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APHID TRANSMISSION OF SUGARCANE MOSAIC VIRUS (SCMV)

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Transmission of sugarcane mosaic potyvirus from corn to corn by six aphid species viz. *Myzus persicae*, *Schizaphis graminum*, *Aphis gossypii*, *Rhopalosiphum maidis*, *R. padi* and *Sitobion avenae* was investigated. Sugarcane mosaic virus has a non-persistent or stylet-borne relationship with its aphid vectors. Rate of transmission was highest for *R. maidis* and *R. padi* (92%), followed by *S. graminum* (72%), whereas, *Sitobion avenae* failed to transmit SCMV.
Key words: Aphid, transmission, sugarcane mosaic virus, SCMV, *Saccharum officinarum*.

INTRODUCTION

Sugarcane mosaic virus (SCMV) is a member of the family potyviridae of plant viruses. Brandes (1920) showed that the corn leaf aphid *Rhopalosiphum maidis* could transmit mosaic from diseased to healthy sugarcane and this insect remained the only known vector until Ingram and Summers (1936, 1938) determined that the rusty plum aphid *Hysteroneura setariae* and the green bug *Schizaphis graminum* could also transmit the disease in sugarcane. Transmission of the virus from corn to corn and from sorghum to sorghum was obtained by Lawas and Fernandez (1949) with *Aphis gossypii* in the Philippines and by Anzalone and Pirone (1964) with *Myzus persicae* in Louisiana. *R. maidis* is much more efficient as a vector of mosaic virus than *S. graminum* or *H. setariae* (Ingram and Summers, 1936, 1938). In Morocco, Fischer and Lockhart (1974) found that *R. maidis* but not *R. padi* from Taiwan as a vector of SCMV. When several species of insect can transmit a virus, it is more difficult to assess their relative importance in the virus transmission. The principal vector is sometimes the least prevalent insect.

Shukla and Rao (1989) observed 52 and 48% natural transmission of SCMV sorghum strain respectively during two successive years with *M. persicae*, *A. gossypii*, *Longiunguis sacchari* and *R. maidis* at Gorakhpur, India. Rao *et al.* (1990) rated *R. maidis* as a major vector of SCMV in Eastern U.P., India. Joshi and Mishra (1990) reported *A. craccivora*, *R. maidis* and *Melanaphis sacchari* with 48, 40 and 30% transmission efficiencies of SCMV, respectively. Chen *et al.* (1990) studied the transmission abilities of seven different aphid vectors of SCMV in Taiwan and found *R. maidis* and *S. graminum* as the most efficient vectors. Noone et al. (1994) reported that *R. maidis*, *A. gossypii* and *M. persicae* transmitted the sugarcane strain of sugarcane mosaic potyvirus (SCMV-SC) in a non-persistent manner. Similarly, Garrido and Użcategui (2000) observed that the SCMV was transmitted from sorghum to sorghum in a non-persistent manner by the aphid *R. maidis*.

MATERIALS AND METHODS

This study was carried out in the glass-houses of Department of Soil Science and Plant Breeding & Genetics, University of Agriculture, Faisalabad during March-April 2002. Following aphid species were collected from fields at the campus and reared on their respective hosts.

Aphid	Collected From	Botanical Name
Myzus persicae Sluz.	Raddish	*Raphanus sativus* L.
Schizaphis graminum Rond.	Wheat	*Triticum aestivum* L.
Aphis gossypii Glover.	Holly-hock	*Althea rosea* L.
Rhopalosiphum maidis Fitsch. (= *Aphis maidis*) and *R. padi* L.	Maize	*Zea mays* L.
Sitobion avenae	Oat	*Avena sativa* L.

Sweet-corn seedlings seeded in pots were used as test plants. Each aphid species was starved for 1 hour in petri-dish containing dry filter paper. The starved aphids were then placed on the virus source plant (corn-seedling) allowing a virus acquisition feeding period for 1-2 minutes. Aphids were removed with a camel's hair brush and immediately transferred to healthy seedling of sweet corn (5 viruliferous aphids/seedling) for inoculation feeding. The plants were covered with cylindrical insect cages during the 24 hour test period. Aphids were killed by spraying the seedlings by an insecticide. Test plants were

transferred from the laboratory to the insect free glass-house and observed for symptom expression for about one month. In each experiment healthy corn seedlings not exposed to aphids were placed with test plants in the glass-house to serve as control.

RESULTS

All the aphid species in the transmission tests gave highly significant results (Table-1) and transmitted SCMV in a non-persistent manner, except *Sitobion avenae*. It was found that *M. persicae* transmitted SCMV in the range of 15-45% with a mean of 29%. Similarly, A. gossypii gave a range of 10-30% with a mean of 19%. Whereas, *S. graminum* transmitted SCMV in the range of 55-85% with a mean of 72%. The mixed population of *R. maidis* and *R. padi* transmitted SCMV in the range of 80-100% with a mean of 92%. On the other-hand, *Sitobion avenae* did not seem to be involved in the transmission of SCMV as only one plant showed the symptoms but no virus could be recovered in back inoculation test.

DISCUSSION

The transmission of SCMV by the five test aphid species is comparable to that reported by Brandes (1920), Ingram and Summers (1936, 1938), Lawas and Fernandez (1949), Anzalone and Pirone (1964), Fischer and Lockhart (1974) and Yang (1978, 1988). The finding that SCMV can be transmitted after an acquisition-feeding period of 1-2 minutes, the non-persistent or stylet-borne transmission, supports the reports, Noone *et al.* (1994) and Garrido and Użcategui (2000). The transmission study clearly demonstrates that *R. maidis*, *R. padi* and *S. graminum* are more efficient vectors than the *M. persicae* and *A. gossypii* in transmitting the SCMV and would be best suited for use in the large scale SCMV transmission studies. Similar opinions have been expressed by Ingram and Summers (1936, 1938), Yang (1988), Rao *et al.* (1990).

The minor difference in the results of aphid transmission of SCMV from other studies can be attributed to the source of virus isolate, experimental conditions, different SCMV strains and techniques used in the studies and aphids behavior. As observed in this study, different aphid species have different feeding behavior. *Rhopalosiphum spp.* And *Myzus persicae* probed more readily than *A. gossypii*. Palatability of the host might also be one of the reasons for the success or failure of the aphid to transmit SCMV.

Table 1: Analysis of variance for the transmission of sugarcane mosaic virus by different Aphid species

Source of Variation	Degree of Freedom	Sum of Square	Mean square	F.value	Prob.
Aphid species	4	29306.000	7326.500	81.406**	0.0000
Error	20	1800.000	90.000		
Total	24	31106.000			

** = Highly significant

The comparative transmission of SCMV by these aphid species (Table-2) clearly suggest that *R. maidis* and *R. padi* were the most efficient (92% transmission) vectors of SCMV, followed by *S. graminum* (72%), whereas, the transmission by *M. persicae* (29%) was statistically similar to *A. gossypii* (19%).

Table 2. Comparison of transmission of sugarcane mosaic virus by different Aphid species

Aphid Vector	Common Name	Total No. of Plants Tested	Total No. of Plants Infected	Mean % Infection
Myzus persicae Sluz.	Green Peach Aphid	100	29	29 c
Schizaphis graminum Rond.	Wheat Aphid	100	72	72 b
Aphis gossypii Glover.	Cotton Aphid	100	19	19 c
Rhopalosiphum maidis Fitsch. (= *Aphis maidis*) and *R. padi* L.	Corn Leaf Aphid/Maize Aphid and Bird Cherry Aphid	100	92	92 a
Sitobian avenae	Grain aphid	100	0	0 d

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