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SCREENING OF CASTOR GERMPLASM AGAINST LEAFHOPPER AND CAPSULE BORER

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ABSTRACT

A Screening trial with 21 castor genotypes against leafhoppers (*Empoascaflavescens*), and castor shoot and capsule borer, (*Conogethespunctiferalis*), was carried out in Dryland farm of Sri Venkateswara Agricultural College, Tirupati, and Andhra Pradesh during *kharif*, 2013. Of the twenty one genotypes screened, the cultivars M-574 (2.97), 48-1 (2.89) and PCH-294 (2.80) recorded lower incidence of leaf hopper whereas high incidence was recorded in DPC-9 (7.41) followed by DCH-111(6.43). The capsule damage caused by shoot and capsule borer in all the accessions was significant and the damage ranged from 13 to 47.29 per cent. The highest percent capsule damage was recorded in DPC-9 (47.29), PCS-262 (32.78) and PCS-171 (30.79). The least incidence was found in GCH-4 (13.17), PCH-288 (14.47) 48-1 (16.78), PCH-111 (17.37) and PCH-254 (17.39). The remaining cultivars showed the damage per cent of 20-30. The entries with triple bloom, loose spike, and non-spiny capsules were found to be resistant to leaf hopper and capsule borer when compared to the entries with zero and single bloom, compact spike and bold, spiny capsules.

KEYWORDS: Castor, Leafhopper and Shoot & Capsule Borer

INTRODUCTION

Castor (*Ricinuscommunis*L.) is an important non-edible oilseed crop and is grown especially in arid and semi arid regions. Castor crop plays an important role in the agricultural economy of the earning substantial foreign exchange through export of castor beans and oils. Castor crop suffers from many biotic stresses. Among the major lepidopteran pests, the castor shoot and capsule borer, *Conogethespunctiferalis* (Guen.) is an important one as it reduces the yield of castor considerably by boring into tender shoots and capsules. It has been reported to cause damage 4-20 per cent inflorescences and 16-82 per cent spikes of castor thus reducing 9-23 per cent yield (David *et al.*, 1964). Green leaf hopper, *Empoascaflavescens* (Fab.) is one of the serious sucking pests at vegetative stage. By the introduction of high yielding varieties and hybrids, leafhopper became a serious problem from last two decades. The use of resistant varieties in the IPM programmes is the most economic approach and would be inexpensive in long run because it minimizes the number of insecticides application, lessens the expenses involved in plant protection and conserves the natural enemies besides preserving the environmental safety. Hence the present study was conducted to identify resistant genotypes against leafhoppers and capsule borer.

MATERIAL AND METHODS

An experiment was conducted at the field located in Dry land farm, Sri Venkateswara Agricultural College, Tirupati to screen selected castor genotypes to assess their relative reaction to leafhoppers (*Empoascaflavescens*) and shoot and capsule borers (*Conogethespunctiferalis).* The experiment was laid out in a randomized manner with two replications by sowing 21 genotypes of castor with row to row spacing of 180 cm and with a row length of 6 m each. The seed material was procured from RARS, Palem, Mahabubnagar (Dst.,) and Directorate of Oilseeds Research (DOR), Hyderabad. Sowing was done on 23-07-2013 with a spacing of 180 cm between the rows and 60cm within the row.

Leafhoppers (Empoascaflavescens)

The nymph and adult populations and hopper burn symptoms were recorded from 3 leaves per plant for each entry in five randomly selected plants from one month after germination till the maturity at weekly intervals. 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.

Hopper burn injury on leaves was taken in the following standard grades as per All India Coordinated Research Project on Castor.

Table: 1

Grade (Score)	Hopper Burn on Leaves (% Injury)
0	No injury
1	Hopper burn 0-10%
2	Hopper burn up to 11-25 %
3	Hopper burn up to 26-50 %
4	Hopper burn above 50 %

Shoot and Capsule Borer Damage

The extent of damage of the pest was recorded by counting the number of infested capsules and total number of capsules on the 5 randomly selected plants at weekly intervals and expressed as percentage by using the following formula.

$$\text{Per cent infestation of capsules} = \frac{\text{No. of Capsules infested}}{\text{Total No. of Capsules}} \times 100$$

RESULTS

It was evident that all the twenty one genotypes screened against leaf hopper and capsule borer showed differential reaction to leaf hopper population and capsule borer damage.

Leaf Hopper Incidence in Different Accessions

There was a significant difference in the leaf hopper population per plant among different genotypes. The cultivars showed peak infestation of leaf hoppers in the second fortnight sown crop of September and first week of October. It implies that, leaf hoppers were positively correlated with temperature. Cumulative data on the leaf hopper population revealed that incidence of the pest was observed more in the genotypes DPC-9 and DCH-177 with the mean population of 7.41 and 6.43 per plant respectively. The less number of populations was observed in the genotypes PCH-294, 48-1, M-574 (Figure 1).

