

OCCURRENCE AND DISTRIBUTION OF A VIRUS-INDUCED DISEASE
OF BARREL CACTUS IN CALIFORNIA

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ABSTRACT

A serious disease of California barrel cactus, Ferrocactus acanthodes, caused by an isolate of cactus virus X was observed in the Clark mountains of eastern San Bernardino County, California, but not in other southern California areas. The incidence of infection was about 5.5% of the total barrel cactus population.

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In 1974, a viruslike disease of California barrel cactus, Ferrocactus acanthodes, was observed in the Clark mountains of eastern San Bernardino County, California (2). External symptoms consisted of: (a) distorted and malformed areoles arranged in a disorganized manner along the affected stem; (b) twisted and malformed spines; (c) depressed necrotic spots; and (d) systemic mottle (Fig. 1). Sometimes, affected terminal buds became branched, causing plants to develop "multiple-heads," which in the past have been thought to result from genetic disorders.

A virus designated as "barrel cactus virus" was isolated from a diseased barrel cactus plant and transmitted to healthy cactus and certain herbaceous plants. Preliminary studies indicated that this virus was an isolate of cactus virus X (1). This paper reports the results of surveys made to determine the prevalence of the disease in several southern California barrel cactus forests.

MATERIALS AND METHODS

Diseased plants were identified by their external symptoms characterized primarily by distortion of the stem. Plant samples, including pollen, were collected at random and inoculated to leaves of Chenopodium amaranticolor and C. quinoa plants or examined with the electron microscope for presence of virus particles.

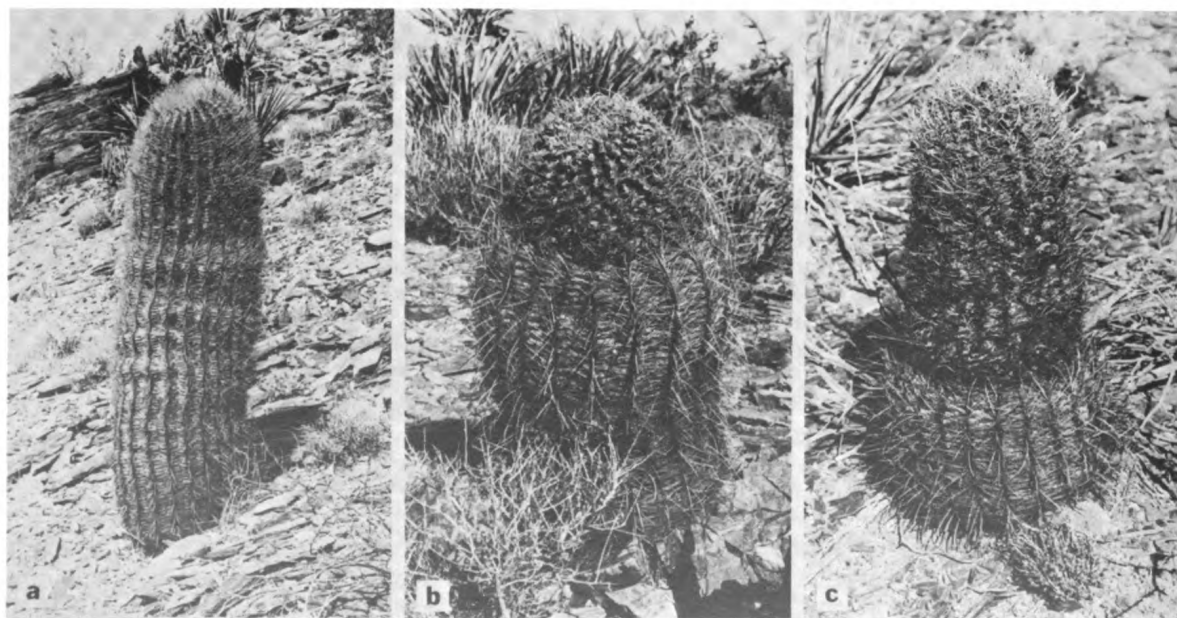


FIGURE 1. California barrel cactus, Ferrocactus acanthodes. (a) virus-free plant. (b, c) plants naturally infected with barrel cactus virus.

Incidence of the disease in the Clark mountains was studied intensively. The area was divided arbitrarily into five separate zones and all healthy and diseased barrel cactus plants in each zone were counted. Incidence of the disease was then expressed as percentage of diseased cactus plants in the total barrel cactus population.

