

REVIEW OF THE DISEASES OF NOPALITOS AND TUNAS AND THEIR CONTROL

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The cactaceous plants are native to the American continent (Bravo-Hollis, 1978). There are many native species of cactus in the southern United States, Mexico, certain parts of Central America and South America. It has been noted (Bravo-Hollis, 1978) that Mexico has the greatest quantity of cactus species, because of its latitude, topography and climates. After the discovery of America in 1492, various cactus species were taken to Europe and other parts of the world (Bravo-Hollis, 1978).

This work briefly reviews the diseases of cladodes and tunas (fruits) of edible Opuntia species and comments on their control. Although many Opuntia species have a thick cuticle, cacti have been attacked by fungi that can penetrate the cuticle directly or following mechanical damage. Cladodes can be infected by various fungi, namely Colletotrichum gloeosporioides (perfect stage of Glomrella cingulata described by Osada et al. [1991]). This fungus, on low positioned cladodes and under high humidity produces round black necrosis and has been observed in the U.S.A. and in different states in Mexico. The black necrotic area produces a perforation in the cladode causing considerable damage. Another fungal problem of the cladodes, due to Pythium species, has been observed in many nurseries in the state of Mexico, in California and Florida. Pythium causes a soft rot and complete destruction of the attacked cladode at the soil level. In some Mexican municipalities, the percentage of infection may be as high as 30% (Cortes and Fucikovsky, 1986). Cacioppo (1991) mentions that Phytophthora cactorum and P. omnivora have caused wilt and possible rot of cladodes, and that, Phyllosticta opuntiae has caused a certain type of scab. In Mexico, a yellow-red scorch of the cladode and fruit named "Mal del oro" (Pimienta 1990) has been caused by the fungi Alternaria and Hansfordia species. However it seems that more work needs to be done to confirm this. Necrosis of the cladodes in Italy has been produced by a yeast belonging to the genus Pichia (Gramata and Varvaro, 1990).

Bacterial diseases of cladodes and tunas have been studied in Mexico by Fucikovsky and Jaimes (1981). Bacteria of coliform group, with isolates similar to Erwinia chrysanthemi, and E. carotovora subsp. carotovora and atroseptica were identified as agents of soft rots in the state of Mexico and these were associated with dipterous insects (Fucikovsky, 1990). The flies apparently introduce the bacteria when ovipositing; the larvae then distribute the bacteria inside the cladodes and the tissue rots very rapidly. Because of this infection, the abscission zone is affected and the cladodes fall off.

Also, bacterial spots of cladodes due to E. carotovora subsp. carotovora have been observed in Italy (Varvaro and Gramata, 1990). Alcorn et al. (1991) has named Erwinia cacticidea as the causal agent of the cladode rots. An interesting rot of tunas by bacteria from the family of Enterobacteriaceae was described from Mexico (Fucikovsky and Luna, 1990), where five different species of birds were implicated in the original mechanical damage, together with five different insect species as probable disseminators.

With regard to virus infections, Pimienta (1990) mentions three types of virus causing mosaic or chlorotic areas on the cladode reported by Chessin and Leseman (1972) on wild Opuntia species in Arizona, Utah and Nevada.

In Mexico, two other symptoms are found on Opuntia plantations. The first symptom is excessive bud proliferation on cladodes, which, however, is not very frequent. The cause of this effect is unknown, although there is a suggestion that spiroplasm might be the responsible agent.

The other disease is the thickening of the cladodes, which is combined with poor plant growth, low fruit production, fruit fall, some fruiting on flat cladode surface and necrosis of the phloem. This disease can be transmitted by grafting, but remission of symptoms by antibiotics is in doubt (Barrientos and Solorzano, 1990; Osorio et al. 1990).

The control of these diseases may be summarized as follows:

1. The black necrosis (anthracnose) could be controlled by cutting away the diseased cladodes and possibly by copper or zinc contact fungicides.
2. Pythium soft rot has been effectively controlled by application of Bordeaux paste on the surface of the cladodes to be placed in soil (Cortes and Fucikovsky, 1986). The attack of Phytophthoras could probably be prevented the same way.
3. Phyllosticta, Alternaria and Hansfordia have not been studied with respect to their control, but preventive fungicides will probably be effective. No control has been studied against Pichia.
4. The bacterial diseases have been partially controlled by Bordeaux spray. Knowing that insects are associated with these rots, the most effective treatment in diminishing these rots will probably result from the use of permitted insecticides.
5. All other Opuntia problems, namely viral, excessive bud proliferation and cladode thickening have been controlled by elimination of plants or plant parts with symptoms.

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