Development and evaluation of diverse wilt resistant monoecious lines in castor

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ABSTRACT

Since 1990s, development of wilt resistant and high yielding hybrids has played an important role in increasing the productivity of castor from around 320 kg/ha to 1700 kg/ha. Eleven elite monoecious lines having wilt resistance were developed by hybridization using five germplasm and seven elite monoecious lines. The elite lines *viz*., ICS-303, ICS-304, ICS-315 and ICS-318 had better yield traits like spike length, seed weight and seed yield per plant. ICS-320 and ICS-321 derived from 48-1 and RG-2991 had the highest oil content (>50%) than the checks 48-1 and DCS-107. These elite lines will help in development of wilt resistant and high yielding hybrids and varieties in castor.

Keywords: Castor, Monoecious lines, Wilt resistance

Castor is an important commercial, industrial and non-edible oilseed crop suitable for both rainfed and irrigated cultivation in tropical and sub-tropical climatic conditions. Fusarium wilt (caused by *Fusarium oxysporum* f.sp. *ricini*) causes 39-77% yield loss (Pushpavathi *et al.*, 1997). Hence development of wilt resistant varieties is critical for sustainable crop yields (Dubey, 2016). We report here the development of wilt resistant lines in castor using diverse germplasm lines.

A total of 21 diverse germplasm lines were crossed with 9 proven monoecious lines and their F_1s were selfed or backcrossed with the proven parents, according to the desirability of traits. Atleast, 200 F_2 plants from each cross were subjected to agromorphological evaluation and selection in *kharif/rabi* seasons. 10-20 best progenies were selected and selfed in each F_2 population based on the desirable traits like days to 50% flowering, proportion of maleness, longer spike length, larger capsule size, spines on capsules, branching pattern etc. 40 plants were evaluated from each of the selected progenies in F_3, F_4, F_5 and F_6 generations. 142 selected and stabilized lines were further evaluated for agronomic and morphological traits in ARBD (2 rows of 10 plants each, spacing 90 x 60 cm), along with checks 48-1 and DCS-107 under rainfed conditions during *kharif* 2017-18 season at ICAR-IIOR. Of these, 11 monoecious lines with desirable agromorphological traits and wilt incidence <10% were identified as elite lines from a total of 44 lines screened for wilt reaction (resistant check 48-1 and susceptible check JI-35) in wilt sick plot at ICAR-IIOR during 2017-18 as per the standard procedure (Santha Lakshmi *et al.*, 2014).

Table 1. New monoecious lines, their pedigree, agro-morphological characters and wilt reaction

ICS No.	Pedigree of ICS Lines	Colour & Bloom	PNN	DF50	EPSL (cm)	SW (g)	OC%	SYPP(g)	Wilt% @150 days
ICS-303	(RG-799 X DCS-96) X DCS-96	G2SP	12-16	63	49	30.5	46.9	128	0
ICS-304	(RG-799 X DCS-96) X DCS-96	G2SP	14-16	64	58	32.5	47.7	153	0
ICS-305	(RG-799 X DCS-106) X DCS-106	G2SP	13-15	65	38	28	47.9	116	7.8
ICS-312	DCS-97 X DCS-94	R2SP	11-15	58	69	26	47.4	118	5.6
ICS-314	RG-1582-3 X PCS-43	G2SP	10-14	64	42	30	47	107	2.2
ICS-315	RG-1582-5 X JC-3	G2SP	15-17	66	47	34	46.3	99	0
ICS-316	DCS-94 X RG-3105	G2SP	15-16	61	63	33.5	42	89	3
ICS-318	DCS-94 X RG-3105	G2SP	15-17	64	46	37.5	48	150	0
ICS-319	DCS-9 X RG-2672	R2SP	14-15	58	55	27	46.5	101	8.8
ICS-320	48-1 X RG-2991	R2SP	14-17	64	45	28.5	51.7	114	4.4
ICS-321	48-1 X RG-2991	R2SP	14-17	62	38	27.5	51	146	4.8
DCS-107 ©	-	G2SP	16-18	63	39	28.0	47.50	128	
48-1©	-	R2SP	16-18	65	38	27.7	49.50	112	2.20
JI-35	-			-	-	-	-		89.7

G2- Green and Double bloom, R2-Red, double bloom, M3- Mahogany Triple bloom, SP-Spiny capsules, PNN-Primary node number range, DF50-Days to 50% flowering EPSL-Effective primary spike length, SW-100 seed weight, OC %- Oil content %, SYPP-Seed yield per plant

Agromorphological traits and wilt reaction of identified elite lines is given in Table 1. These lines had 5 diverse germplasm lines and 7 elite lines in their pedigree. ICS-303, ICS-304, ICS-315 and ICS-318 not only had zero wilt incidence but also better yield traits like longer effective spike length, higher 100 seed weight and seed yield per plant. These elite monoecious lines would be a good source for development of high yielding and wilt resistant varieties and hybrids in castor.

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Linkage between stem colour and pigmentation in young leaves of castor

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ABSTRACT

Development of superior cultivars in any crop including castor requires knowledge on inheritance of various traits to handle the segregating generations in various breeding methods. In the present study, inheritance of anthocyanin pigmentation in younger leaves was studied in three F_2 populations. The results revealed that the presence of anthocyanin in emerging leaves inherited as monogenic dominant and it showed tight linkage with red stem colour.

Keywords: Anthocyanin, Castor, Leaf colour, Linkage, Stem colour

In castor, morphological traits such as stem colour, waxy coatings (bloom), capsule spinyness, plant type, leaf shape and branching pattern show qualitative nature of inheritance (either monogenic or oligogenic) among which plant type, leaf shape, type of nodes and branching pattern are tightly linked (Lavanya *et al.,* 2018). Characters having qualitative inheritance not only serve as major descriptors for DUS testing but also play important role in handling segregating populations. Presence of pigmentation in emerging leaves is one of the 30 descriptors used in DUS testing of castor genotypes. In the present study, an attempt was made to study the inheritance pattern of pigmentation in young leaves.

Five inbred lines *viz.,* RG-1149 (green stem with presence of pigmentation in young leaves), RG-2874 and 48-1 (red stem with presence of pigmentation in young leaves) and RG-1673 and RG-2685 (green stem with absence of pigmentation in young leaves) were used to generate three F_2 populations *viz*., RG-1149 × RG-1673, 48-1 × RG-1673 and RG-2685 × RG-2874 segregating for pigmentation in young leaves. Data for stem colour and presence of pigmentation in young leaves was recorded before flowering on F_2 plants in the experimental farm of ICAR-IIOR during *kharif* 2019-20.

The segregation pattern for stem colour and presence of pigmentation is presented in Table 1. Appearance of F_1 in all three crosses indicated the dominant nature of presence of pigmentation. The segregation for pigmentation in F_2 populations revealed monogenic inheritance. In two F_2 populations (48-1 × RG-1673 and RG-2685 × RG2874), in which the parents differed for stem colour and pigmentation, the red stem and presence of pigmentation were dominant over green stem and absence of pigmentation. Recombinants having red stem with absence of pigmentation or green stem with presence of pigmentation were not found indicating strong linkage between the two traits in castor genotypes studied. In a panel of more than 280 castor germplasm lines studied for different traits, lines with combination of red stem and absence of anthocyanin and green stem with presence of pigmentation were very less in frequency (data not shown). This trend in germplasm panel supports the hypothesis that stem colour and pigmentation in young leaves are tightly linked in castor.

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