RESULTS

The disease was found only in the Clark mountains of San Bernardino County (Fig. 2). Virus particles were observed in all samples collected from diseased barrel cactus plants but not in those from healthy ones. Thus far, there is no evidence to indicate that the disease occurs in other barrel cactus forests, including Deep Canyon in Riverside County, the Anza-Borrego desert, and other areas in San Diego County.

Table 1 shows the incidence of the disease in the Clark mountains revealing 5.5% of the barrel cactus population was infected. No disease was found in young plants (less than one foot in height and at preflowering age). If young nonflowering plants were excluded from this survey the incidence of disease was about 9.1%.

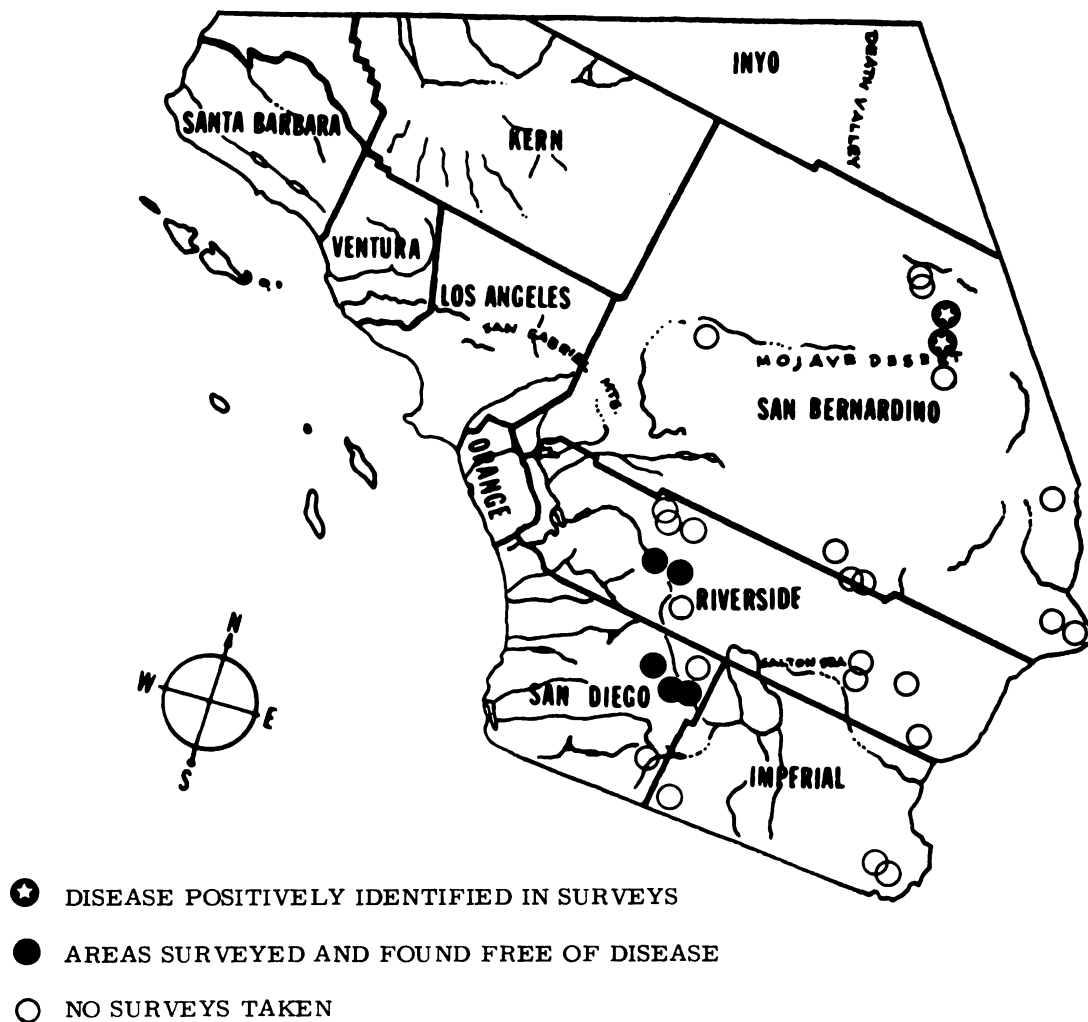


FIGURE 2. Locations of barrel cactus forests in southern California (after Benson, 1969).

