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Pea Leaf Roll Virus: Transmission by Aphids[1] to Pulse Crops in Iran[2,3]

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Pea leaf roll virus (PLRV) was first reported to be affecting pulse crops (food legumes) in Iran in 1968 (Kaiser et al. 1968). The virus affects most pulses and can cause serious crop losses, particularly when these food legumes are grown near important reservoir hosts, especially alfalfa, *Medicago sativa* L. (Kaiser and Danesh 1971a, b). Until recently, little was known concerning the vectors of PLRV in Iran. Kaiser and Danesh (1971a) showed that *Aphis craccivora* Koch, *Acyrthosiphon pisum* (Harris), and *A. sesbaniae* David were vectors of PLRV in Iran. Because of the importance of PLRV in the cultivation of food legumes in Iran, and a lack of information concerning various aspects in transmission of the virus by insects, an investigation was undertaken to study the vector-virus relationships.

MATERIALS AND METHODS.—The isolates of PLRV, a circulative virus (Drijfhout 1968; Tinsley 1959) were obtained from diseased, field-collected broadbeans grown at Karaj, Iran. Isolates were maintained by aphid transmission on broadbean, *Vicia faba* L., and fenugreek, *Trigonella foenum-graecum* L., in the greenhouse (mean 20°±10°C).

Aphid colonies were reared on healthy plants that were indexed periodically (to virus-free broadbean or fenugreek) to insure that they remained nonviruliferous. Broadbean was used to maintain the colonies of *Aphis craccivora*, *A. fabae* Scopoli, *A. gossypii* Glover, *Acyrthosiphon pisum* (biotypes from N (Karaj) and S (Shiraz) Iran), *A. sesbaniae*, and *Myzus persicae* (Sulzer); fenugreek was used to maintain a colony of *Therioaphis trifolii* (Monell).

For the tests, healthy, starved (1–3 h) aphids were transferred singly or in groups to PLRV-diseased plants for a specified time (1–24 h) or permitted to colonize infected plants for several generations. Then the aphids were transferred to healthy indicator plants where they were allowed inoculation feeding exposures ranging from one observed probe (5 sec to 1 min) to 72 h. After the inoculation-feeding exposure, the plants were sprayed with an aphicide and maintained free of insects for the duration of the test. At 14–21 days after inoculation, the percentage of plants with symptoms of PLRV was determined. Aphid species colonized broadbean in the field, except for *T. trifolii* which was found colonizing chickpea, *Cicer arietinum* L.

RESULTS.—Longer acquisition-feeding exposures and longer incubation of PLRV within the bodies of *A. craccivora*, *A. gossypii* and *A. sesbaniae* resulted in higher rates of transmission. Lower rates of transmission were observed with *A. pisum* and *A. fabae*.

A direct positive correlation was noted between the length of the inoculative feeding exposure and the rate of transmission: generally, the longer the aphids (*A. pisum*, *A. sesbaniae*, *A. craccivora*, *A. fabae*, and *A. gossypii*) were exposed to feeding, the higher the rate.

Apterous adults of *A. pisum*, *A. sesbaniae*, *A. craccivora*, and *A. fabae* were usually the most efficient transmitters of PLRV; lower rates of transmission were produced by alate adults and nymphs. *A. gossypii* transmission by the nymphs and alate forms exceeded that of the apterous adults. *M. persicae* transmitted poorly; *T. trifolii* did not transmit. The Karaj biotype of *A. pisum* transmitted with greater efficiency than the Shiraz biotype.

As the number of viruliferous aphids (*A. pisum*, *A. sesbaniae*, *A. craccivora*, *A. fabae*, *A. gossypii*, and *M. persicae*) feeding on the indicator host plants was increased (from 1, 2, 5 and 10), the rate of transmission of PLRV also increased. Again, no transmission occured with *T. trifolii*, but its feeding caused transient vein-clearing that disappeared when the insects were removed.

DISCUSSION.—In Iran, PLRV is transmitted by 6 species of aphids that normally colonize food and forage legumes. The aphids *A. fabae* and *A. gossypii*, appear to be new vectors of PLRV. Generally, the transmissibility of PLRV that we observed was in agreement with the results of other researchers (DeFluiter and Hubbeling 1955; Drijfhout 1968; Grylls and Butler 1959; Grylls and Peak 1969; Heathcote and Gibbs 1962; Quantz and Völk 1954; Smith 1966; Thottappilly 1969, 1970). However, *A. pisum* is the principal vector of PLRV in most countries where both the virus and the vector occur (Drijfhout 1968) and also is the most important in Iran (Kaiser and Danesh 1971a). There the species is the primary colonizer of alfalfa, the main reservoir and overwintering host of PLRV.

Biotypes of aphid species, as for *A. pisum*, are important because they can differ in the efficiency with which they transmit PLRV and other viruses. Differences in transmission reported by various investigators (Quantz and Völk 1954; Thottappilly 1969; Wilson 1968) for *M. persicae* probably resulted because of the presence of biotypes. Although the one biotype of *T. trifolii* utilized in our studies did not transmit the virus, *T. trifolii* and other aphid species from different areas of Iran may uncover biotypes that are vectors of PLRV.

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