Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 2471-2474
Received: 04-09-2018
Accepted: 06-10-2018

Manjunatha KL
Ph.D. Scholar, Dept. of Agril. Entomology, UAS, GKVK, Bengaluru, Karnataka, India

PC Ganiger
Associate Professor, Dept. of Agril. Entomology, UAS, GKVK, Bengaluru, Karnataka, India

CR Jahir Basha
Assistant Professor, Dept. of Plant Pathology, ARS, Pavagada, Karnataka, India

Correspondence
Manjunatha KL
Ph.D. Scholar, Dept. of Agril. Entomology, UAS, GKVK, Bengaluru, Karnataka, India

Field screening of castor germplasm against pests infesting castor

Manjunatha KL, PC Ganiger and CR Jahir Basha

Abstract
The field experiment was conducted during *kharif* season, 2013 at ARS Pavagada to screen the promising germplasm entries of castor for confirmation of reaction to different insect pests' *viz.* defoliators, sucking pests and capsule borer. Total sixteen entries of castor were collected from ZARS, GKVK, Bangalore and ZARS, Hiriyur and the results revealed, among sixteen entries, RG-3336, RG-3294, DPC-9, HCGP-2, RG-3388, DCH-519, HCGP-1, DCS-9, M-574, 48-1 and DCS-107 were found to be tolerant (with < 10% damage) and the entries HCGP-3, RG-3405, GCH-4, DCS-107, RG-3336, RG-3315, DPC-9, RG-3388, DCH-519, JC-12, RG-3294, DCS-9 & GCH-4 proved moderately tolerant (with 20-30% damage) against leaf miner, *Liriomyza trifolii*, Capsule borer, *Conogethes punctiferalis*, semilooper, *Achaea janata* and tobacco caterpillar, *Spodoptera litura* infestation.

Keywords: Screening, castor, germplasm, pests

Introduction

Castor (*Ricinus communis* L.*)* is an important non-edible oil seed crop belonging to the family Euphorbiaceae. It has gained great potential as the oil is being used for aircrafts as lubricant and also for grease, hydraulic fluids, soaps, Printing inks and for ayurvedic medicine (Weiss, 1983). India is one of the world principal producers of castor, covering 9.16 lakh hectare area with an annual seed production of 11.20 lakh tonnes and an average seed yield of 1223 kg/ha representing 73 per cent of production, followed by China (12%) and Brazil (6.4%) (Anon., 2013) [1].

Gujarat is the leading state in castor seed production in India with 75 per cent of the total production followed by Rajasthan (14%) and Andhra Pradesh (13%) (Anon, 2013) [1]. Besides, an oilseed crop, castor has also been considered as the most preferred and successful host for eri silkworm rearing. Castor, a highly cross pollinated plant is attractive to insects including parasitoids and pollinators.

Castor is a major oilseed crop in dry land area. The yield loss due to insect pests has been estimated in the range of 35-40 per cent. More than 100 pest species infest castor crop, but only a few major pests are responsible for the crop losses (Kolte, 1995) [4]. Number of insect pests, mostly the defoliators and sucking pests at different growth stages, have also been reported from Manipur by Ram *et al*. (1981) [7]. The castor semiooper, *A. janata* and tobacco caterpillar, *S. litura* are the most common and regular pests of castor, which can cause even the complete defoliation (Lakshminarayana, 2003 [5]; Sarma *et el*., 2005) [8].

A wide range of insecticides have been proved as effective in reducing the pest population. However, negligence of the principles in crop protection, indiscriminate and extensive use of synthetic pesticides led to problems like insecticidal resistance, resurgence of secondary pests, destruction of natural enemies, environmental pollution and health hazards. To mitigate pest problems particularly to insects, efforts have been made to develop alternatives to chemical pesticides which are effective and environmentally sustainable (Thomas and Waage, 1994) [10]. Host plant resistance is one such method.

Plant resistance as a control method is particularly suited for castor as it is hardy, grown under rainfed conditions on marginal lands as a patch, border or intercrop by small farmers who do not usually resort to any pest control methods. There is no comprehensive information indicating the response of castor germplasm to different insect pests. To pay particular attention for identification of field resistant/tolerant castor germplasm and development of host plant resistance as a method of control in castor ecosystem.