Table 1. Distribution of a virus-induced disease of California barrel cactus in the Clark mountains, San Bernardino County, California.

Zone	Number of plants	% Disease	% Disease excluding <1-inch-high plants
1	583	6.17	10.84
2	628	4.77	7.55
3	699	6.86	11.67
4	437	4.57	6.96
5	414	4.34	7.50
Total	2761	Average 5.50	9.11

DISCUSSION

Six viruses in three unrelated virus groups have been found occurring naturally in plants of the Cactaceae; however, none of the three is reported to infect California barrel cactus (4, 5, 6, 8, 9, 11). There was no information to indicate whether the barrel cactus virus was a heretofore unreported strain of cactus virus X that attacks barrel cactus, or whether barrel cactus was sufficiently sensitive to that virus to develop severe external symptoms. These findings are the first to indicate that the barrel cactus is a host.

The incidence and distribution of the disease in the Clark mountains indicate natural spread of the causal virus. Although the mode of natural spread of barrel cactus virus has not been determined, we propose pollen as the mode of transmission for two reasons: (a) the association of the virus only with cactus plants of flowering age; and (b) the infectivity of pollen from infected plants but not from healthy ones. If natural spread resulted from a plant or animal vector or some mechanical means, one would expect to see young plants also developing the disease.

Evidence for pollen transmission, albeit circumstantial, is significant; but confirmation through controlled cross-pollination is needed. Whether the virus is also seed transmitted has yet to be determined because thus far we have not collected a nonaborted germinable seed from diseased barrel cactus.

Absence of the disease in other barrel cactus forests in southern California indicates that the disease is restricted in its distribution and that there are factors limiting its long distance spread. Presence of diseased plants within the immediate area would seem to be essential for spread, to serve as inoculum sources for pollen transmission. Absence of germinable seeds from infected plants as well as absence of plant and animal vectors would effectively limit spread of the virus. In other words, spread would be restricted to pollen and transmission would occur only to flowering plants within the immediate area. Plants grown from healthy seed would acquire considerable size by the time they become receptive to the virus and many would produce normal seed before they get infected. It is important, therefore, not to introduce diseased plants into a cactus forest with no previous record of the disease. It would seem equally important to eradicate diseased plants from forests with low disease incidence.

Although cactus virus X had been found occurring naturally in the United States in some flat-padded opuntias (7), and *Platyopuntia monacantha* (10), this is the first report of cactus virus X naturally infecting and causing a serious disease in native barrel cactus plants.

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MYROTHECIUM DISEASE OF SOYBEAN IN INDIA

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ABSTRACT

Myrothecium roridum caused leaf spot symptoms on soybean. The spots were dark brown, circular, with a necrotic zone surrounded by a chlorotic band. There were numerous black sporodochia in the necrotic zone. The symptoms on flowers and pods have been described for the first time in this paper. About 50% of the plants were found to be infected at the University Experimental Farm during 1973 kharif (rainy season). Severely infected flowers and pods dropped from the plants, which resulted in yield loss.

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The leaf spot disease of soybean (Glycine max) caused by Myrothecium roridum Tode ex Fr. was first reported from the United States in 1944 (1), and later from Malaya (3), India (4), and Cambodia (2). In recent years the disease has become important in India. Saksena and Tripathi (5) estimated the disease incidence to be 20-25% during the 1968-69 growing season at Kanpur. Symptoms on leaves, flowers, and pods, pathogenicity of the organism, and losses caused by the disease were studied in detail. The results are presented here.

MATERIALS AND METHODS

The soybean crop growing at the University Experimental Farm at Jabalpur was surveyed for the Myrothecium leaf spot disease during 1973 kharif (rainy season). Disease severity was estimated on leaves by using a scale based on the number and size of spots on the leaves. The disease rating was calculated as follows:

Disease rating = Score for number of spots x Score for size of spots

Score for number of spots

- 0 - No spots
- 1 - 1-5 spots/leaf
- 2 - 6-10 spots/leaf
- 3 - 11-15 spots/leaf
- 4 - Above 15 spots/leaf

Score for size of spots

- 0 - No spots
- 1 - Small-sized spots, up to 2 mm in diameter
- 2 - Medium-sized spots, 3-5 mm in diameter
- 3 - Large-sized spots, 6-10 mm and above in diameter