

## **Search for resistance to reniform nematode (*Rotylenchulus reniformis*) infecting castor (*Ricinus communis*), sunflower (*Helianthus annuus*)**

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### **ABSTRACT**

In the present study total of 29 genotypes of castor which includes released varieties, hybrids and their parental lines were screened in pots using reniform nematode (*Rotylenchulus reniformis*) infected soil with an initial inoculum density of > 10 nematodes per C.C. soil. Average no. of egg masses per root system ranges from 21.5 (GCH 2) to 70.5 (DCS 107). None of the genotype was found either highly resistant or resistant to reniform nematode. Five lines (GCH 2,4,5,6 and JI 35) were found moderately resistant with an average egg mass index of 5.2 to 5.7. Sixteen lines were observed as susceptible with an average egg mass index of 6.2 to 7.8. Seven lines were recorded as highly susceptible to this nematode. Total of 25 released varieties and hybrids of sunflower were obtained and screened in pots using reniform nematode infested soil with an initial inoculum density of > 10 nematodes per C.C. soil. Average no. of egg masses per root system ranges from 10.7 (LSF-8) to 72.3 (CO-3). Two cultivars (LSF-8 and RSFH-1) were found resistant to reniform nematode with an average egg mass index of 3.3 and 3.8. Four lines (LSFH-35, TAS-82, SS-56 and Bhanu) were found moderately resistant with an average egg mass index of 4.7 to 5.8. Seventeen lines were found susceptible with an average egg mass index of 6.0 to 7.7. Only two lines (CO-1 and CO-3) were found highly susceptible to this nematode.

**Key words:** Genotypes, *Helianthus annuus*, *Rotylenchulus reniformis*, Reniform nematode, Resistance.

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### **INTRODUCTION**

Castor is a non-edible oilseed crop predominantly grown in rainfed regions of India for its oil which has industrial as well as medicinal importance. India is the leading producer of castor with 59.1% of world castor growing area and 64% of world castor production with 1146 kg/ha of productivity (2006). Yield loss and damage due to reniform nematode (*Rotylenchulus reniformis*) is one of the least known yet economically important constraints of castor production. This polyphagous nematode pest attacks numerous cultivated crops probably after root-knot nematode (*Meloidogyne* spp.) in terms of host range. In India, yield loss estimates by [1] indicated that in castor alone it inflicts monetary loss to the tune of Rs. 180 million which is equivalent to 13.93% avoidable yield loss. Random survey by network project on reniform nematode (2001-05) revealed that the nematode was found fairly prevalent throughout India with an overall frequency of occurrence of 42.3% with an average population density of 327 nematodes / 200 cc soil [2].

Sunflower is an important edible oilseed crop which had been introduced in India during 1970's. India ranks fourth in terms of area (21%) and shares 3.6% of world sunflower production with an average yield of 526 kg/ha. Root-knot nematode, *M. incognita* was calculated to cause 16.44% avoidable yield loss on sunflower [3]. Survey on major sunflower growing regions of Karnataka revealed that reniform nematode *R. reniformis* was the predominant plant parasitic nematode. Prasad and Imtiyaz Ahmad, 2002 [4] estimated avoidable yield loss in sunflower due to reniform nematode. *R. reniformis* was ranged from 40.1 to 48.7 %. Host plant resistance offers cost effective, input efficient nematode management strategy with lesser nematode population build up for succession crop. It's an important component in oilseed based cropping systems where majority of the growers belong to marginal and small

farmers. In view of their economic and medicinal value, a project work has been undertaken with the following objectives. To screen castor and sunflower genotypes for resistance against reniform nematode, *R. reniformis*.

## MATERIALS AND METHODS

All the experiments were carried out in the Laboratory and greenhouse in the Directorate of Oilseeds Research, Rajendranagar, Hyderabad. Earthen pots were washed, cleaned and disinfested before use, by rinsing them through four percent formalin solution. The formalin was allowed to evaporate before their use for experiments. Both the sand and field soil were steam sterilized at 1.0546 kg/cm<sup>2</sup> for 4 hrs. Earthen pots were filled with sand and soil mixture (1:1). Standard doses of NPK were used in the sand soil mixture and mixed thoroughly before filling the pots. Three random samples of sterilized soil samples were processed by modified sieving and Beermann funnel technique [5] and examined to ensure that the sterilized soil was free from nematodes.

