

DISTRIBUTION

Throughout the province, particularly in areas of poor air drainage (frost pockets) or cold wet soils.



Figure 259. Soft brown buds killed by late spring frost.

HOST SUSCEPTIBILITY:

Trees of all ages are susceptible. Interior varieties are more tolerant than coastal varieties of the same species. Douglas-fir is most commonly affected in central BC.

SIGNS & SYMPTOMS:

Frost injury results from unusually cold temperatures occurring in late spring or early fall. Late spring frost affects buds just breaking dormancy and succulent new growth. Injury is visible within two days of frost incidence when foliage becomes limp and fades to yellow. After approximately one week, killed buds turn dark brown and soft. Affected foliage of the branch tips becomes red-brown and droopy. These symptoms are often most pronounced in the upper crown of smaller trees on the emerging succulent foliage.

Frost lesions are rough, callused patches on the main stem created by frost-killed cambium. Necrotic bark eventually sloughs off to expose the sapwood. Raised lateral woody folds, called frost ribs, surround older cankers. This type of injury generally occurs on young to pole-sized trees. Subsequent freezing of



Figure 260. Frost cracks extending up main stem.

these lesions can cause internal radial shake, seen as brownish, resin-soaked rings of disrupted wood.

Frost cracks are usually seen in older trees, especially in true fir species. This type of damage is characterized by long, dark vertical cracks in the main stem. Frost heaving is almost exclusively restricted to first-year seedlings in cold, poorly drained soils. Affected seedlings are ejected from the soil and their roots are generally broken within several centimetres of the root collar.

DAMAGE:

Late spring frosts are usually more injurious than early fall frosts. Reduced lateral and leader growth or tip dieback are common. Frost heaving is also caused by late spring frosts, and can result in significant seedling mortality on newly planted sites at higher elevations in the interior. Internal radial shake can adversely affect growth rates and wood quality. Frost lesions or frost cracks act as entry points for canker and decay fungi or can lead to stem breakage. Several canker fungi act as weak pathogens following frost damage, and cause substantial dieback and branch flagging injury.

SIMILAR DAMAGE:

A variety of biotic and abiotic agents can cause damage resembling frost damage. Repeated frost injury resembles damage caused by animal browsing. Consider climatic conditions, and look for signs of animal activities to distinguish between these agents. Frost cracks may be confused with lightning hits. However, lightning injury leaves a more jagged furrow in the bark, and may have accompanying broken tops. Shoot damage by insects such as the terminal weevil can be similar to late spring frost damage. Look for signs of insect feeding and activity to identify the causal agent.



Figure 261. Wilted necrotic needles resulting from late damage to recently flushed foliage.



Figure 262. Seedling mortality caused by frost.



Figure 263. Frost-injured tips initially turn yellow. Older damage is dark brown.