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Transmission and management of necrosis virus disease of sunflower (*Helianthus annuus* L.)

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During the last two decades, the sunflower crop has emerged as one of the major edible oilseed crops in the world, ranking second in importance after soybean (Anon. 2000). In the global scenario, several viruses belonging to *cucumo*, *ilar*, *poty*, *tospo* and *umbra* virus groups infect sunflower (Brunt *et al.* 1996). In India, only the association of *poty* and *tospo* virus has been observed until the emergence of a new disease called necrosis (Anon., 1997; Jain *et al.* 2000). The disease was observed in a serious proportion in parts of Karnataka during 1997. Now the disease is prevalent in almost all sunflower growing areas of India. Symptoms of the disease include occurrence of necrotic spots which coalesce later giving a scorched appearance of leaves. The necrosis then spreads further along the petiole and the stem causing necrotic streaks. Later, the necrosis also spreads to the floral organs leading to the collapse of the plant. Early infected plants produce heads that contain chaffy, ill filled and poor quality

seeds. Maximum incidence of the disease (upto 80%) was observed during Kharif season whereas it was less during rabi season (Ramiah *et al.* 2001).

In order to know the etiology of the disease, the following studies were undertaken.

Sap transmission studies

The leaves and stems of sunflower plants showing typical symptoms of necrosis disease were collected and used for sap transmission studies. The samples were ground in 0.1 M phosphate buffer, pH 7.2 containing 0.1 % 2-mercaptoethanol using chilled pestle and mortar. Then the extract was inoculated on cotyledonary leaves of cowpea plants (cv. C 152) which were previously dusted with carborundum powder (600 mesh) and the excess inoculum was washed off with water using a squeeze bottle. The number of plants showing the local lesions were observed at periodical intervals.

Table 1. Plants expressing symptoms of necrosis disease after sap inoculation.

Extract collected from	Extract inoculated on	Days after inoculation	No. of plants inoculated	No. of plants showing symptoms	Per cent infection	Type of symptom
<i>Helianthus annus</i>	<i>Glycine max</i>	7 th	15	5	33.3	CL
<i>Helianthus annus</i>	<i>Vigna unguiculata</i>	4 th	15	15	100.0	NL
<i>Helianthus annus</i>	<i>Nicotiana tabacum</i>	7 th	15	10	66.6	WRL
<i>Helianthus annus</i>	<i>N. glutinosa</i>	7 th	15	0	0.0	-
<i>Helianthus annus</i>	<i>Trianthema portulacastrum</i>	5 th	15	12	80.0	RL
<i>Helianthus annus</i>	<i>Helianthus annus</i>	9 th	15	5	33.3	NL
<i>Cowpea</i>	<i>Helianthus annus</i>	7 th	15	9	60.0	NL

Note: CL - Chlorotic lesion, NL - Necrotic lesion, RL - Reddish lesion, WRL - White ring like lines

Table 2. Influence of date of sowing on necrosis virus disease incidence

Accessions / Varieties	July	August	September	October	November	December
GAUSUF15	10.3	15.4	0.0	0.0	0.0	44.0
MSFH 17	28.0	4.0	0.0	0.0	0.0	27.3
KBSH1	12.9	3.8	0.0	0.0	0.0	18.5
Co 4	15.4	0.0	0.0	0.0	0.0	15.8
Morden	31.8	0.0	0.0	0.0	0.0	0.0
Co 3	22.2	4.0	0.0	0.0	0.0	0.0

The plants viz., soybean, *Nicotiana glutinosa*, *Trianthema portulacastrum*, tomato and sunflower were also inoculated with the extract to know the host range of the virus.

Influence of date of sowing on the incidence of necrosis disease

Monthly sowing was taken up starting from the month of July to December 1999 and the disease incidence was recorded. The varieties viz., GAU SUF 15, MSFH 17, KBSH 1, Co 4, Morden and Co 3 were used for this experiment. The observation on disease occurrence was observed 30 days after sowing and it was expressed as per cent infection by counting the total number of plants and number of plants infected.

Management of sunflower necrosis disease

In order to manage the disease, an experiment was laid out with seven treatments and three replications in randomized block design. The details are given in Table 3.

Sap transmission studies revealed that the disease can be transmitted from sunflower to cowpea which exhibited localized necrotic lesions at 4 days after inoculation. The percent success was found to be 100 per cent. When back inoculated, it produced necrosis symptoms on sunflower at 7 days after inoculation. Likewise, soybean, tobacco, tomato plants were sap inoculated and the result of which are given in Table 1.

Table 3. Management of sunflower necrosis disease

No.	Treatment	Disease incidence (%) on				Yield kg/ha
		15 DAS	30 DAS	45 DAS	60 DAS	
T1	Imidacloprid seed treatment (2g / Kg of seed)	0.0 (0.19)	0.0 (0.19)	0.0 (0.19)	0.0 (0.19)	1220
T2	T1 + imidacloprid (0.1 %) spray at 30 and 45 DAS	0.0 (0.19)	0.0 (0.19)	0.0 (0.19)	0.0 (0.19)	1246
T3	Marshall seed treatment @ 40 g/ Kg of seed	1.7 (7.49)	3.3 (10.4)	3.3 (10.4)	3.3 (10.4)	1055
T4	T ₃ + imidacloprid (0.1 %) spray at 30 and 45 DAS	1.8 (7.71)	1.8 (7.71)	3.6 (10.9)	3.6 (10.9)	1006
T5	Soil application of carbofuran 3 G @ 8 Kg a.i /ha	1.4 (6.79)	2.8 (9.63)	2.8 (9.63)	2.8 (9.63)	1188
T6	T ₅ + Dimecron (0.1 %) spray at 30 and 45 DAS	0.0 (0.19)	1.7 (7.49)	1.7 (7.49)	2.8 (9.63)	1100
T7	Control	2.8 (9.63)	3.6 (10.9)	5.4 (13.4)	5.4 (13.4)	952
	CD	0.43	0.23	0.29	0.29	

Means in parentheses are Arcsin transformed values

A trial conducted at Millet breeding station during the year 1999 revealed that the incidence of necrosis disease was found to be the highest in the accession, GAU SUF 15 (44.0 %) when the sowing was taken up in December. Whereas the incidence was 10.3 and 15.4 per cent when it was sown during the months of July and August respectively. The incidence of necrosis was not observed in any of the accessions during the months of September, October and November. The incidence was not observed during August also in varieties like Co 4 and Morden (Table 2).

A trial laid out for the management of necrosis disease indicated that the disease incidence was found to be nil when the seeds were treated with imidacloprid @ 2g / Kg of seed followed by spraying with 0.1 % imidacloprid at 30 and 45 DAS as against 5.4 per cent in control. The yield was also found to be the highest (1220 Kg/ha) in the same treatment (Table 3). Seed treatment with imidacloprid 70 wp @ 7.5 g / Kg of seed reduced the insect vector population significantly during the early stage of the crop. Prophylactic sprays with imidacloprid 200SL @ 0.1 % concentration at 15 days interval starting from

