SCREEN CAGES TO PROTECT CONTROL-POLLINATED PINE CONES FROM SEEDBUGS

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Three types of screen wire cages to protect control-pollinated pine cones from seedbugs are described. The cages can be installed when pollination bags are removed and will substantially decrease seed losses during cone development.

Controlled pollinations are used in tree improvement programs to generate specific crosses for progeny testing and to create new genetic combinations from selected parents. The extra time and expense required for controlled pollination plus the enhanced genetic utility of the resulting seed justify more than the normal level of protection from insects.

Yields of filled seed in natural stands and seed orchards have been increased dramatically by using screen cages to protect individual cone clusters from the leaffooted pine seedbug (*Leptoglossus corculus* (Say)) and the shieldback pine seedbug *(Tetyra bipunctata* (H. & S.)) (*2, 4, 6*). Three types of cages and their use with controlled pollinations are described here.

The Cages

Type 1

An aluminum wire cage placed around the entire tip of Virginia pine *(Pinus virginiana* Mill.) branches effectively protected second-year cones for 6 months *(2).* The cages were made from 18 by 16 mesh aluminum window screen stapled in the form of a cylinder (figure 1 A). These cylinders ranged from 12 to 30 inches in length and 4 to 8 inches in diameter, depending on branch size. The base of the cylinder was fastened with staples around the branch below the cone. A 3- by 5- by 1 /2-inch polyurethane foam pad prevented injury to the stem. The upper end of the cylinder was stapled shut.

Type 2

Aluminum screen wire cages with ends of tubular gauze or fiberglass

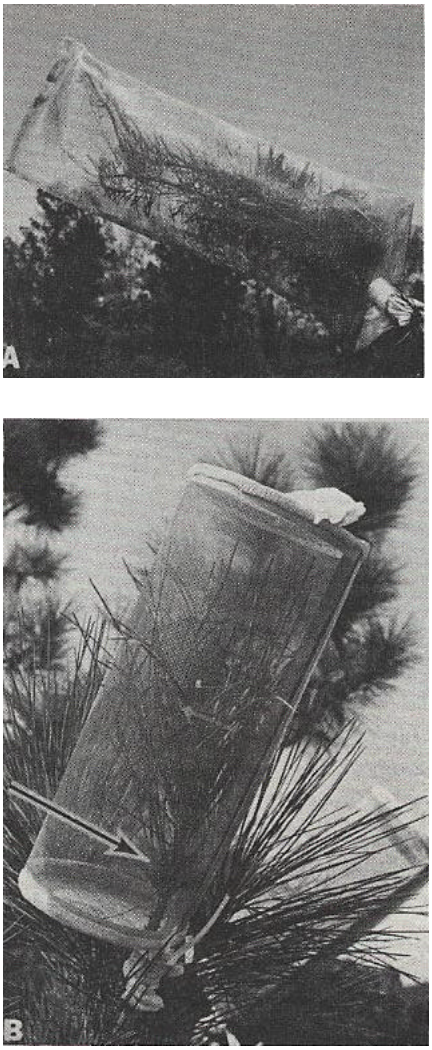

Figure 1.—(A) *Aluminum screen wire cage (type 7) protecting Virginia pine cones. (B) Screen wire cage with gauze ends (type 2) protecting a cluster of loblolly pine conelets (arrow).*

screen wire have been used extensively to protect conelets of slash (*P. elliottii* Engelm) and loblolly (*P. taeda* L.) pines (*4, 6*). These cylinders were 5 or 6 inches in diameter by 12 inches long (figure 1B). They were formed by stapling screen wire along one end of a 3/8- by 3/4- by 36-inch wood strip. Each end of the cylinder was ringed with masking tape, and a 10-inch section of tubular gauze was stapled of the ends. The cages were easily identified by drawing numbers with acetate glue and spraying the glue with paint. Plastic-covered wires ("Twistems")[1] held the ends of the tubular gauze closed and in place.

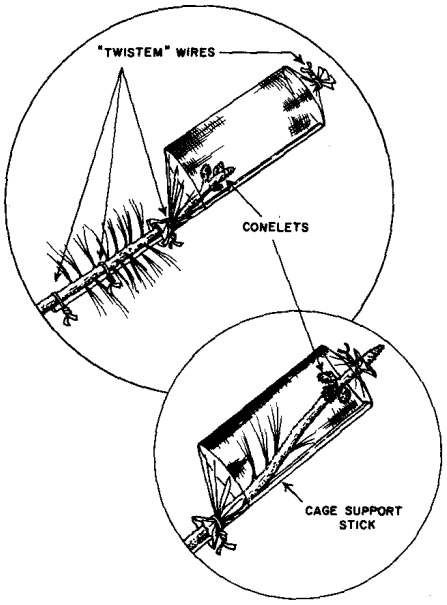

Figure 2.—*Position of type 2 cages used to protect conelets.*

[1] Mention of commercial products in this paper is for identification only and does not constitute endorsement by USDA to the exclusion of others which may be suitable.

