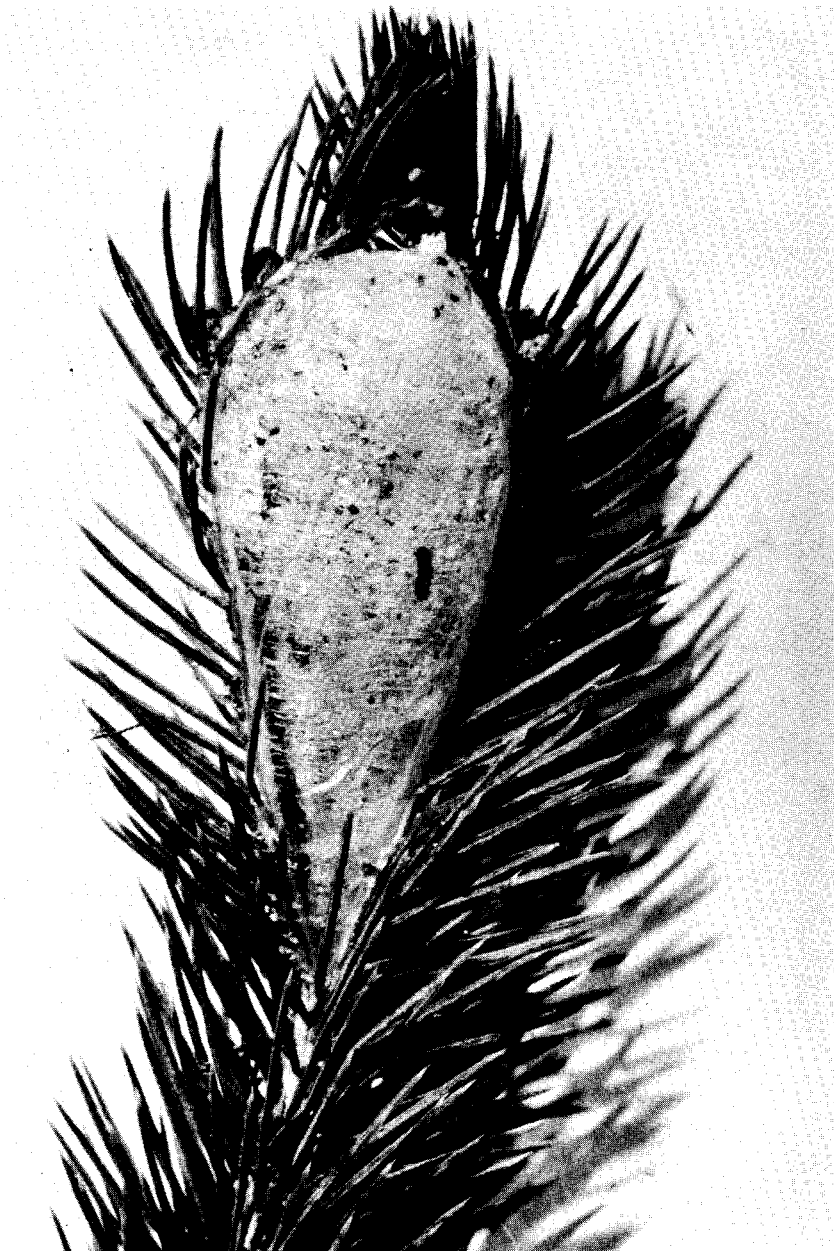


"Windowpaning" injures branch tips

Unusual Ice Damage Suggests Extra Care Needed in Overwinter Cold Storage

Ralph D. Nyland and H. Jack Irish¹



In the course of research into overwinter cold storage of conifer nursery stock at sub-freezing temperatures, we discovered a most unusual type of ice damage affecting some of the stored white spruce, Norway spruce, and balsam fir. The damage (figs. 1-4) involves a splitting of the leader or side branch tip due to the buildup of ice within the plant tissues. In the most extreme form, the ice splits the branch tip in half (figs. 1 and 2). In a milder form, the ice swells the stem, distorting it (fig. 3).

Such ice damage, called "windowpaning" by the nursery staff, was not widespread. It affected only a few jelly-roll bundles and occurred on less than 5 percent of the plants within the affected rolls. By itself it did not kill plants. The damage occurred mostly at the tips of the first lateral branches and

Figure 1.-Windowpaning in lateral branch tip. (Photo courtesy G. Snyder)

¹ Project leader and technical assistant, respectively, Applied Forestry Research Institute, State University College of Forestry, Syracuse, New York.

affected only 3 to 4 inches of the branch tip (fig. 4). On a few plants, it was found on the terminal shoot. Buds and, branches below the splitting were not affected and appeared normal.

How did the "windowpaning" occur? We do not know exactly, but by referring to storage chamber temperature records, our observations during storage, and our recollections of the operations involved in placing the stock in storage, we have hypothesized a possible explanation.

For part of our research, the nursery's staff lifted the white spruce, Norway spruce, and balsam fir seedlings during mid-October 1970, wrapped them into standard jelly-roll bundles, stacked them on palletized crates, filling each crate to capacity, and moved the crates into the freezer for storage. Air temperature within the freezer was kept initially at about 29-33°F, and later controlled to 28-29°F. Our intent was to freeze the stock and keep it frozen throughout the winter.

In stacking the rolls on pallets and arranging them within the chamber, we inadvertently set them quite close together, creating an almost solid mass of seedlings. As a result, the jelly-roll bundles on the top of the piles froze properly, but apparently acted to insulate those underneath. Packing materials and the roots within the rolls at the bottom of the stacks did not freeze. However, the tips of the plants were constantly exposed to sub-freezing temperatures. Hence, roots of the plants remained unfrozen and in contact with free moisture in the packing material while the tops were frozen. These conditions persisted for an extend-

ed period before we recognized the situation.

We speculate that water within the branches at the tips of the plants froze. Ice may have then created a pressure gradient within the plant, causing a flow

of moisture from roots to branches. With the continuous freezing of newly arriving moisture at the edge of the frozen zone of plant tissue, ice deposits built up within the branches. Eventually, these accumulated to such a degree that the branch split open, exposing the ice. Presumably, ice would con-

Figure 2.—Damage to branch tip from windowpaning. (Photo courtesy G. Snyder)





Figure 3.—Slight ice damage to stem of seedling. (Photo courtesy G. Snyder)

tinue to accumulate for as long as the lower portions of the plants remained unfrozen and the branch tips were subjected to freezing temperatures.

Curiosity notwithstanding, formation of ice within the plant tissues to create the "windowpaning" damage during overwinter cold storage should not be considered terribly noteworthy nor a serious problem to nurserymen. However, our observation might serve as a warning to ourselves and others. Assuming our explanation is reasonably correct, it suggests that we must use caution to see that the bundles of seedlings get fully frozen and are kept that way. We know now to initially stack the crates with plenty of air flow

around the bundles to facilitate freezing. Then once they have frozen solid, the stacks should be rearranged to make more efficient use of the storage space. That will

require a little extra handling. But it may be a small price to pay in order to prevent possible damage from "windowpaning" to plants in cold storage.

Figure 4.—Windowpaning affects mainly the tips of the first lateral branches. (Photo courtesy G. Snyder)

