

## Research Note

### SILVERING OF CUCURBITA MOSCHATA (DUCHESNE) POIR ASSOCIATED WITH BEMISIA TABACI GENN. (HOMOPTERA: ALEYRODIDAE) IN PUERTO RICO<sup>1</sup>

Complete silvering of summer squash (*Cucurbita pepo* L.) leaves was first observed in Israel in 1963.<sup>2</sup> This disorder is characterized by the progressive clearing of the leaf areas, until the entire upper lamina is distinctly silvered.<sup>2,3</sup> In cases where plants are severely affected by this condition, economic losses occur.<sup>4,5</sup>

Currently, silverleaf has taken on importance in areas like the state of Florida where, although rare until 1987, it has become severely damaging and widespread in *Cucurbita* spp.<sup>6</sup> Similarly, in Puerto Rico, silverleaf was first observed sporadically in 1987, on pumpkin, *Cucurbita moschata*. At present, silverleaf is widespread in all parts of the island, especially in the southern coastal plain, where it is generalized in pumpkin. Many growers in this semi-arid region have abandoned their fields after reporting heavy economic losses caused by decreasing yields and poor fruit quality.

The cause of silverleaf is not known. Whereas in Israel drought has been implicated as the main cause of silverleaf,<sup>2</sup> re-

searchers in Florida have associated high populations of the sweet potato whitefly [*Bemisia tabaci* (Gennadius)] with this disorder.<sup>6</sup> In Puerto Rico, silverleaf prevails in semi-arid areas, but it is always found in association with high *Bemisia tabaci* populations.

*Bemisia tabaci* is a new colonist of cucurbit host-plants in Puerto Rico. Martorell<sup>6</sup> does not list this insect, or its synonym *B. inconspicua*, from cucurbits in his host-plant catalogue for Puerto Rico. Bird and Maramorosch<sup>7</sup> report the failure of the then known form of *B. tabaci* to breed on economically important cucurbit species, which had been reported as host-plants for this whitefly in Israel. At present, *B. tabaci* is a serious pest of cucurbits and also of other economically important crops in Puerto Rico. The relevance of determining the role of *B. tabaci* in the development of silverleaf in pumpkin is underscored by the crop's position as the most important vegetable grown in Puerto Rico.<sup>8</sup> Studies reported in this research note were directed

<sup>1</sup>Manuscript submitted to Editorial Board 28 March 1990.

<sup>2</sup>Paris, H. S., H. Nerson and Y. Burger, 1987. Leaf silvering of *Cucurbita*. *Can. J. Plant Sci.* 67: 593-98.

<sup>3</sup>Burger, Y., A. Schwartz and H. S. Paris, 1988. Physiological and anatomical features of the silvering disorder of *Cucurbita*. *J. Hort. Sci.* 63: 635-40.

<sup>4</sup>Ayyalon, A., 1969. Growing green summer squash for export. Ext. Serv. Bull. Israel Ministry of Agriculture. Tel Aviv.

<sup>5</sup>Maynard, D. N. and D. J. Cantliffe, 1989. Squash silverleaf and tomato irregular ripening: new vegetable disorders in Florida. Vegetable Crops Fact Sheet. Fla. Coop. Ext. Serv. IFAS.

<sup>6</sup>Martorell, L. F., 1976. Annotated food plant catalog of the insects of Puerto Rico. *Univ. P.R. Agric. Exp. Stn.*, Río Piedras.

<sup>7</sup>Bird, J. and K. Maramorosch, 1978. Viruses and virus diseases associated with whiteflies. *Advances in Virus Research* Vol. 22: 1-55, Academic Press. N.Y.

<sup>8</sup>Anonymous, 1988. Annual report on agricultural production in Puerto Rico-1987. Office of Agricultural Statistics P. R. Dep. Agric.

towards determining the relation between silverleaf in *C. moschata* and *B. tabaci*, as well as towards ascertaining whether the condition was infectious.

Eighty pumpkin seedlings (i.e., cotyledons plus one leaf), from each of two seed sources (one from normal plants and the other from plants affected by silverleaf), were divided randomly into four equal groups. Two groups from each seed source were caged and exposed to *B. tabaci* adults at a density of 10 to 15 whiteflies per plant, whereas the other two groups were kept in whitefly-free cages. This test was replicated. As shown in the following tabulation, no silverleaf symptoms were detected in plants from whitefly-free cages 21 days after colonization. Seed source did not influence the appearance of silverleaf. This finding indicates no seed transmission of this condition or predisposition to acquire it.

<i>Seed Stock</i>	<i>Treatment</i>	
	<i>Colonized</i>	<i>Non-colonized</i>
Silverleaf parental	76 (95%)	0 (0%)
Normal parental	75 (94%)	0 (0%)

First symptoms of silverleaf were observed in plants after the sixth day of exposure to whiteflies, and complete silvering was observed between 10 to 14 days after colonization. New growth was unaffected if whiteflies were excluded from cages; thus silverleaf symptoms appeared not to be incited by an infectious agent.

To determine whether the cause of silverleaf was infectious and capable of perpetuating itself in series-grafted plants, 13 scions from silverleaved plants were side-grafted on normal *C. moschata* vines (stocks). Nine of these grafts were successfully established on normal vines as evidenced by callus formation, organic union, and ample development of the scion. After more than 30 days of observation, no silverleaf symptoms were detected on the normal

grafted stock nor on the scion grafts. In a reciprocal test, five scions from normal material were top-grafted on silverleaved vines. Similarly, no signs of silverleaf were detected on vines developing from the scions two weeks after grafting.

None of the vines originating from plants grafted with silvered scions developed symptoms of this disorder. These results indicate that the agent responsible for *C. moschata* silverleaf disorder is not a systemic infectious agent such as a mycoplasma-like organism, a plant virus or a viroid.

We believe that a new race or biotype of *B. tabaci* has been introduced into Puerto Rico. This view is supported by the greatly expanded host range of this new form, which includes many plant species not previously attacked by this whitefly in Puerto Rico. We also believe that this appearance of the silverleaf disorder in Puerto Rico coincided with the arrival of this polyphagous new variant of *B. tabaci* in 1987. In all probability this *B. tabaci* form, new to Puerto Rico, gained access into the island on plant cuttings of its preferred host *Euphorbia pulcherrima* Willd. Poinsettia cuttings bearing a few leaves are introduced in Puerto Rico yearly, and used for propagation before the Christmas season. The authors have detected *B. tabaci* on cuttings thus introduced.

*Alejandro E. Segarra-Carmona*  
Associate Entomologist

*Department of Crop Protection*  
*Julio Bird*

*Phytopathologist*  
*Department of Crop Protection*  
*Jaime Escudero*

*Research Assistant*  
*Department of Crop Protection*  
*Guillermo Fornaris-Rullán*  
*Assistant Researcher*

*Department of Crop Protection*  
*Rosa A. Franqui*  
*Research Assistant*  
*Department of Crop Protection*