Cage installation was similar to bagging for control pollinations. Excess needles were clipped or pulled off the branches. The cage was slipped over the conelet cluster and secured to the branch with "Twistems." Careful positioning of the cage allowed room for shoot growth (figure 2). If the shoot was long enough, the terminal bud was allowed to protrude from the upper end of the cage. Gauze ends that were snagged during cage installation were easily patched with glue. The use of fiberglass screen in place of gauze eliminated this problem.

This type of cage has also been used to protect maturing cones of loblolly and slash pines. For this purpose, the screen wire cylinders used were 6 to 8 inches long and 5 to 7 inches in diameter. In the initial design, gauze sleeves were stapled to each end of the cylinder. However, cages with fiberglass screen sewn on the ends with Dacron® thread proved more durable (figure 3). These cages were easily slipped over the branches and tied at each end with "Twistems" (figure 4).

Type 3

A third type of cage is currently being used by the Forest Service and the Georgia Forestry Commission at Macon, Ga., to protect conelets and cones of loblolly and slash pines. A 2- by 100-foot piece of flexible fiberglass screen 2 (one half of a 4- by 100-foot roll) is lapped over and sewn up one side with Dacron® thread to form a long tube approximately 7 inches in diameter. The tube is then cut into sections 18 to 20 inches long. The top of the tube is stapled shut, and the bottom is fastened below the conelets by wrapping "Twistems" around the branch and a protective foam pad (figures 5A and 5B).

Figure 3.—*Screen wire cages with ends of fiberglass screen (type 2) , protecting clusters of loblolly pine cones.*

The support cane originally used for the pollination bag is also used for the cage, but the cage is usually attached considerably higher than was the pollen bag (figure 5C). The cage is placed far enough below the conelet to allow for cone expansion at maturity, and needles that interfere with attachment of the cage are removed. Lateral branches may be pruned before the cage is attached in order to reduce the amount of foliage in the cage. The lateral branches with conelets should not be bunched together into a single cage. After the first growing season, the cages are opened and refastened below the terminal bud to allow for shoot growth on the most vigorous branch tips (figure 5D).

After the vegetative bud has been released, the cage needs no further attention until cone harvest. Cones apparently mature at the same time inside the cages as outside, but seed released from cones that open early are retained in the cages.

Special Problems

The need for protection of control-pollinated cones depends upon when seedbugs are likely to be actively feeding. Seedbugs destroy or damage ovules and developing seed over a period of two growing seasons. However, their potential for damage is greatest in the first growing season and becomes less as the cones and seed reach maturity (*5*). In a study on Virginia pine, caging was adequate protection against seedbugs

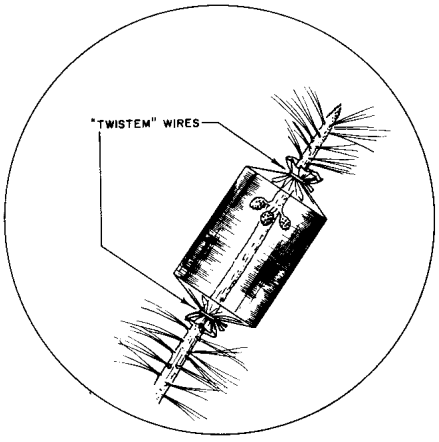

Figure 4.—*Position of type 2 cages used to protect cones.*

[2]Phiferglass, manufactured by Phifer Wire Products, Tuscaloosa, Ala.

