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Present status of different modes of transmission of Sunflower Necrosis Virus (SNV) on sunflower, weeds and crop plants

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ABSTRACT

An investigation was carried out to know the various methods of spread of the sunflower necrosis virus (SNV) through sap, seed, insect vector and pollen during *kharif* 2006 at the AICRP (Sunflower), Zonal Agricultural Research Station, GKVK, Bangalore. The necrosis virus was successfully transmitted through sap and the per cent transmission ranged from 43.33 to 56.66 on sunflower genotypes. Whereas, the vector, *Thrips palmi* Karny Successfully transmitted SND to sunflower test plants at acquisition access period of 3 days and inoculation access period of 5 days. The symptoms produced were mild mosaic followed by dark green, chlorosis and vein thickening, puckering and stunted growth of plants. SNV was efficiently transmitted to cowpea, groundnut, cucumber and horsegram with the per cent transmission of 15, 10, 5 and 5 by sap and while 10, 5, 5 and 5 by thrips transmission, respectively. They exhibited the symptoms as mosaic and chlorosis followed by necrotic spots on emerging leaves and reduction in leaf size with stunted growth by both sap and thrips transmission methods.

Key words : Necrosis Virus Disease, Transmission, Sunflower, Thrips, Weeds.

Sunflower is one of the major oilseed crops and has occupied a large area under cultivation in Karnataka. It is reported to be susceptible to several diseases. Recently the sunflower necrosis virus (S.N.V.) disease on sunflower causing severe yield losses has been reported from Bangalore (Anonymous, 1997) Because of its fast spreading nature and severity. It has threatened the sunflower cultivation in Karnataka, Andhra Pradesh, Tamil Nadu and Maharastra causing total loss of the crop (Anonymous, 2000).

The sunflower necrosis disease comprised as chlorotic and necrosis of a leaf lamina and distortion of leaf. The necrosis extending to midveins, petioles and flower bracts eventually results in killing of plants. It causes greater loss in yield because of its severity and fast spreading nature. The knowledge on the source of inoculum and mode of transmission in the field are still lacking. Keeping the above points in view, an attempt was made to evaluate the host-range of the virus among crop plants and weeds.

MATERIALS AND METHODS

The studies on the mechanical sap inoculation of the sunflower necrosis virus using 0.05 phosphate buffer and thrips transmission of virus was carried out under insect proof glass house located at the AICRP (Sunflower), Zonal Agricultural Research Station, GKVK, Bangalore.

Young leaves from the necrosis infected sunflower plants were collected and the sample was macerated in pestle and mortar by adding chilled phosphate buffer (1 ml/g of leaf tissue) and extract was filtered. The celite was added to the extract and the resultant extract was used as standard inoculum for sap transmission.

Sap transmission of virus:

Sunflower plants were raised in polythene bags and maintained in insect proof glass house. A small piece of sterilized absorbent cotton wool soaked in standard inoculum was gently rubbed on the upper surface of leaves of the test plants. During inoculation, the leaves were supported from below with left-hand palm to avoid any injury and to assume uniform pressure and spread of inoculum. The inoculated leaves were washed ten minutes after inoculation with a jet of sterile water from squeeze bottle to remove excess inoculum. Each set of plants inoculated thus was labelled separately and kept in insect proof glass house. These plants were maintained for symptoms expression up to 30-40 days.

Thrips transmission of virus:

Test plants raised in insect proof nylon mesh cages were used in transmission experiments. The healthy colony of *Thrips palmi* Karny was raised from adults collected in the field and maintained on sunflower plants by weekly transfer of active nymphs. Young sunflower leaves, showing clear symptoms were kept in the Petri plate. Along the rim of Petri plate, a thin layer of water was poured and about 20-30 nymphs were released on to such leaves showing characteristic symptoms of the disease using fine moist camel hairbrush. The nymphs

were allowed for acquisition access period of 1-3 days under normal room temperature. Nymphs fed on healthy leaves served as check. Twenty nymphs of *Thrips palmi* were transferred using fine hairbrush on to test seedlings raised in nylon mesh cages. The normal movement of thrips was observed to ensure that injury do not occur during the transfer. The plants were observed upto 50 days for expression of symptoms.