Material and methods

The field experiment was conducted during *kharif* season of 2013 at ARS Pavagada to screen the promising germplasm entries of castor for confirmation of reaction to different insect

Pests' *viz.* defoliators, sucking pests and capsule borer. Sixteen entries (RG-3336, HCGP-1, RG-3294, RG-3405, RG-3315, M-574, DPC-9, HCGP-3, HCGP-2, RG-3388, DCH-519, DCS-9 (Jyothi), JC-12, 48-1 (Jwala), GCH-4 and DCS-107) of castor were collected from ZARS, GKVK, Bangalore and ZARS, Hiriyur and raised at ARS Pavagada. To study their resistance/tollerance to different insect pests of castor, each variety was sown in a single row of 20mtrs on 25-7-2013 with the row spacing of 90 cm and 45 cm between the plants.

The crop was raised as per the package of practices (Anon., 2013) [1] except the plant protection measures. For recording observations, five plants were selected randomly from each entry and each plant taken as replication. The observations were recorded from the first fortnight of August to second fortnight of December at fortnightly interval.

For varietal susceptibility or resistance to semilooper, hairy caterpillar, tobacco caterpillar, slug caterpillar and spiny caterpillar the larval counts were made on randomly selected 5 plants of each variety and also by counting the number of leaves defoliated and was converted in to percentage with the following formula.

$$\text{Per cent defoliation} = \frac{\text{Number of leaves defoliated}}{\text{Total number of leaves observed}} \text{ X } 100$$

With respect to shoot and capsule borer, the level of incidence of the pest was recorded by counting the number of infested capsules on five randomly selected plants in each variety and was converted into percentage with the following formula.

$$\text{Per cent capsule infestation} = \frac{\text{Number of capsules infested}}{\text{Total number of capsules observed}} \text{ X100}$$

The incidence of leaf miner was recorded by counting the number of leaves infested on five randomly selected plants in each variety and was converted into percentage with the following formula.

$$\text{Per cent leaf infestation} = \frac{\text{Number of leaves infested}}{\text{Total number of leaves observed}} \text{ X100}$$

The sucking pest population was estimated by counting the number of leaf hoppers and thrips from three leaves per plant on five randomly selected plants in each variety. The leaves were selected as one from top (excluding two top most leaves), middle (medium matured leaves) and bottom (leaving two bottom most leaves) on the main shoot. The thrips population was counted by tapping the leaf on black card board.

The incidence of plant bugs and ash weevils population was recorded by counting the number of plant bugs and weevils on five plants. Similarly, the incidence of grass hoppers were estimated by making the counts on randomly selected five plants in each variety.

For characterizing evaluated castor cultivars in to Tolerance (T), moderately Tolerant (MT), moderately susceptible (MS) and Susceptible (S) to different pests of castor, mean values of individual cultivars were compared following the scale adopted by Hegde *et al.* (2009) [3]. Arbitrarily, entries were classified into different groups for different pests as mentioned below.

Table: Pest infestation scoring scale

Reaction	Serpentine leaf miner and defoliators (% leaf infestation/defoliation)	Shoot and capsule borer (% capsule infestation)
Tolerance	0-20	0-10
Moderately Tolerance	>20-30	> 10-20
Moderately susceptible	>30-40	> 20-40
Susceptible	>40	> 40

Results and discussion

Screening of castor genotypes against different insect pests

Serpentine leaf miner, *Liriomyza trifolii*

In the present study, total 16 genotypes were screened. Based on arbitrary classification the entries, RG-3336, RG-3294, RG-3315, DPC-9, HCGP-2, RG-3388, DCH-519, HCGP-1, DCS-9, M-574, 48-1 and DCS-107 were tolerant which recorded less than 20 per cent leaf infestation. The entries HCGP-3 (25%), RG-3405 (23%), GCH-4 (21.70%) and DCS-107 (20.70%) were moderately tolerant. The entries tested here were entirely different from the entries tested by different scientists. Hence, it is difficult to draw conclusions comparing with others. However, the results were in confirmative with the results obtained by Hegde *et al*. (2009) [3] with respect to 48-1 which proved as tolerant (Table 1)

Shoot and capsule borer, *Conogethes punctiferalis*

The entries HCGP-1, RG-3294, M-574, DCS-9, 48-1 and GCH-4 were tolerant and the entries, RG-3336, RG-3405, RG-3315, DPC-9, HCGP-3, HCGP-2, RG-3388, DCH-519, JC-12 and DCS-107 were moderately tolerant. The present results are in confirmation with the results obtained by Hegde *et al.* (2009) [2] for the entry 48-1 which showed tolerance against capsule borer damage. Similarly Patel *et al*. (1987) [6], (Anon, 1993-94) [1], Anon (2004-05) [1] and Suganthy (2011) [9] screened different entries of the same series RG-1228, 1266, 1280 and RG 1359 and GCH-7, GCH-4, GCH-6, GCH-5 which showed tolerance to capsule borer damage (Table 1).

