Molnar and McMinn 1960, Poelker and Hartwell 1973), although there are also significant differences.

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TREE SPECIES DAMAGED

Seventeen conifer tree species have been reported damaged by the Japanese black bear in Japan (Table 1). All of these conifers are native, except the Norway spruce (*Picea abies*), which was introduced from Europe. The most frequently and severely damaged species are the Japanese cedar and Japanese cypress,

Table 1. Conifer tree species damaged by the Japanese black bear.

Common name	Scientific name
Japanese cedar, cryptomeria	<i>Cryptomeria japonica</i>
Japanese cypress	<i>Chamaecyparis obtusa</i>
Sawara cypress	<i>Chamaecyparis pisifera</i>
Fir	<i>Abies firma</i>
Veitch fir	<i>Abies veitchii</i>
Maries fir	<i>Abies mariesii</i>
Nikko fir	<i>Abies homolepis</i>
Japanese hemlock	<i>Tsuga sieboldii</i>
Hiba arborvitae	<i>Thujaopsis dolabrata</i>
Japanese white pine	<i>Pinus pentaphylla</i> var. <i>himekomatsu</i>
	<i>Pinus pentaphylla</i> var. <i>pentaphylla</i>
Japanese red pine	<i>Pinus densiflora</i>
Japanese larch	<i>Larix leptolepis</i>
Tigertail spruce	<i>Picea polita</i>
Hondo spruce	<i>Picea jezoensis</i> var. <i>hondoensis</i>
Umbrella pine	<i>Sciadopitys verticillata</i>
Norway spruce	<i>Picea abies</i>

which are common in natural mixed-species stands, are planted extensively, and are the most useful tree species in Japan. During the last 5 years, the area of bear damage had ranged between 400 and 1,200 ha annually.

Although the Japanese black bear apparently has a definite preference for conifers, damage to broad-leaved trees such as chestnut (*Castanea crenata*), spicebush (*Lindera erythrocarpa*), cucumber tree (*Magnolia obovata*), wingnut (*Pterocarya rhoifolia*), oak (*Quercus mongolica* var. *grosseserrata*), and linden (*Tilia japonica*) also occurs in Japan but is rarely reported (Watanabe et al. 1970).

CHARACTERISTICS OF DAMAGE

Infliction of Damage

The Japanese black bear typically loosens the bark at the base of the tree and peels it upward, apparently with

the teeth and claws. The bark is usually removed in strips 3-5 cm in width and the injury may extend up the trunk to a height of 2-4 m. Peeled bark of the Japanese cedar remains attached to the tree, dangling in long strips. The bark of other conifer species, such as fir (*Abies firma*), Japanese larch (*Larix leptolepis*), and Japanese hemlock (*Tsuga sieboldii*), does not remain attached to the trunk (Fig. 1).

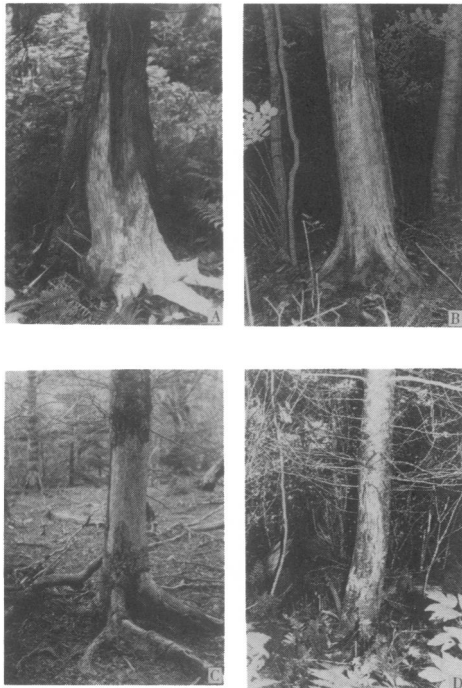


Fig. 1. Injuries inflicted on coniferous trees by Japanese black bears. A. Japanese cedar. B. Nikko fir. C. Hondo spruce. D. Japanese larch.

After removal of the bark, the exposed sapwood is apparently eaten, since shallow grooves 2-3 mm deep are distinctly imprinted on the sapwood. These grooves are typically vertical on wounds above the root collar and horizontal or diagonal on wounds near the root collar (Fig. 2). The bark is not eaten or removed from the site of injury.

Damage is typically basal, and gnawing on sapwood may extend to a height of 1.0-1.5 m on the trunk, or approximately as high as the bear can reach when standing on its hind legs. Unlike the American black bear (Poelker and Hartwell 1973), there is no evidence that the Japanese black bear will climb trees to feed on sapwood in their upper portions.

