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RESEARCH ARTICLE

Studies on seed transmission of tobacco streak virus causing sunflower necrosis disease

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ABSTRACT

Sunflower necrosis disease caused by *Tobacco streak virus* poses potential threat to the cultivation of sunflower in India. The early infection kills entire plant and the disease appears as necrosis of leaves, petiole, stem, bracts and malformation of head. TSV has wide host range and it is transmitted by vector through infective pollen. In the present study, transmission of TSV by seed was ruled out, since no seed transmission was recorded with the seeds of sunflower cultivars (Morden, DRSF-108, KBSH-1, KBSH- 41, KBSH- 44, KBSH- 53, Sunbred- 275, DRSH-1, ASF-107 and RSF-101) collected from necrosis infected plants in grow-out test. However, reduction in germination percentage from seeds of diseased plants was noticed as compared to healthy seeds.

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INTRODUCTION

Sunflower (*Helianthus annuus* L.) is an important edible oilseed crop in the country next to groundnut and soybean. The crop was introduced into India during 1969, which accounts for nearly 5 per cent of the current oil seed production. Sunflower oil is used for culinary purposes, in the preparation of vanaspati and in the manufacture of soaps and cosmetics. Sunflower oil is a rich source of linoleic acid (64 per cent) and good for heart patients. The crop has shown distinct superiority over other oilseed crops owing to its wider adaptability to different agro-climatic conditions.

Seed transmission was very well proved in different isolates worldwide since seed transmission of *Tobacco streak virus* (TSV) has been documented both in seeds of naturally infected and artificially sap inoculated plants belonging to different families. Seed transmission of TSV was successful in tomato up to 10 per cent (Sdoode and Teakle, 1988); in Beans up to 26.4 per cent (Walter *et al*., 1992) and in *P. hysterophorus* up to 6.8- 48 per cent (Sharman *et al*., 2009).

However, seed transmission was not reported in naturally or experimentally infected groundnut, sunflower, *Parthenium* or several other annual crops infected with TSV in India (Prasada Rao *et al*., 2003 and 2009; Reddy *et al*., 2007).

Virus spread through seeds is of great concern as a route for the introduction of viruses into new areas, where they may spread and become established if suitable vectors and hosts are available. Hence, an attempt was done to check the seed transmission of TSV in sunflower using seeds collected from sunflower necrosis disease (SND) infected plants.

MATERIALS AND METHODS

Naturally infected plants of the popular sunflower cvs. Morden, DRSF-108, KBSH-1, KBSH-41, KBSH-44, KBSH-53, Sunbred-275, DRSH-1, ASF-107 and RSF-101 infected with SND were tagged in the field. All the plants were tested for TSV infection by Direct antigen-coated enzyme linked immunosorbent assay (DAC-ELISA) using polyclonal antiserum of TSV and the seeds from TSV positive plants were collected at maturity and stored for two months after drying. The seeds thus, collected were used in grow-out tests to assess the seed transmission. Similarly, seeds from artificially inoculated sunflower plants were also tested for

seed transmission. Seeds collected from healthy plants of the respective sunflower cultivars served as control. Five hundred seeds from sunflower cv. Morden and one hundred seeds from other cultivars were picked at random and sown in earthen pots filled with sterilized potting mixture under insect proof glass house conditions. Seedlings were regularly monitored for symptom expression upto six weeks of sowing. Leaves from all the seedlings were collected and tested in groups of 10 samples (bulk analysis) for the presence of virus by DAC-ELISA using polyclonal antiserum of TSV.

RESULTS AND DISCUSSION

In grow out test, only 57 per cent of the seeds (cv. Morden) germinated which were collected from naturally infected plants compared to 90 per cent in seeds collected from apparently healthy cv. Morden (Table 1). The germination percentage of the seeds, which were collected from artificially inoculated plants was only 66 per cent compared to 87 per cent in seeds from uninfected plants.

Among the different cultivars, the seeds collected from naturally infected sunflower plants showed reduction in the germination percentage compared to healthy check. Seed germination ranged from 40 per cent (ASF-107) to 63 per cent (KBSH-44), compared to 83 per cent and 88 per cent germination in seeds of healthy plants, respectively.

The growth pattern was similar in seedlings raised from seeds collected from infected sunflower plants and uninfected plants. However, reduction in germination percentage was observed with the seeds collected from the infected and artificially inoculated plants compared to the seeds collected from the uninfected plants irrespective of the cultivar tested.

