Research Paper :

Virus vector relationship studies of Sunflower Necrosis Virus (SNV) and its vector *Thrips palmi* (Karny)

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International Journal of Plant Protection (October, 2010), Vol. 3 No. 2 : 260-263

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SUMMARY

In the present study, investigations were made to establish the precise virus-vector relationship for which initially the transmission of Sunflower Necrosis Virus (SNV) through *Thrips palmi* (Karny) was determined. The results revealed that the vector *Thrips palmi* (Karny) could acquire the virus with an Acquisition Access Period (AAP) of 3 days from the cotyledonary leaves of an infected sunflower plant, with a resultant 16.67% transmission. Similarly, Inoculation Access Period (IAP) of 6 days was necessary for successful transmission of the virus with 13.33 % transmission of the virus. The percentage of transmission increased with increase in both acquisition and inoculation feeding period. Further, it was observed that a single thrip was enough to acquire and transmit the virus from an infected to healthy sunflower plant.

Key words : Sunflower necrosis virus (SNV), *Thrips palmi* (Karny), Thrips transmission, Acquisition access period (AAP), Inoculation access period (IAP).

Accepted :
July, 2010

Sunflower is one of the important crops that has contributed to rapid growth in oilseed production during late eighties and early 1990s in India. Sunflower is the oil of preference among the consumers world over due to its health appeal and in India too, sunflower oil is the largest selling oil in the branded oil segment. However, sunflower production has been severely affected due to its infection by Sunflower Necrosis Virus (SNV). This necrosis disease on sunflower was observed in serious proportion in parts of Karnataka during summer in 1997 (Nagaraju *et al*., 1998). Further, the disease incidence was reported from several parts of Karnataka *viz*., Dharwad, Raichur, Chitradurga, Haveri, Ranebennur, Naragund, Gadag, Tumkur and Kolar districts (Anonymous, 1998). This disease is caused by Sunflower necrosis virus which belongs to genus *Ilarvirus* related to tobacco streak virus. The disease was characterized by necrosis of leaves followed by necrosis on petioles, stem and floral calyx (Jain *et al.,* 2000).

The virus is transmitted through mechanical sap inoculation from infected plant to a healthy one (Linga Reddy, 2003). Further, it was observed that among the different insect species, aphids (*Myzus persicae*), jassids (*Empoasca kerri*) and whiteflies (*Bemisia tabaci*) failed to transmit the virus (Halakeri, 1999). Whereas *Thrips palmi* (Karny) was reported to transmit SNV successfully to healthy sunflower plants (Anjula, 2000, Aravind, 2002). However, different threshold periods of vector for virus acquisition, inoculation and minimum number of thrips for transmission of SNV need to be studied. Therefore, present investigations were emphasized to find the same.

MATERIALS AND METHODS

Confirmatory studies on SNV transmission through *Thrips palmi*:

Test plants (genotypes Morden, KBSH-1 and KBSH-44) rose in insect proof nylon mesh cages were used in transmission experiments. The healthy colonies of *T. palmi* maintained on sunflower, green gram and peanut plants by weekly transfer of active nymphs were used for transmission studies.

Young sunflower leaves showing clear symptoms were kept in the Petriplate. Along the rim of Pertriplate, a thin layer of water was poured and about 20-30 nymphs were released onto such leaves using fine hair brush. Nymphs fed on healthy leaves served as check. After three days, 20-25 nymphs were transferred using fine hairbrush on to test plants raised in insect proof wooden cages. Sunflower seedlings at two leaves stage were used for the experiment. The normal movement of thrips was observed to ensure that injury do not occur

during the transfer. The plants were kept undisturbed allowing the nymphs to feed. These test plants were kept under observation upto 50 days for symptom expression.

Determination of Acquisition Access Period (AAP):

About 25-30 active nymphs were allowed to feed on young sunflower leaves showing typical disease symptoms of SNV, kept in a plastic container. The lids of the container were removed and replaced with 60-mesh size white nylon mesh. Wet cotton was placed at the edge of the petiole to prevent the leaf from drying. The nymphs were allowed to feed on infected leaf for varying acquisition periods of 1, 2, 3 and 4 days. Later, the nymphs were transferred on to the test plants using fine hairbrush. The normal movement of thrips was observed to ensure that injury to thrips has not occurred during the transfer. The plants were observed upto 50 days for expression of symptoms.

Determination of Inoculation Access Period (IAP):

About 25-30 nymphs were collected using fine hairbrush, which were kept for AAP of three days in a plastic container at room temperature. The viruliferous nymphs were then transferred onto sunflower test plants kept in wooden cages in glasshouse. Systemic insecticide (Imidachloprid 0.05%) was sprayed onto the test plants at different inoculation periods of 1, 2, 4, 5, 6, 7, 8 and 9 days. The mortality of the vectors was ascertained and observations were recorded.