**Collection, identification and raising pure culture of reniform nematode, (*R. reniformis* race) A – AP 1:** Reniform nematode cultures were collected from castor plants grown on roadways near rajendra nagar, Rangareddy district of Andhra Pradesh and identification was done by Goodey, 1931 method [6]. After confirmation of the species as *R. reniformis*, single egg mass from the female was used to raise pure culture of *R. reniformis* and race A was identified by using host differentials viz., cotton, cowpea and castor. Race A was further identified as AP-1 isolate using bajra (Pusa 23) and mustard (Pusa bold) as host differentials. The infected soil as such was used for screening for resistance experiment. An initial soil inoculum load of 10 – 15 nematodes per C.C of soil was maintained.

**Screening of castor and sunflower genotypes against *R. reniformis* Race A-AP1:** Genotypes of castor and sunflower were obtained from various AICRP – castor and sunflower centers for the purpose of evaluating varietal response against *R. reniformis* inoculation. Thus a total of 29 castor and 25 sunflower genotypes were collected and screened for nematode resistance. The seeds were sown in 22 cm earthen pots containing 2 kg of nematode infested soil @ 10 – 15 nematodes per C.C. soil. Each treatment was replicated six times and arranged in completely randomized design and given light irrigation as and when required.

## RESULTS AND DISCUSSION

Plants were uprooted gently without damaging the rhizosphere and the numbers of egg masses per root system were recorded after 35 days after sowing. Genotypes were categorized on the basis of Egg mass index scale which is based on the number of egg masses produced on the roots of the screened castor and sunflower against reniform nematode. Accordingly the genotypes were categorized following 1 – 9 scale. (Sharma and Ashok kumar, 1991)[7] (Table1).

Table 1: Genotypes Categorization

Scale	No. of egg masses / root system	Reaction	Abbreviation
1	0	Highly Resistant	HR
2	1 to 5	Resistant	R
3	6 to 10	Resistant	R
4	11 to 15	Moderately Resistant	MR
5	16 to 20	Moderately Resistant	MR
6	21 to 30	Susceptible	S
7	31 to 40	Susceptible	S
8	41 to 50	Susceptible	S
9	Above 50	Highly Susceptible	HS

### Screening of castor genotypes for resistance to reniform nematode

A total of 29 genotypes of castor which includes released varieties, hybrids and their parental lines were screened in pots using reniform nematode infested soil with an initial inoculum density of > 10 nematodes per C.C. soil. Average no. of egg masses per root system ranges from 21.5 (GCH 2) to 70.5 (DCS 107). None of the genotype was found either highly resistant or resistant to reniform nematode. Five lines viz. GCH 2,4,5,6 and JI 35 were found moderately resistant (MR) with an average egg mass index of 5.2 to 5.7. Sixteen lines were observed as susceptible (S) with an average egg mass index of 6.2 to 7.8. Seven lines were recorded as highly susceptible (HS) to this nematode (Table 2). The results are in agreement with [8].

**Screening of sunflower genotypes for resistance to reniform nematode:** A total of 25 released varieties and hybrids of sunflower were obtained and screened in pots using reniform nematode infested soil with an initial inoculum density of > 10 nematodes per C.C. soil. Average no. of egg masses per root system ranges from 10.7 (LSF-8) to 72.3 (CO-3). Two cultivars viz. LSF-8 and RSFH-1 were found resistant to reniform nematode with an

average egg mass index of 3.3 and 3.8. Four lines viz. LSFH-35, TAS-82, SS-56 and Bhanu were found moderately resistant (MR) with an average egg mass index of 4.7 to 5.8. Seventeen lines were found susceptible (S) with an average egg mass index of 6.0 to 7.7. Only two lines viz. CO-1 and CO-3 were found highly susceptible (HS) to this nematode (Table 3). The results are in agreement with the work done by Rebois *et al.*, 1973[9] on another plant species.

**Table 2: Response of castor genotypes to reniform nematode (*R. reniformis*) infection**  
(Average of six replications)

S. No.	Genotype	Average no. of egg-masses per root system	Egg-mass Index	Reaction
1	CO 1	43.8	7.8	S
2	Sowbhagya	29.0	6.2	S
3	48-1	35.3	6.8	S
4	DCS 9	30.3	6.5	S
5	DCS 107	70.5	8.8	HS
6	GAUC 1	40.8	7.0	S
7	GC 2	50.8	8.5	HS
8	GC 3	34.2	6.8	S
9	Kranti	50.4	8.4	HS
10	Haritha	31.7	6.7	S
11	TMV 5	50.4	8.2	HS
12	GAUCH 1	29.3	6.2	S
13	GCH 2	21.5	5.2	MR
14	GCH 4	24.7	5.7	MR
15	GCH 5	23.3	5.7	MR
16	GCH 6	22.4	5.6	MR
17	GCH 7	57.7	7.2	S
18	DCH 177	64.2	8.7	HS
19	DCH 519	29.3	6.3	S
20	RCH 1	18.8	4.7	MR
21	TMVCH 1	56.0	8.7	HS
22	SH 72	39.8	7.7	S
23	Geetha	37.3	6.8	S
24	VP 1	36.8	7.2	S
25	JI 35	23.3	5.7	MR
26	TMV 5-1	38.8	7.3	S
27	DCS 78	31.5	6.5	S
28	SKI 215	62.0	8.5	HS
29	DPC 9	29.7	6.2	S