The characteristics of damage vary considerably. Observations indicate that the upper sides of the trunks of trees growing on slopes are sometimes damaged first and the lower sides at a later time. Far more trees are partially girdled than are completely girdled, and trees



Fig. 2. Grooves on tree wounds caused by Japanese black bears. A. Vertical grooving on exposed sapwood. B. Horizontal grooving on the root collar.

growing on level sites seem to be more prone to complete girdling.

Observations also indicate that an individual bear typically damages several trees (up to about 10) during 1 tree-feeding period. These trees are usually adjacent to each other and the feeding period appears to be of short duration.

The total area of bark removed from conifers varies from 0.9 to 2.1m², and approximately 60-90 percent of the exposed sapwood area is gnawed. The area of bark removal is much smaller among broad-leaved trees, apparently because their bark is more difficult to remove than that of conifers (Watanabe et al. 1970).

Diameter of Damaged Trees

The diameter at breast height (dhh) of recently damaged trees ranges from 12 to 93 cm, and trees from 20 to 50 cm in diameter are most frequently damaged in natural stands. In planted stands of Japanese cedar and Japanese larch, the frequency of damage tends to be greatest among trees over 10 cm dbh, and trees from 15 to 30 years old, particularly those over 20 cm dbh, are often selected by bears (Fig. 3)(Watanabe et al. 1973).

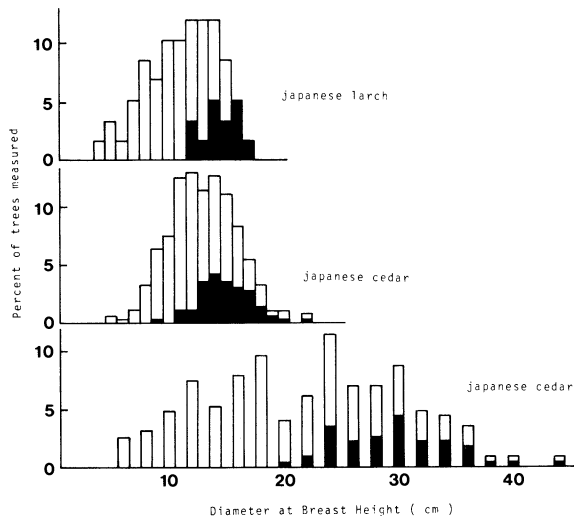


Fig. 3. Relationship of bear damage to tree diameter. Shaded areas indicate damaged trees.

Slight differences in size or age of damaged trees can be detected in separate stands, possibly due to differences in age structure of the stands. Frequency of damage is generally considered to vary significantly with density and age structure in Japanese timber stands, and the same assumption has been made regarding bear damage in North America (Poelker and Hartwell 1973).

Necessary precautions against bear damage are taken in Japan when trees reach a diameter of about 10 cm.

DISTRIBUTION AND SEASON OF DAMAGE

The approximate distribution of the Japanese black bear and the regions where damage has occurred are shown in Fig. 4. Significant bear damage has been reported throughout a large portion of the Pacific coastal region in the Shizuoka, Gifu, Shiga, Kyoto, Mie, Nara, Wakayama, Tokushima, and Kochi prefectures on the islands of Honshu and Shikoku.

In contrast, in the Hokuriku and Tohoku districts on Honshu, where bears are abundant, damage is absent or negligible. It is very peculiar and consequently of considerable interest that bear damage has not been observed in Tohoku and Hokuriku, where many native conifers occur and where Japanese cypress, Japanese cedar, and Japanese larch are planted extensively. The presence of American black bears with no evidence of bear damage to trees is also a well-known phenomenon in many areas of North America (Poelker and Hartwell 1973).