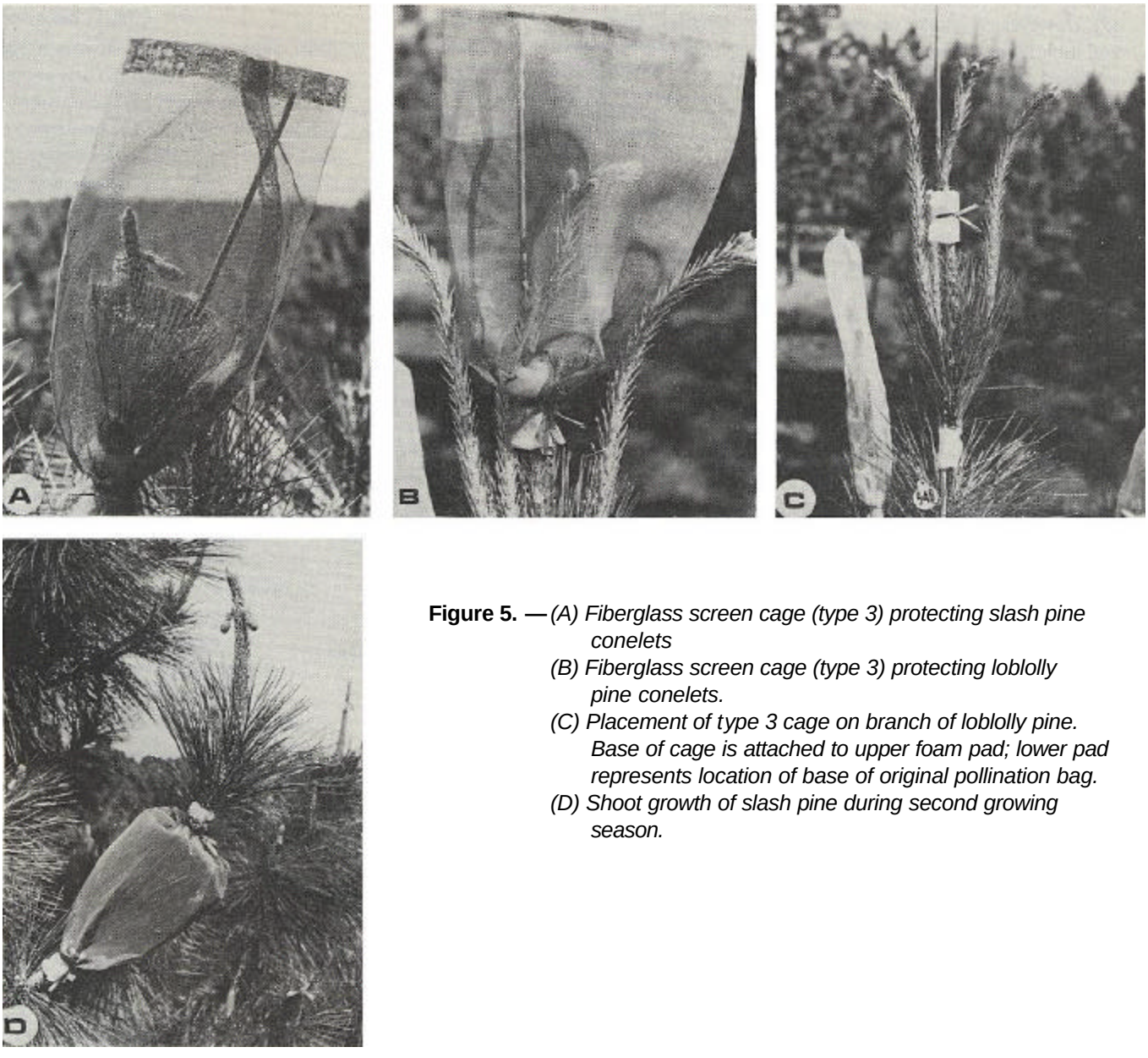

Figure 5. — *(A) Fiberglass screen cage (type 3) protecting slash pine conelets*
(B) Fiberglass screen cage (type 3) protecting loblolly pine conelets.
(C) Placement of type 3 cage on branch of loblolly pine. Base of cage is attached to upper foam pad; lower pad represents location of base of original pollination bag.
(D) Shoot growth of slash pine during second growing season.

(*3*). However, in studies on slash and loblolly pines, extensive losses occurred during the first year of development (*1, 4*). Since seedbug population trends cannot be predicted in advance, caging for the full 2 years of development is required for complete protection. At Macon, cages are placed upon slash and loblolly pine conelets at the time of bag removal and left in place until harvest. If ice storms occur frequently, it may be necessary to remove the cages during the winter.

Screen cages do not exclude coneworms (*Dioryctria* spp.), which apparently enter the cages as small larvae and attack developing cones. In orchards where coneworms are likely to be a problem, it may be necessary to spray the entire branch and cage with insecticides periodically. Fungi sometimes appear inside the screen cages, particularly on the dead needles, but their effect on seed formation or subsequent germination is unknown.

On some control-pollinated trees, conelets have died inside the cages. This mortality may be related to pollination problems, rather than to the presence of the cages.

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