No seed transmission of SND was detected in the sunflower cultivars tested, which were found to be infected under field conditions. Further, non- seed transmission of the virus was confirmed by DAC-ELISA using polyclonal antiserum of TSV, where all the seedlings raised from infected sunflower plants tested negative to TSV.

The tests conducted clearly indicate non-transmission of the virus through the seeds of sunflower cultivars tested. In the present study, seeds collected from artificially inoculated plants of sunflower cv. Morden and field infected plants of cv. Morden, DRSF-108, KBSH-1, KBSH-41, KBSH-44, KBSH-53, Sunbred-275, DRSH-1, ASF-107 and RSF-101 in grow- out test gave negative results for seed transmission. Negative seed transmission of SND was also reported by Nagaraju and Hanumantha Rao (1999) and Chander Rao *et al.* (2002 &2003) in cvs. KBSH-1 and Morden. Prasada Rao *et al.* (2003) reported lack of TSV seed transmission in both externally infected and artificially inoculated seeds of groundnut and sunflower.

The loss in percentage of germination may be due to the poor viability of the seed due to various factors including virus infection. More ever, sunflower is sensitive in terms of dormancy, where there will not be germination due to extreme/ unfavourable environmental conditions, such as temperature and even due to over drying of seeds. Poor viability of seeds collected from SND infected sunflower plants was also reported by Chander Rao *et al.* (2003) and Reddy *et al.* (2007).

Recently, Prasada Rao *et al*. (2009) also confirmed that TSV seed transmission was not observed in seeds of naturally and experimentally infected groundnut (cvs. JL- 24 and TMV-2), sunflower (cv. PAC-36), urdbean, mungbean, soybean (cvs. Bragg and JS-335), French bean (cv. Top crop), marigold, *C. quinoa*, *G. globosa* and *P. hysterophorus.* Vemana and Jain

Table 1: Transmission of SND through the seeds collected from infected sunflower plants

Sunflower cultivars	No. of seeds		Germination (%)		Per cent seed transmission
	Sown	Germinated	Infected	Control*	
Seeds collected from artificially inoculated plants					
Morden	500	329	66	87	0
Seeds collected from naturally infected plants					
cv. Morden	500	284	57	90	0
KBSH-1	100	61	61	86	0
KBSH-41	100	59	59	85	0
KBSH-44	100	63	63	88	0
KBSH-53	100	58	58	90	0
S-275	100	52	52	91	0
DRSH-1	100	46	46	85	0
DRSF-108	100	56	56	80	0
ASF-107	100	40	40	83	0
RSF-101	100	41	41	86	0

*Seeds collected from apparently healthy and uninoculated plants.

(2010) also reported non-seed transmission of TSV in groundnut (cvs. JL-24, TMV-2, Prasuna, Kadiri 6, Kadiri 9, Anantha and Kadiri 7 bold). So far, TSV seed transmission was not proved from any crop or weed hosts in India as reported earlier by several workers. Hence, it is concluded that non-seed transmissible strain of TSV might be existing in India.

Previous studies on seed transmission of TSV in groundnut and sunflower in India also concluded that Indian TSV isolate was not seed transmissible (Prasada Rao *et al.*, 2003, Reddy *et al.*, 2007; Vemana and Jain, 2010). Further, Walter *et al*. (1995) investigated the genetic basis for seed transmission with TSV pathotype I isolate Mel-40 and pathotype II isolate Mel F infecting beans (*P. vulgaris*) and revealed that many minor RNA species were not detected in the seed transmitted isolate Mel-40. In this context, there is a need for comparison of complete genome sequence of non-seed transmissible and seed transmissible strains of TSV of different regions and locations with special reference to their host range, physicochemical properties and genetic diversity.

In the absence of seed transmission, primary inoculum of the virus is provided by secondary hosts and weed hosts prevalent in and round the fields. It is the fact that the virus is brought by the thrips vector from outside which helps in spread of the disease under field conditions. However, it is worthy to test seed transmission of TSV in all the popular cultivars of sunflower grown in different regions/states and also weed species and other crop plants belonging to different families which were positive to TSV under natural conditions to rule out the emergence of seed transmissible TSV strain infecting sunflower in India.

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