Semilooper, *Achaea janata*

In the present study the results revealed that the entries RG-3336, HCGP-1, RG-3405, M-574, HCGP-3, HCGP-2, 48-1, were tolerant However, RG-3294, RG-3315, DPC-9, RC-3388, DCH-519, DCS-9, JC-12, GCH-4 and DCS-107 were moderately tolerant (Fig.12). The present findings were in confirmation with Hegde *et al.* (2009) [3] for the entry 48-1 which showed tolerance against semilooper damage. Similarly Sarma *et al*. (2006) [8] who screened the different entries against castor semilooper (Table 1).

Tobacco caterpillar, *Spodoptera litura*

GCH-4 (26.80%), JC-12 (22.80%) and HCGP-3 (25.40%) entries were moderately tolerant, and entries RG-3336, RG-3294, RG-3405, RG-3315, DPC-9, HCGP-3, HCGP-2, RG-3388, DCH-519, HCGP-1, DCS-9, M-574 and DCS-107 were tolerant. No literature available on *Spodoptera litura* with respect to screening of castor genotypes of present entries, tested (Table 1).

Leafhopper, *Empoasca spp*.

The leafhoppers population ranged between 1.02 to 9.18 leaf hoppers per 3 leaves per plant. The highest number (9.18 no. /3 leaves) of leaf hoppers was recorded in RG-3336, followed by HCGP-2 (7.98), DPC-9 (7.74) and RG-3315 (6.48) and lowest population was recorded in remaining entries M-574 (1.02 no./ 3 leaves), DCS-9 (2.34 no./ 3 leaves). No literature pertaining to above entries against leafhoppers is available However, Suganthy (2011) [9] who screened RG series, recorded highest number of leafhoppers in RG 3089 (89.00 per plant) and least number in RG-2786 (9.00 per plant) (Table 2).

Table 1: Field response of castor genotypes to major defoliators and capsule borer

Entries	Mean% infestation of defoliators and capsule borer			
	***A. Janata* (% defoliation)**	***S. litura* (% defoliation)**	***L. trifolii* (% leaf damage)**	***C. punctiferalis* (% capsule damage)**
RG-3336	5.20^{e} (13.08)	11.20^{f} (19.51)	3.10^{h} (10.02)	13.10^{ab} (21.19)
HCGP-1	18.10^{bc} (25.17)	15.66^{e} (23.28)	16.70^{cd} (24.09)	6.10^{f} (14.20)
RG-3294	24.60^{ab} (29.71)	15.30^{e} (23.00)	19.90^{abcd} (26.47)	7.70^{ef} (16.04)
RG-3405	4.50^{e} (12.21)	17.70^{cd} (24.85)	23.00^{ab} (28.64)	14.90^{a} (22.67)
RG-3315	20.60^{abc} (26.93)	18.70^{c} (25.60)	12.00^{ef} (20.23)	14.70^{a} (22.51)
M-574	18.50^{bc} (25.45)	16.30^{de} (23.78)	0.00^{i} (0.00)	10.00^{cde} (18.31)
DPC-9	22.60^{ab} (28.36)	17.90^{cd} (25.00)	0.00^{i} (0.00)	15.10^{a} (22.84)
HCGP-3	9.70^{d} (18.10)	25.40^{a} (30.24)	25.00^{a} (29.94)	12.00^{abc} (20.23)
HCGP-2	13.90^{cd} (21.86)	15.10^{e} (22.84)	10.00^{fg} (18.25)	11.20^{bcd} (19.51)
RG-3388	24.30^{ab} (29.52)	19.50^{c} (26.18)	16.30^{cd} (23.79)	12.30^{abc} (20.49
DCH-519	22.00^{ab} (27.92)	11.50^{f} (19.79)	18.30^{bcd} (25.30)	10.30^{bcd} (18.67)
DCS-9	28.80^{a} (32.43)	9.60g (18.00)	12.00^{ef} (20.13)	8.60^{de} (16.99)
JC-12	22.70^{ab} (28.43)	22.80^{b} (28.48)	15.30^{de} (23.00)	10.70^{bcd} (19.05)
48-1	5.00^{e} (11.43)	7.80^{h} (16.15)	8.30^{g} (16.69)	4.00^{g} (11.34)
GCH-4	25.90^{ab} (30.57)	26.80^{a} (31.16)	21.70^{ab} (27.73)	3.60^{g} (10.92)
DCS-107	28.90^{a} (30.50)	15.10^{e} (22.74)	20.70^{abc} (27.04)	11.60^{bc} (19.87)
S. Em±	2.20	1.00	1.39	1.05
CD at 0.05	6.59	2.98	4.15	3.14
CV (%)	15.47	7.27	11.99	9.88

