limiting capacity of the 800-ml receiver is about 300 g of water, since this is the maximum amount of water that can be frozen in the flask safely without breakage during subsequent de-icing. De-icing was conveniently performed by allowing the flask to warm slowly in air.

TABLE 2

Operation time (hr)	Water collected (ml)
3.5	325
5.5	700
11	1015
27	1040 (complete)

The efficiency of the apparatus may be judged from the data in Table 1. Approximately 6 hr was required to remove 200 ml of water distributed equally between four 400-ml flasks. The time of sublimation is somewhat slower than that possible with the apparatus of Campbell and Pressman (*1*), as might be expected from the shorter path from the ice surface to condensing surface in the latter apparatus. The effectiveness of the present apparatus with large volumes of solution is evident from the results in a typical run (Table 2) in which 1050 ml of a dilute solution of blood group A substance was distributed among four 800-ml flasks. The lyophilizing was essentially complete after 27 hr, the apparatus being in continuous operation during this time except for receiver changes. Care must be taken if melting of the material in the lyophil flask is to be avoided to make the final receiver exchange when sufficient ice remains in the lyophil flasks to keep the material frozen. This precaution may be of importance in case the material being lyophilized is denatured readily.

The author is indebted to D. H. Campbell and E. L. Bennett for discussion concerning the operation and construction of this apparatus.

Reference

1. Campbell, Dan H., and Pressman, David. *Science,* 1944, **99**, 285.

Pollination of *Asarum canadense* L.

Harvey E. Wildman

West Virginia University, Morgantown

There has been some question whether *Asarum canadense* L. is self-pollinated or whether it is cross-pollinated by insects. Guides to the wild flowers of the northeastern states, even some of those most recently published, state that *Asarum canadense* L. is pollinated by small insects found among dead leaves on the forest floor. At least one species of *Asarum* is known, however, not to be so pollinated. Kugler (*1*) was led by his experiments to conclude that insects in no way aided the pollination of *Asarum europaeum* L. He further showed that the stigma matured first, but it was still receptive to pollen at the time the anthers of the blossoms matured. He thought that *A. europaeum* L. could be and probably was self-pollinated.

To ascertain the type of pollination occurring in *A. canadense* L. the following method was employed. The anthers and filaments were removed from the blossoms, some of which were left uncovered, and some covered with wax paper bags. Still other blossoms, with the flower parts intact, were covered with wax paper bags before the stamens matured. Care was taken to see that no insects were present in the flowers at the time of covering.

Thirty-seven of the 50 plants, whose blossoms had been covered and the flower parts left intact, were observed a few weeks later. Of these 37, 26 had produced seeds. These could be distinguished readily by the greatly enlarged or inflated ovary. When they were opened, sound seeds were found. Four of these 37 plants had not produced seeds. Their blossoms were not withered or dried. Seven other plants had blossoms which had withered and turned brown, showing no sign of seed development.

Thirty of the 50 plants with covered blossoms and with stamens removed were observed. All of these were abscised. No trace of any blossoms was found in the 50 specimens from which stamens had been removed and which were left uncovered among the other intact plants. In the flowers from which the stamens were removed, or where the stamens for some reason had not developed, the pistils withered and died.

The few insects seen to visit the flowers during this experiment were fulgorids, aphids, and one ant.

Since no plants with stamens removed produced seeds, whether the flowers were covered or uncovered, and since the majority of those with flowers intact did produce seeds, even when enclosed in bags, it seems reasonable to conclude that the plants are normally self-pollinated and that cross-pollination occurs rarely if at all. The plants in this group that did not produce seeds had evidently become injured while being tied up.

Reference

1. Kugler, Hans. *Ber. Dtsch. Bot. Ges.*, 1934, **52**, 348.