Bear damage to trees occurs mainly between mid-

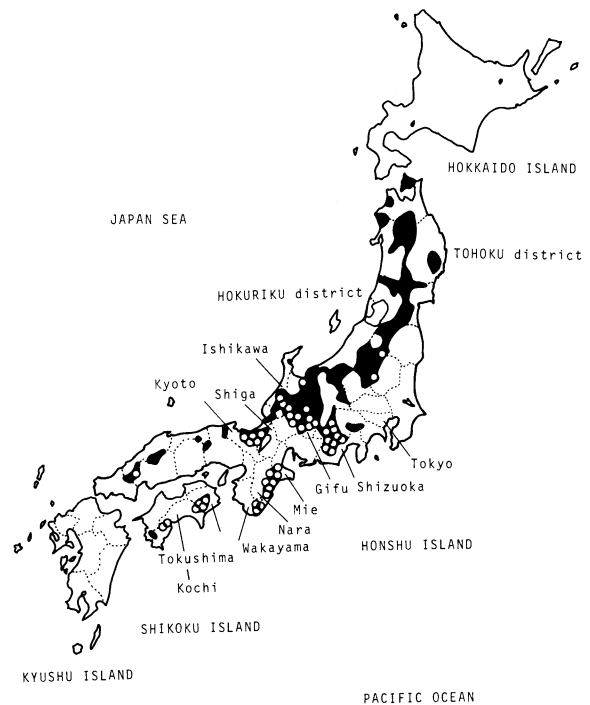


Fig. 4. Distribution of the Japanese black bear and regions where bear damage has occurred in Japan. Circles indicate occurrence of damage.

June and mid-July in the rainy season, when the bark can be readily stripped.

TREE DETERIORATION AND MORTALITY CAUSED BY DAMAGE

The relationship between the percentage of bole circumference girdled and subsequent unthriftiness or mortality of damaged trees is shown in Fig. 5. Complete girdling results in eventual death of the tree. The majority of Japanese cedar trees sustain bole circumference girdling of 10-40 percent without showing evidence of physical distress, trees with approximately 50 percent girdling usually exhibit distress symptoms such as defoliation and cone production, and trees with partial girdling of more than 60 percent typically exhibit a distinct lack of vigor. Partial girdling can also cause reduction in the rate of tree growth. All types of bear-caused wounds permit infection by stain and decay organisms, and such infections can result in deterioration of wood quality (Watanabe and Komiyama 1976).

Since bear damage usually occurs sporadically over large areas, it is generally impractical to remove damaged trees before actual stand harvest. In most cases, the damaged trees are left standing. At present, the control of Japanese black bear populations appears to be the only practical way of alleviating this waste of Japan's vital timber resource.

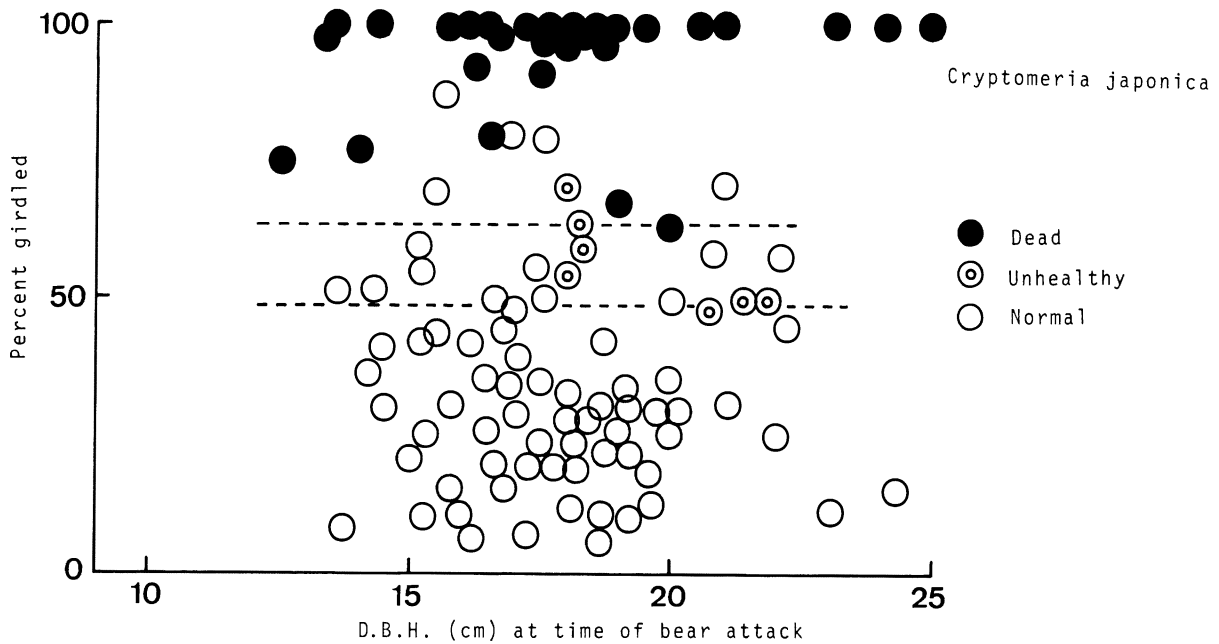


Fig. 5. Relation between percentage of bole circumference girdled and subsequent physical effect on girdled trees.

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