(HR – Highly Resistant; R – Resistant; MR – Moderately Resistant; S – Susceptible; HS – Highly Susceptible).

**Table 3: Response of sunflower genotypes to reniform nematode (*R. reniformis*) infection**  
(Average of six replications)

S. No.	Genotype	Average no. of egg-masses per root system	Egg-mass Index	Reaction
1	DRSF 108	35.3	7.0	S
2	DRSF 113	36.0	6.8	S
3	DRSH 1	34.5	7.0	S
4	LSF-8	10.7	3.3	R
5	LSFH-35	18.8	5.2	MR
6	NDSH-1	32.3	6.2	S
7	RSFH-1	12.8	3.8	R
8	CO-1	55.5	8.0	HS
9	CO-2	37.8	7.2	S
10	CO-3	72.3	8.3	HS
11	CO-4	32.7	6.7	S
12	CO-5	46.0	7.7	S
13	TCSH-1	29.7	6.2	S
14	Surya	36.3	6.5	S
15	PKV-SF-9	27.8	6.0	S
16	TAS-82	27.3	5.8	MR
17	PKV-SH-27	28.5	6.2	S
18	KBSH-1	34.5	6.8	S
19	KBSH-41	30.2	6.2	S
20	KBSH-42	39.8	7.0	S
21	KBSH-44	38.3	7.2	S
22	Morden	34.0	6.5	S
23	SS-56	20.0	5.0	MR
24	Bhanu	17.7	4.7	MR
25	PSH 569	26.8	6.0	S

(HR – Highly Resistant; R – Resistant; MR – Moderately Resistant; S – Susceptible; HS – Highly Susceptible).

### CONCLUSION

In the present investigation a total of 29 genotypes of castor and 25 genotypes of sunflower were obtained and screened for potent resistant varieties for reniform nematode (*Rotylenchulus reniformis*) respectively. Out of 29 genotypes of castor only 5 lines (GCH 2,4,5,6 and JI 35) were found moderately resistant (MR) and out of 25 genotypes of sunflower only 2 cultivars (LSF-8 and RSFH-1) were found resistant to reniform nematode. So by using gene and r-DNA technology much work is to be done on these varieties of genotypes to get better and potent resistant varieties against this harmful and yield decreasing nematode.

### REFERENCES

- [1]R.K. Jain, K.N. Mathur and R.V. Singh, *Ind. J. Nemat.*, **2007**, 37, 219.
- [2]H.S. Gaur, R.V. Singh, S. Ganguly, D.J. Patel, V. Indira, S.P. Tiwari, N.L. Mhase, A.K. Mukhopadhyaya, M.R. Khan, M.R and M. Sivakumar, **2005**. Studies on the reniform nematodes, *Rotylenchulus reniformis*. Network project consolidated final report. Pp. 1- 166.
- [3]V. Devappa, K. Krishnappa and B.M.R. Reddy, *Ind. J. Nemat.*, 1998, 28(1), 95.
- [4]D. Prasad and Imtiyaz Ahmad, *Ann. Pla. Prot. Sci.*, **2002**, 10(1), 172.
- [5]J.R. Christie and V.G. Perry, *Pro.Helminth. Soc. Washi.*, **1951**, 18, 106.
- [6]T. Goodey, *J. Helminth.*, **1931**, 15, 137.
- [7]S.B. Sharma and P. Ashok Kumar, *Ann. App. Biol.*, **1991**, 115, 323.
- [8]Beasley, J. P., and J. E. Jones. 1985. The current status in the development of resistance to the reniform nematode in cotton in Louisiana. p. 23-25. *In Proc. Beltwide Cotton Conf.*, New Orleans, LA. 6-11 Jan. **1985**. Natl. Cotton Counc. Am., Memphis, TN.
- [9] R.V. Rebois, B.J. Eldridge, J.M. Good and A.K. Stoner, *Pl. Dis.Reptr.*, **1973**, 57, 169.