Transmission of necrosis virus to weeds through sap inoculation:

The test plants of each weed species were raised in polythene bags and maintained in insect proof glass house. A group of twenty plants of each weed species were sap inoculated on second and fourth fully expanded leaves. Ten plants of each species of weeds were kept inside infect proof cages and thrips transmission of the virus was carried. The sap inoculated plants were labeled and kept for symptom expression in glass house and observed up to 40 days and the per cent transmission was calculated.

Transmission of necrosis virus to crop plants through sap and thrips:

The test plants of each species were raised in polythene bags and maintained in insect proof glass house. A set of ten plants of each species such as, groundnut, cowpea (C-152), soybean, tobacco, cucumber and horsegram were sap inoculated on cotyledon leaves before the emergence of trifoliate leaves in legume crops, while at 6-8 leaf stage in tobacco and second and fourth fully expanded leaves in other plants. Similarly, thrips transmission of SNV on each of these test plants was carried using viruliferous nymphs. The mechanical inoculated and thrips transmitted plants were labeled and kept for symptom expression in glass house up to 40 days and the per cent transmission was calculated.

RESULTS AND DISCUSSION

The reaction of sunflower genotypes to necrosis virus by sap inoculation is presented in Table 1. Maximum per cent transmission by sap inoculation was 43.30, 46.66 and 56.66 per cent on KBSH-1, KBSH-44 and Morden, respectively. The tested plants showed chlorotic spots (1-12 days after inoculation) which later turned necrotic.

The successful transmission of necrosis was 6.6 per cent on KBSH-1and 10 per cent on Morden, when minimum acquisition access period of two days and inoculation access period of 5-6 days were given (Table 2). The successful thrips transmission and the symptoms observed were similar to that reported by Anjula (2000) and Ajith Prasad (2004).

Out of twenty six weed plants inoculated mechanically, twelve weeds *viz., Galinsoga parviflora, Euphorbia geniculata, Phyllanthus niruri, Malvestrum coromandelianum, Achyranthus aspera, Abutilon indicum, Ocimum canum, Crotalaria striata, Bidens pilosa, Acanthospermum hispidum, Guizotia abyssinica* and *Ageratum conyzoides* could able to produce disease symptoms (Table 3), indicating the wide host-range of sunflower necrosis virus. The results are similar to the report of Lavanya *et al.* (2005), who reported that SNV has wide host-range comprising of 15 plant species belonging to Fabaceae, six plant species

Table 1: Efficacy of sap transmission of sunflower necrosis virus disease

Sr. No.	Cultivars	No of plants *		Per cent transmission	Symptoms
		Inoculated	Infected		
1.	KBSH-1	150	65	43.30	Chlorosis with half moon shaped and curling of leaves
2.	KBSH-44	150	70	46.66	Necrosis of leaves
3.	Morden	150	85	56.66	Chlorotic and necrotic spots on leaves
	Average transmission			48.87	

* 10 days old seedlings at second leaf stage were sap inoculated with SNV and symptoms were observed 15 days after inoculation.

Table 2: Transmission of necrosis virus disease through its vector, *Thrips palmi*

Sr. No.	*Variety	Acquisition Access period (AAP) days	Inoculation Access period (IAP) days	No of plants		Per cent Transmission
				Inoculated	Infected	
1.	KBSH-1	1	3-4	30	0	0.00
		2	3-6	30	2	6.66
		3	5-7	30	4	13.33
2.	Morden	1	3-4	30	0	0.00
		2	5-6	30	3	10.00
		3	5-7	30	5	16.66

* 10 days old seedlings were inoculated with viruliferous thrips

Table 3 : Transmission of sunflower necrosis virus disease to weed plants through sap inoculation