Determination of minimum number of thrips required to transmit the disease:

Healthy nymphs were allowed to feed on to SNV infected sunflower leaves at room temperature. Different batches comprising 1, 2, 5, 20, 25 and 30 nymphs were collected and placed on each of the test plants (sunflower) raised in insect proof wooden cages. The normal movement of thrips was observed to assure that injury had not occurred during the transfer. The vector was allowed to feed the test plants and observations were recorded.

RESULTS AND DISCUSSION

In the present study, investigation was made to establish the precise virus-vector relationship. *Thrips palmi*, vector of SNV successfully transmitted SNV to KBSH-1 (16.67%), KBSH-44 (20.00%) and Morden (26.67%) with an average transmission range of 21.10 per cent (Table 1). Successful transmission of SNV through thrips was also reported by Anjula (2000) and Ajith Prasad (2004). In virus-vector relationship studies results revealed that one and two days were not sufficient for successful acquisition and transmission of the disease. Whereas, AAP of 3 and 4 days resulted in successful transmission (16.67% and 20.00%, respectively) of the virus (Table 2). Similar results have been reported by Shivasharanayya (2000) and Aravind (2002) who found that thrips could acquire the virus and become viruliferous only when they feed for 3 days on the source plant and the per cent transmission ranged from 15.0 to 20.5 and 12.0 to 20.0 per cent, respectively.

The present study also revealed that IAP of 6 days was necessary for successful transmission of the virus (Table 3). Aravind (2002) also reported that IAP of 12 days was needed to transmit the virus to the succeeding plants.

Further experiment was carried out to find out minimum number of thrips required to transmit the virus. The results revealed that a single thrip was enough to transmit the virus, however, the per cent transmission remained low (6.67) (Table 4).

Table 1: Transmission of SNV through *Thrips palmi*

Sr. No.	Cultivar	Replication	No. of plants		Transmission (%)	Mean transmission (%)	DAC ELISA reaction
			Inoculated	Infected			
1.	KBSH-1	I	10	2	20		
		II	10	1	10	16.67	Positive
		III	10	2	20		
2.	KBSH-44	I	10	2	20		
		II	10	2	20	20.00	Positive
		III	10	2	20		
3.	Morden	I	10	3	30		
		II	10	2	20	26.67	Positive
		III	10	3	30		
		Mean transmission (%)				21.10	

Table 2: Determination of Acquisition Access Period (AAP) of sunflower necrosis virus by *Thrips palmi*

Sr. No.	AAP	Number of plants		Transmission (%)	Mean transmission (%)
		Inoculated	Infected		
1.	5 hours	10	-		
		10	-	-	-
		10	-		
2.	10 hours	10	-		
		10	-	-	-
		10	-		
3.	24 hours (1 day)	10	-		
		10	-	-	-
		10	-		
4.	48 hours (2 days)	10	-		
		10	-	-	-
		10	-		
5.	72 hours (3 days)	10	2	20	
		10	1	10	16.67
		10	2	20	
6.	96 hours (4 days)	10	2	20	
		10	2	20	20.00
		10	2	20	

Note: IAP – 6 days

Table 3: Determination of Inoculation Access Period (IAP) of sunflower necrosis virus by *Thrips palmi*

Sr. No.	IAP (days)	Number of plants		Transmission (%)	Mean transmission (%)
		Inoculated	Infected		
1.	1	10	-		
		10	-	-	-
		10	-		
2.	2	10	-		
		10	-	-	-
		10	-		
3.	4	10	-		
		10	-	-	-
		10	-		
4.	5	10	-		
		10	-	-	-
		10	-		
5.	6	10	1	10	
		10	1	10	13.33
		10	2	20	
6.	7	10	2	20	
		10	1	10	16.67
		10	1	10	
7.	8	10	2	20	
		10	2	20	20.00
		10	2	20	
8.	9	10	2	20	
		10	2	20	20.00
		10	2	20	

Note: AAP --- 3 days

Table 4 : Determination of minimum number of thrips required to transmit SNV

Sr. No.	Number of thrips per plant	Number of plants		Transmission (%)	Mean transmission (%)
		Inoculated	Infected		
1.	1	10	1	10	
		10	0	00	06.67
		10	1	10	
2.	2	10	1	10	
		10	1	10	06.67
		10	0	00	
3.	5	10	1	10	
		10	1	10	10.00
		10	1	10	
5.	20	10	2	20	
		10	2	20	23.33
		10	3	30	
6.	25	10	3	30	
		10	3	30	26.67
		10	2	20	
7.	30	10	2	20	
		10	3	30	26.67
		10	3	30	

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