New fungus associated with vascular wilt of shasta daisy

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Shasta daisies (the 'Killian' cultivar of *Chrysanthemum maximum* Ramond) have been grown in California for sale as cut flowers for the past 30 to 40 years. In the past, the causal agent of vascular wilt on the shasta daisy was believed to be *Verticillium* sp. because the disease symptoms of the plant include vascular browning (figs. 1 and 2), stunting, wilting, and unilateral chlorosis of the lower leaves (fig. 3). However, *Verticillium* was not isolated from infected plants. Another fungus, *Acremonium strictum* W. Gams, was isolated consistently, and subsequent studies indicate that it is the causal agent. This is believed to be the first report of the disease.

Isolations from stems, roots, and leaves of shasta daisies were made from plants with and without disease symptoms. Plants were obtained from commercial fields in southern California during winter and spring 1976. *Acremonium strictum* was recovered from the vascular tissues of both roots and stems of plants. The fungus was isolated most frequently from stem tissues, so only stems were examined throughout the remainder of this study. At no time were *Verticillium* spp. or other wilt fungi recovered from the plants in frequencies significant enough to warrant investigation.

The second part of the study was carried out from spring 1977 to spring 1978. The degree of vascular browning in the crowns of the plants was rated on a scale from 0 (no browning) to 4 (severe or maximum browning). Values recorded are an average for 20 to 30 plants sampled at each time period. The age of the tissue used was standardized by selecting stems on which the flower buds were fully formed and beginning to open. The presence of the fungus was determined using the same stems. Three 2 to 3 mm cross-sectional pieces from each of six locations from the crown to the tip of the stem were plated-out on water agar medium. Values recorded in fig. 4 represent the percentage of pieces positive for *Acremonium strictum* out of the total number of pieces plated-out. A correlation was obtained between the intensity of vascular browning and percentage of stem pieces yielding the fungus.

The cyclic nature of the disease is also shown in the figure. Root divisions were replanted in the late summer and early fall. At this time, they showed a moderate degree of vascular browning and infection with *A. strictum*. As the temperature became cooler and the day length shortened, the plants resumed vegetative growth. The vascular browning and the presence of the fungus both reached a low at that time. When the plants began to grow vigorously in late November, flowering began and the symptoms of the disease became more apparent. By March all of the symptoms of the disease were expressed. The severity of the symptoms increased throughout the spring and early summer, reaching a maximum in late June. At this time, most of the plants ceased rapid growth, and the vascular browning and percent infection of new tissue both decreased. By late August, the fields had been plowed under and replanted for the next season.

The studies reported here indicate the involvement of *Acremonium strictum* in the expression of vascular wilt of shasta daisy. Preliminary pathogenicity tests confirm the role of *A. strictum* in this disease. Additional studies involving epidemiology and control of the disease are being carried out.

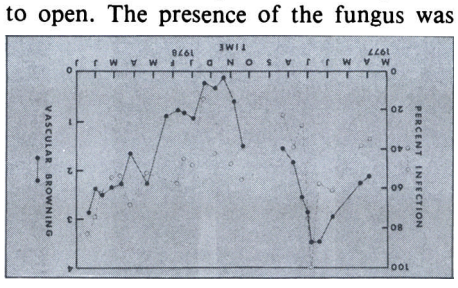

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Fig. 1 (top). Cross-section of shasta daisy stems showing vascular browning symptoms. Fig. 2 (center). Longitudinal sections. Fig. 3 (right). Diseased shasta daisy plants showing early symptoms of wilt, stunting, and lower leaf chlorosis. Fig. 4 (left). Relationship of vascular browning, percentage of infection with *Acremonium strictum*, and time of year in a field planting of shasta daisy.