Note: Figures in the parentheses are arcsine transformed values

3.1.6. Thrips, *Scirtothrips dorsalis*

The mean number of thrips population on castor germplasm ranged between 4.30 to 14.50 thrips per 3 leaves per plant. The highest (14.50) population was recorded in RG-3405 followed by HCGP-2 (13.30/3 leaves) and DPC-9 (12.10/3 leaves). The lowest population (4.30/ 3 leaves) was recorded in M-574, closely followed by RG-3388 (4.70), 48-1 (4.80/3 leaves), DCS-9 (5.10/3 leaves), JC-12 (5.60/3 leaves), DCS-107 (6.40) and GCH-4 (6.50/3 leaves) (Table 2).

Castor spiny caterpillar, *Ergolis merione*

The response of castor genotypes to spiny caterpillar population ranged between 0 to 2.28 numbers per plant. There was a significant difference among the entries. Almost all the entries were completely free from spiny caterpillar population except RG-3315 (2.28 larvae/plant), followed by M-574 (0.54/plant), CCH-4 (0.44/plant) and RG-3336 (0.22/plant) (Table 2).

Tussock hairy caterpillar, *Olene mendosa*

The response of castor genotypes to *O. mendosa* population differed significantly among the entries. The population ranged between 0 to 1.29 larvae per plant. The highest number (1.29 larvae per plant) of larvae were recorded in RG-3405, which was on par with M-574, DPC-9, RG-3336, RC-3388 and DCS-9 and it differed significantly with remaining entries. The remaining entries were completely free from larval population of *O. mendosa* (Table 2).

Grasshoppers

The grasshopper population on castor genotypes was observed throughout the growing period of the crop. The mean number of grasshopper's population on castor germplasm ranged between 0.13 to 2.81 adults per plant. The highest (2.81/plant) population was recorded in RG-3405, which was on par with RG-336 (2.49 no./ pant), RG-3294 (2.42 no./ plant), HCGP-1, HCGP-1(1.76 no./ plant each), M-574 (1.75), DCS-9 (1.74 no./ plant) and DCH-519 (1.63 no./ plant), which differed significantly from remaining entries (Table 2).

Table 2: Field response of castor genotypes to sucking pests and minor defoliators of castor

Entries	Number of larvae or adults/plant					
	Ergolis merione	***Olene mendosa***	**Grasshoppers**	***Myllocerus* spp.**	**thrips**	**leafhoppers**
RG-3336	0.22^{b} (0.84)	0.78^{abcd} (1.13)	2.49^{ab} (1.68)	0.23^{bc} (0.85)	11.40^{b} (3.44)	9.18^{a} (3.10)
HCGP-1	0.00^{b} (0.71)	0.00^{e} (0.71)	1.76^{abcd} (1.49)	0.54^{ab} (1.02)	9.10^{c} (3.09)	5.22^{bcd} (2.37)
RG-3294	0.00^{b} (0.71)	0.70^{bcd} (1.08)	2.42^{abc} (1.66)	0.63^{ab} (1.06)	8.30^{cd} (2.96)	3.06^{def} (1.85)
RG-3405	0.00^{b} (0.71)	1.29^{a} (1.34)	2.81^{a} (1.78)	0.00^{c} (0.71)	14.50^{a} (3.87)	3.36^{def} (1.93)
RG-3315	2.28^{a} (1.60)	0.00^{e} (0.71)	0.63^{defg} (1.06)	0.00c (0.71)	6.60^{def} (2.65)	6.48^{abc} (2.63)
M-574	0.54^{b} (1.02)	1.26^{ab} (1.33)	1.75^{abcd} (1.48)	0.00^{c} (0.71)	4.30^{h} (2.17)	1.02^{g} (1.17)
DPC-9	0.00^{b} (0.71)	1.13^{abc} (1.25)	1.1^{cdef} (1.23)	1.26^{a} (1.30)	12.10^{ab} (3.55)	7.74^{ab} (2.86)
HCGP-3	0.00^{b} (0.71)	0.00^{e} (0.71)	0.48^{fg} (0.99)	0.48^{bc} (0.97)	11.50^{b} (3.46)	3.6d^{ef} (1.99)
HCGP-2	0.00^{b} (0.71)	0.57^{cd} (1.03)	1.27^{bcde} (1.31)	0.63^{ab} (1.06)	13.30^{ab} (3.70)	7.98^{ab} (2.90)
RG-3388	0.00^{b} (0.71)	0.73^{abcd} (1.10)	1.2^{bcdef} (1.28)	0.00^{c} (0.71)	4.70^{h} (2.26)	3.84^{def} (2.05)
DCH-519	0.00^{b} (0.71)	0.45^{d} (0.97)	1.63^{abcde} (1.44)	0.26^{bc} (0.86)	7.40^{cde} (2.80)	2.64^{ef} (1.72)
DCS-9	0.00^{b} (0.71)	0.79^{abcd} (1.13)	1.74^{abcd} (1.50)	0.47^{bc} (0.97)	5.10^{fgh} (2.35)	2.34^{fg} (1.62)
JC-12	0.00^{b} (0.71)	0.00^{e} (0.71)	1.55^{abcdef} (1.41)	0.68^{ab} (1.08)	5.60^{efgh} (2.45)	4.86^{cde} (2.29)
48-1	0.00^{b} (0.71)	0.00^{e} (0.71)	0.53^{efg} (1.01)	0.28^{bc} (0.87)	4.80^{gh} (2.28)	5.22^{bcd} (2.37)