Sr. No.	*Weed species	Family	No of plants inoculated	No of plants infected	% SNV transmission	Symptoms
1.	*Galinsoga parviflora*	Asteraceae	25	6	24	Chlorosis of leaves
2.	*Amaranthus spinosus*	Amaranthaceae	25	0	0	-
3.	*Chromolaena odoratum*	Asteraceae	20	0	0	-
4.	*Euphorbia geniculata*	Euphorbiaceae	25	3	12	Chlorosis of leaves
5.	*Solanum nigrum*	Solanaceae	20	0	0	-
6.	*Phyllanthus niruri*	Euphorbiaceae	25	3	12	Chlorosis of leaves
7.	*Malvestrum coromandelianum*	Malvaceae	25	4	16	Vein clearing and chlorosis
8.	*Ageratum conyzoides*	Asteraceae	25	3	12	Chlorosis and necrosis
9.	*Polygonum plebjum*	Polygonaceae	20	0	0	-
10.	*Datura stramonium*	Solanaceae	20	0	0	-
11.	*Tridax procumbens*	Asteraceae	20	0	0	-
12.	*Achyranthus aspera*	Amaranthaceae	25	1	4	Mosaic chlorosis and reduction in leaf size
13.	*Abutilon indicum*	Malvaceae	25	2	8	Vein cleaning and chlorosis of leaves
14.	*Ocimum canum*	Labiatae	20	1	5	chlorosis
15.	*Argemone mexicana*	Papaveraceae	25	0	0	-
16.	*Commelina benghalensis*	Commelinaceae	20	0	0	-
17.	*Crotalaria striata*	Fabaceae	25	2	8	Clhorosis
18.	*Bidens pilosa*	Asteraceae	20	1	5	Chlorosis
19.	*Alternanthera sessilis*	Amaranthaceae	20	0	0	-
20.	*Borreria stricta*	Rubiaceae	20	0	0	-
21.	*Stachytarpeta indicum*	Verbenaceae	25	2	8	Chlorosis and necrosis
22.	*Leucas aspera*	Labiatae	20	0	0	-
23.	*Acanthospermum hispidum*	Asteraceae	25	2	8	Marginal necrosis of leaves
24.	*Synedrina nodiflora*	Asteraceae	20	0	0	-
25.	*Parthenium hysterophorus*	Asteraceae	25	0	0	-
26.	*Guizotia abyssinica*	Asteraceae	20	2	10	Marginal necrosis of leave

*12 days old seedlings were used for inoculation

belonging to Cucurbitaceae, three plant species belonging to each Malvaceae and Solanaceae and one each to Brassicaceae and Moringaceae. Ramaiah *et al.* (2001) also transmitted the SNV to plant species belonging to Amaranthaceae, Chenopodiaceae and Fabaceae

The symptoms expressed were mosaic followed by chlorotic spots on leaves of *Galinsoga parviflora*, followed by curling and drying of leaves; on *Euphorbia geniculata*, *Phyllanthus niruri*, *Malvestrum coromandelianum* and *Crotalaria striata* the symptoms produced were mosaic, chlorosis of leaves followed by vein cleaning and thickening of veins and similar symptoms have also been reported by earlier workers *viz.*, Anjula (2000), Ramaiah *et al.* (2001) and Linga Reddy (2003).

Among the crop plants tested, the sunflower necrosis virus was efficiently transmitted to cowpea, groundnut, cucumber and horsegram with the per cent transmission of 15, 10, 5 and 5 by sap inoculation and while 10, 5, 5 and 5 by thrips transmission, respectively (Table 4). The symptoms on inoculated groundnut appeared as chlorotic

Table 4 : Sap and thrips transmission of SNV to crop plants

Sr. No.	Name of the crops	Family	*No of plants inoculated		No of plants infected		Per cent transmission	
			Sap	Thrips	Sap	Thrips	Sap	Thrips
1.	Groundnut	Fabaceae	20	20	2	1	10.0	5.0
2.	Cowpea (C-152)	Fabaceae	20	20	3	2	15.0	10.0
3.	Soybean	Fabaceae	20	20	0	0	0	0
4.	Tobacco	Solanaceae	20	20	0	0	0	0
5.	Cucumber	Cucurbitaceae	20	20	1	1	5.0	5.0
6.	Horsegram	Fabaceae	20	20	1	1	5.0	5.0

*12 days old seedlings were used for inoculation

spots and mosaic, followed by chlorosis on leaves 15-20 days after sap inoculation and 20-25 days after thrips transmission. While, cowpea (C-152), showed chlorosis of leaves (10-20 days after sap inoculation) followed by thickening of leaf veins and reduction in leaf size. The chlorosis and thickening of veins were observed on cowpea leaves on 15-20 days after thrips transmission. Further, chlorosis of leaves with mottling symptoms was present on horsegram and cucumber both by sap and thrips transmission. The similar observations were made by Anjula (2000) and Ajith Prasad (2004).

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