RESEARCH NOTE

INDUCTION OF FLOWERING IN NICOTIANA ACAULIS AND N. THYRSIFLORA[1]

By L. G. BURK, Agricultural Research Service, U.S. Department of Agriculture, and North Carolina State University.[2]

One difficulty of maintaining a seed collection of the **Nicotiana** species relatives of cultivated tobacco is associated with the special day length and temperature requirements that some of them must have to initiate flowers and produce seeds. Two species that are particularly troublesome in this regard are **N. acaulis** and **N. thyrsiflora.**

By the use of supplemental lighting to extend the normal length of day in the Oxford greenhouses, it was possible to contrive an artificial day-length regime that successfully induced flowering in plants of **N. acaulis.** On the other hand, plants of **N. thyrsiflora** were induced to flower by growing them in an environmental chamber under a system of reduced temperature and a shortened day length.

The use of germplasm from related species for improving valuable cultivars has become a standard practice in plant breeding. Inter-specific breeding methods have been invaluable in providing high levels of disease resistance in *Nicotiana tabacum* L. (3, 5). Maintenance of a seed collection of wild species at a single location can often be a problem because of the specialized requirements for flowering and seed production of individual members of a diverse group of plants from different geographical locations (1, 2, 4).

Two species, *N. acaulis* Spegazzini and *N. thyrsiflora* Bitter ex Goodspeed, have been particularly troublesome with respect to the induction of flowers and production of seeds. *N. acaulis* first came to my attention as a vegetative sample that had been sent to Beltsville from Argentina via diplomatic pouch. A few plants were propagated from this material, and a clonal population was eventually established. The plants of *N. acaulis* did not produce flowers for more than two years, despite exposure to various day-length and temperature conditions. Several pots of the *N. acaulis* clone were placed under continuous incandescent illumination, beginning in February, and several flowers developed on one or more branches in July. Flowers also formed on overwintered plants after an early thaw late in February at Beltsville. The flowers were eventually destroyed by subsequent frosts (2). Several years ago I experimented with extended day lengths and found that *N. acaulis* plants could be induced to flower under the greenhouse conditions prevalent at Oxford, when the length of day was at least 16 hours long. Under these light conditions, the flowering branches were considerably elongated and trailed over the edge of the pot. However, plants grown under progressively longer lengths of day had a more compact habit. One of the better combinations tested consisted of 22 hours of day length. A bank of incandescent and fluorescent lamps, suspended 24 inches above the plants, provided supplemental illumination. The growth habit of plants under these light conditions is depicted in Figure 1. Furthermore, the number of flowers was increased considerably, and the number of seeds per capsule was also increased. Although a light period of 22 hours is not known in the natural range of *N. acaulis*, perhaps the increased length of day may compensate for the unnatural greenhouse environment of Beltsville or Oxford. I also found that the seeds of *N. acaulis* could be sown directly on vermiculite. The emerging seedlings were thinned to three or four plants in each 6-inch pot. Dilute nutrient (V.H.P.) solutions were applied at 2-3 week intervals until growth had increased markedly. Thereafter, the pots were fertilized weekly.

Earlier evidence had indicated that plants of *N. thyrsiflora* could be induced to flower when exposed to the "warm short" (2) conditions prevailing in the Beltsville greenhouses and dark chambers. However, all attempts to produce flowering and seed set in this species at Oxford before 1972 had resulted in failure. These repeated failures were cause for concern, and unsuccessful efforts were made to obtain seeds from Argentina.

[1] *Cooperative investigations of the Oxford Tobacco Research Laboratory, Southern Region, Agricultural Research Service, U. S. Department of Agriculture and The North Carolina State University, Agricultural Experiment Station, Raleigh, North Carolina.*

[2] *Research Geneticist, Tobacco Research Laboratory, Southern Region, Agricultural Research Service, U. S. Department of Agriculture, Oxford, N. C. 27565 and Associate Professor, Department of Genetics, North Carolina State University, Raleigh, North Carolina.* *Contribution received Dec. 5, 1973. Tob. Sci. XVIII: 28-29, 1974.*

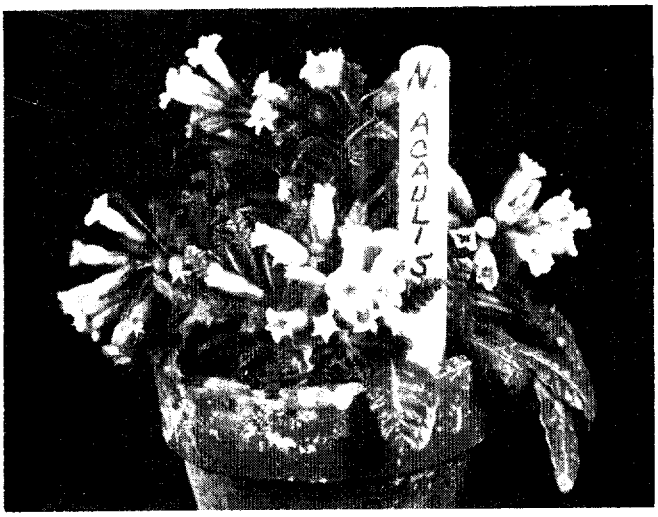

Figure 1. N. acaulis plants in full flower after exposure to a day length of 22 hours.

The availability of a controlled-environment chamber prompted an additional effort to induce flowering in *N. thyrsiflora*. After some experimental adjusting of temperature and light regimes, it was found that flowering could be predictably induced by transferring vigorous plants to a chamber programmed to deliver 8 hours of light at 80 F and 16 hours of darkness at 65 F. The plants of *N. thyrsiflora*, had been placed in the chamber in August and showed the first signs of flowering in the latter part of October. It was of interest that the plant showed none of the fasciation and flower distortion that was commonly observed at Beltsville (2). The most serious problem in maintaining plants of this species was with soil compaction and subsequent drowning of the plants. The latter problem was controlled by repotting the plants at least every six weeks. We have since discovered that, with a minimum of watering, *N. thyrsiflora* plants will grow very well in a mixture of one-half sand, one-fourth vermiculite, and one-fourth loam.

LITERATURE CITED

1. Burbidge, Nancy T. The Australian species of *Nicotiana* L. (Solanaceae). **Austral. J. Bot.** 8: 342-380. 1960.

2. Burk, L. G. Preservation of a *Nicotiana* species collection. **Tob. Sci.** 11: 120-123. 1967.

3. Burk, L. G. and H. E. Heggestad. The Genus *Nicotiana*: A source of resistance to diseases of cultivated tobacco. **Econ. Bot.** 20: 76-88. 1966.

4. Goodspeed, T. H. The Genus *Nicotiana*. Chronica Botanica Company. Waltham, Mass. 1954.

5. Mann, T. J., D. U. Gerstel, and J. L. Apple. The role of interspecific hybridization in tobacco disease control. In: Proc. III World Tobacco Scientific Congress. Mardon Printers Ltd. Salisbury, S. Rhodesia. 201-207. 1963.

I thank Lyawood B. Hughes for valuable assistance in the completion of this study.