GCH-4	0.44^{b} (0.96)	0.58^{cd} (1.04)	1.44^{abcde} (1.37)	0.73^{ab} (1.11)	6.50^{defg} (2.63)	3.48^{def} (1.96)
DCS-107	0.00^{b} (0.71)	0.00^{e} (0.71	0.13^{g} (0.79)	0.55^{ab} (1.02)	6.40^{defg} (2.62)	3.00^{def} (1.86)
S. Em±	0.11	0.08	0.13	0.09	0.11	0.18
CD at 0.05	0.34	0.24	0.40	0.28	0.34	0.54
CV (%)	31.59	18.17	22.20	22.08	8.83	18.44

Note: Figures in the parentheses are angular transformed values

Ash weevil, *Myllocerus spp*.
The response of castor genotypes to ash weevil population differed significantly among the entries. The population ranged between 0 to 1.6 adults per plant and the highest population was observed in DPC-9 (1.26 adults/ plant), which was on par with GCH-4, JC-12, RG-3294, HCGP-2, DCS-107 and HCGP-1(Table 2).
The literature on screening of castor germplasm against thrips, spiny caterpillar, tussock hairy caterpillar, and grasshopper and ash weevil is very meager.

Conclusion
From the present findings it can be inferred that the entry 48-1 (Jwala) is fairly tolerant against all the insect pests observed in the present investigation. Hence, the entry 48-1 is more appropriate for cultivation in dry land areas under rainfed conditions with minimum pest infestation level and better yield.

Acknowledgement
Authors are thankful to the Agriculture Research Station, Pavagada and Department of Agril. Entomology, University of Agril. Sciences, Bangalore for providing the necessary facilities and the moral support to carry out this study.

References

1. Anonymous. Report on castor seed production. Solvent Extractors Association of India, 2013, 2.
2. Hegde JN, Chakravarthy AK. Comparison of germplasm evaluation parameters in castor *Ricinus communis* to leaf miner, semilooper, shoot and capsule borer infestation in Karnataka. Current Bio tica. 2009; 3:386-396.
3. Hegde JN, Chakravarthy AK, Ganiger PC. Screening of castor (*Ricinus communis* Linn.) germplasm against leaf miner, (*Liriomyza trifolii* B.) semilooper, *(Achaea janata L.)* and shoot and capsule borer, (*Conogethes punctiferalis)* in South Karnataka. Current Biotica. 2009; 3:386-396.
4. Kolte SJ. Castor diseases and crop improvement. Shirpa publication, New Delhi, 1995, 85.
5. Lakshminarayana M. Management of defoliators to castor, Frontier Areas of Entomological Research. Proceedings of National Symposium held at IARI, New Delhi, 2003, 21.
6. Patel SM, Salmon SC, Ortman GK. Varietal screening of castor genotypes to shoot and capsule borer. Journal Economic Entomology. 1987; 51: 634-635.
7. Ram BK, Sachan JN, Pathak KA. Insect pests of crops in Manipur. ICAR Research complex for NEH Region, Manipur Centre Imphal, 1981, 55-56.
8. Sarma AK, Singh MP, Singh KL. Resistance of local castor genotypes to *Achaea janata* Linn and *Spodoptera litura* Fabr. Journal of Applied Research. 2006; 17(2):179-181.
9. Suganthy M. Field screening of promising castor cultures against capsule borer, *Conogethes punctiferalis* and leafhopper, *Empoasca flavescens*. Madras Agricultural Journal. 2011; 98(4-6):178-179.
10. Thomas M, Waage J. Integration of biological control and host plant resistant breeding. CAB international, 1994, 5.