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Sources of resistance to major castor (*Ricinus communis* L.) diseases

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Introduction

Castor is an industrial oilseed crop. Because of its almost unlimited industrial applications, castor oil enjoys tremendous world demand. India is the world's top producer and exporter of castor. Wilt (*Fusarium oxysporum f.sp.ricini*), root rot (*Macrophomina phaseolina*) and gray rot (*Botrytis ricini*) are major diseases of castor (*Ricinus communis*) in India and they can cause 80–100% crop damage. No measures are fully effective at controlling these diseases. Cultivars resistant to these fungi would be the most practical way to control these diseases. One can look for naturally occurring genes resistant to biotic stresses in germplasm collections, and identification of disease resistance by systematic screening of castor germplasm has been ongoing since 1991. This paper presents sources of resistance identified in castor germplasm for wilt, root rot and gray rot as well as multiple-disease resistance.

Materials and methods

Fusarium wilt

A total of 820 germplasm accessions were screened in wilt-sick plots at the Directorate of Oilseeds Research, Hyderabad , and Gujarat Agricultural University , S. K. Nagar, from 1991 to 1998. One-hundred-and-ten accessions found resistant to wilt at both locations in different years were further screened for three years (1999, 2000 and 2001) at Hyderabad to study consistency of resistance. These were planted in highly wilt-sick plots with susceptible check variety Aruna and resistant check DCS 9 every two rows in two replications. Each replication comprised a single row of 5 m length with 10 initial plants at 90×45 cm spacing. The inoculum load in the wilt-sick plot was 2046–3023 CFU g –1 soil. Disease incidence (number of infected plants) was monitored periodically at 30-day intervals up to 150 days.

Macrophomina root rot

Screening for *Macrophomina* resistance was carried out in a root-rot-sick plot at Gujarat Agricultural University , Junagadh. The debris of diseased plants were incorporated in the root-rot-sick plot and each plant was inoculated with 50 g fungal culture grown on soil–maize medium. One-hundred-and-forty-three accessions were screened for 2 years in the sick plot along with susceptible check GCH-4 and resistant check JI-257 planted every five rows. Each entry was planted in a single row of 5 m with two replications at 90×45 cm spacing. Disease incidence (number of infected plants) was recorded at 150 and 200 days after planting.

Botrytis gray rot

One-hundred-and-forty-five accessions were screened for *Botrytis* gray-rot resistance along with susceptible check DCS 9 and resistant check 48-1, under artificial epiphytotic conditions in the field at DOR, Hyderabad , from 1999 to 2001. Each entry was planted in a single row of 5 m with two replications at 90×30 cm spacing. Five plants in each row were inoculated with spore suspension (10 6 spores per ml) of *Botrytis ricini*. Sprinkler irrigation was provided to keep the spikes moist for progression of the fungus. The percentage of capsules infected in primary, secondary and tertiary spikes was taken to score *Botrytis* incidence using a 0–9 scale.

Results and discussion

Sources of resistance to Fusarium wilt

Castor is susceptible to wilt, which generally appears in patches, at all stages of growth. It was first reported in India in 1974 (Nanda and Prasad 1974). *Fusarium*wilt incidence as high as 85–90% was reported in wilt endemic areas of various castor-growing states. Even the leading wilt-resistant castor hybrid GCH-4 (Patel et al. 1991) turned out to be susceptible to *Fusarium* wilt with 90% wilt incidence in endemic areas. The resistant variety DCS-9 showed wilt incidence as high as 60% in our experiments indicating gradual breakdown of resistance against wilt; hence, there is a need for identification and incorporation of new sources of wilt resistance in breeding material for development of resistant cultivars.

Out of the 110 accessions identified as resistant to *Fusarium* wilt at both Hyderabad and S. K. Nagar centres in wilt-sick plots, 12 were found to be stable sources of resistance when screened at Hyderabad in three contiguous years (1999–2001) under highly wilt-sick conditions (**Table 1**). Wilt incidence in these accessions ranged from 0 to 20%, whereas in the susceptible check Aruna it was 80–100%, and 30–50% in the resistant check DCS 9. No incidence of wilt was observed in all three years in RG 389, RG 2048 and RG 1628. All the resistant accessions were indigenous collections.

Sources of resistance to Macrophomina root rot

Macrophomina root rot is one of the most destructive diseases of dryland castor crop in India . A long dry spell with high temperature favours this disease. Maiti and Raoof (1984) reported severe aerial infection of *Macrophomina phaseolina* causing die-back symptoms in castor. Prior to screening of germplasm against root rot, no source of root-rot resistance was available to castor breeders. None of the released castor hybrids and varieties is resistant to root rot. Germplasm screening under root-rot-sick conditions at the Junagadh centre (root rot is endemic to the Junagadh region) identified several sources of resistance to root rot (**Table 2**). The disease incidence ranged from 0 to 15% in the 19 resistant accessions identified, while it was 68% in the susceptible check GCH-4. All the resistant accessions were indigenous collections, of which 17 (RG 2706 to RG 2734) were from the Andaman and Nicobar Islands of India.

Sources of resistance to Botrytis gray rot

Incidence of gray rot (*Botrytis ricini*) becomes severe during cyclonic weather and spreads very quickly through air-born conidia. It causes 100% yield loss if prolonged wet weather prevails during flowering and capsule development. Gray rot mainly appears on spikes, but under severe disease conditions the leaves and stems are also infected. Infection during flowering results in flower rot and affects seed filling. Infected spikes become sterile and without capsules. Infected capsules rot and shed off. Infection spreads to the seed on which black sclerotia also develop. Gray rot appeared for the first time as an epidemic in 1996 in castor-growing regions of Andhra Pradesh , India (Annual Progress Report, Castor, 1996). Since then it has reoccurred every year in farmers' fields causing severe damage and it is currently the major castor disease in this region. All the existing castor varieties and hybrids are susceptible to gray rot and non-genetic measures have failed to control it.

Screening of 145 accessions against gray rot under artificial epiphytotic conditions resulted in identification of six resistant accessions (**Table 3**). These were collections from the Andaman and Nicobar Islands . Disease incidence in these accessions ranged from 0 to 9%, while it was 30–99% in the other 140 germplasm accessions screened, and 88% in susceptible check DCS 9, and 29% in the resistant check 48-1. Accessions RG 2731, RG 2732 and RG 2733 possessed multiple resistance to *Fusarium* wilt and root rot. Multiple resistance to wilt and root rot is highly desirable since these are the most problematic diseases in major castor growing areas.

Intensive screening of castor germplasm has enabled us to identify sources of resistance to major castor diseases. These accessions are being used extensively in castor improvement programmes and will help to produce single or multiple disease resistant cultivars.

References

Annual Progress Report, Castor, 1996. Report on the disease situation in the states/regions. Directorate of Oilseeds Research, Hyderabad , India . pp. 121–122.

Maiti S, Raoof MA. 1984. Aerial infection of *Macrophomina phaseolina* on castor. Journal of Oilseeds Research 1: 236–237.

Nanda S, Prasad N. 1974. Wilt of castor a new record. Indian Journal of Mycology and Plant Pathology 4(1): 103–105.

Patel DR, Patel PS, Patel ID. 1991. High-yielding 'GCH-4' castor hybrid is resistant to wilt. Indian Farming, June 1991:11–12.

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