

Lack of Transmission of Exocortis by Slugs in the North of Iran

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ABSTRACT. Heavy feeding of slugs (*Deroceras reticulatum* Muller) on citrus trees during spring and fall causes extensive damage on leaves, shoots, and fruits in Northern Iran. Experiments to test the possibility of exocortis transmission by slugs were conducted at the Iran Citrus Research Institute. Slugs were fed on exocortis-infected Clementine or Etrog citron and then on healthy citron plants. Although extensive wounding was caused by slugs in most citrus plants, none of the healthy citron plants developed exocortis symptoms.

Since 1969, trifoliolate orange has been recommended as cold tolerant rootstock for the Caspian Sea Region in Iran. However, it is very susceptible to exocortis and disease symptoms have been observed on trees of nucellar Valencia orange propagated on this rootstock at Ramsar and Kotra Citrus Experiment Station. Greenhouse biological indexing with Etrog citron indicator plants for exocortis detection (1) showed a high rate of mechanical transmission between citrus and the use of contaminated tools (2). This raised the question of whether any agent causing wounds on infected trees might be able to transmit the disease to healthy trees.

In the Caspian Sea Region, slugs cause extensive damage on citrus leaves, shoots, and fruits, particularly when high populations invade young plantings during the spring and fall. The presence of exocortis in the old plantings opened the possibility that slugs could be spreading the viroid to the new plantings. To test this possibility, three experiments were conducted.

In the first experiment, a 5-yr-old Clementine trees on trifoliolate rootstock with severe symptoms of exocortis were pruned to induce new shoots (August 5, 1991) and protected by a cage with a 1 mm² wire screen. In October 1991, 100 young slugs (just after hatching) were collected from a plot without citrus trees and caged to feed on the Clem-

entine tree for 72 h. Slug feeding caused extensive wounding on most Clementine leaves, young shoots, and fruits. Twenty five container-grown, 1-yr-old Etrog citron plants with good young flush were then introduced into the cage. The containers were placed on the Clementine canopy to help the slugs to move onto the citron plants. Extensive damage was caused to the indicator plants by the slug feeding: 12 of the citrons had lost their leaves and showed extensive wounds in the bark of shoots, eight had loss their leaves and had slight bark damage, and the other five had only leaf but no bark damage. The citron plants were moved into a temperature-controlled greenhouse (18-26°C) and left without pruning of dried shoots until new flush was produced (February 1992). No symptoms were observed in the new shoots. The 25 plants were then pruned to induce new shoots, and five healthy citron plants of the same age were graft-inoculated with 25 exocortis-infected buds (five buds per plant), pruned and incubated in the same bench as control. By March 1992, the five control plants were showing exocortis symptoms; whereas the slug-inoculated citron plants remained symptomless even in successive flushes.

In a second experiment 12 healthy and 13 exocortis-infected 1-yr-old citron plants were caged together forming a circle with alternating healthy and infected plants

in the greenhouse. The same number of slugs were introduced and left to feed for 72 h. The 25 plants lost the leaves and most of the stem bark was also damaged. After 45 days, symptoms appeared in the new flush of the 13 exocortis-infected plants, whereas the plants that were initially healthy remained symptomless in successive flushes.

In the spring of 1993, the second experiment was repeated with five healthy and five exocortis-infected citron plants using adult instead of young slugs. Although the damage

caused by adult slugs was even more intense, no symptoms appeared in the healthy citron plants.

The three experiments conducted indicate that, although exocortis is readily transmitted by contaminated cutting tools, the viroid may not be necessarily transmitted by other wounding agents. In the Caspian Sea Region, different slugs currently cause serious damage to the citrus plantings, but they do not seem to be a vector for exocortis spread.

LITERATURE CITED

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