The incidence of leaf hopper was high (7.41) in the cultivar DPC-9 followed by DCH-177(6.43). The cultivars which showed next high incidence were DCS-107 (4.60), kiran (4.44), PCS-262(4.39), kranthi (4.27) and haritha (4.14).

The cultivars DCH-519 (3.87), PCH-248 (3.85), PCH-254 (3.79), PCH-282 (3.78) and PCH-111 (3.78) were on par with each other. The moderate number of population was observed in PCS-171(3.44), DCS-78 (3.37), PCH-222 (3.26), GCH-4 (3.16) and PCS-106 (3.14). The less number of population was observed in M-574 (2.97), 48-1 (2.89) and PCH-294 (2.80). On the whole, in the present investigation it was found that leaf hopper incidence was more in hybrids than in varieties. The present findings are in conformity with the results of Lakshmi *et al*., (2005) who reported that hybrids were more preferred by the leaf hopper in comparison to varieties.

The maximum hopper burn injury was found in DPC-9 and DCH-177 whereas the less hopper burn injury was found in the genotypes GCH-4, PCH-282, PCH-248, PCH-254, PCH-294, M-574, DCH-519 with triple bloom (all parts possess waxy bloom). The cultivars with double bloom (two parts stem and leaf possess waxy bloom) PCS-106, PCH-222, PCH-111, PCH-262, PCH-288, 48-1, PCS-171, kranthi, kiran, DCS-107, DCS-78 showed moderate reaction to leaf hopper injury. Even though the leafhopper population was more, the hopper burn injury was found to be less in cultivars DCH-519, PCH-282, PCH-248 and GCH-4. Based on the leaf hopper infestation and expression of hopper burn injury these cultivars were designated as tolerant. The cultivars DPC-9 and DCH-177 were highly susceptible to leaf hopper infestation due to zero bloom (no waxy bloom) and single bloom nature (only one part wax stem per leaf). The remaining cultivars with double boom were found to be moderately resistant to leaf hoppers (Table 1).

Percent Capsule Damage by Shoot and Capsule Borer (Conogethes Punctiferalis) in Different Accessions

The data on the per cent capsule damage revealed that there was a significant difference among the cultivars and the damage ranged from 13 to 47.29 per cent. The high per cent capsule damage was recorded in DPC-9 (47.29), PCS-262 (32.78) and PCS-171(30.79). The higher damage was also recorded in the cultivars DCH-519 (28.29%) and PCS-106 (25.23%). The other cultivars DCS-107 (24.58%), PCH-294 (23.50%), PCH-282 (23.29%) and M-574 (22.94%) were on par with each other.

low infestation was observed in GCH-4 (13.17%) and PCH-288 (14.47%). The low incidence was also found in 48-1(16.78%), PCH-111(17.37%) and PCH-254 (17.39%). In the cultivars PCH-248 (21.59%), DCS-78 (20.21%) and PCH-222 (20.10%) moderate infestation of capsule was observed. However, the per cent infestation of capsule borer recorded in the checks was 26.13, 26.11 and 23.83 in Haritha, Kranthi and Kiran, respectively (Table 1).

The less infestation was found in the genotypes with loose spike and small non-spiny capsules (48-1) whereas the maximum infestation was found in the genotypes with compact spike and spiny bold capsules (DPC-9). All the genotypes in the trial are spiny except 48-1 and Kiran. Some cultivars like PCH-222 and DCH-519 are semi spiny. The genotypes GCH-4, PCH-288, 48-1 and PCH-245 have loose spikes whereas the remaining genotypes have semi compact spikes.

The yield of different accessions ranged from 777.74 kg ha^{-1} in DPC-9 to 2820 kg ha^{-1} in GCH-4 and the yield in different accessions was significant (Table 4.39). The cultivar PCH-111 recorded yield of 2573.9 kg ha^{-1} followed by PCH-288 (2407 kg ha^{-1}), 48-1 (1987.5 kg ha^{-1}), M-574 (1606.08 kg ha^{-1}) and PCH-254 (1592.5 kg ha^{-1}). The low yields next to DPC-9 were recorded in cultivars *viz*., PCH-262, PCH-294, DCH-177 and PCS-106 with 854.27, 1043, 1074 and 1092.5 kg ha^{-1} respectively. Moderate level of yields were recorded in PCH-248, PCH-222, PCH-282, DCS-107, PCS-171 and DCS-78 with 1104.87, 1123.39, 1136, 1143, 1188.8 and 1203 kg ha^{-1} respectively. It was clear that these genotypes gave higher yields inspite of higher infestation by leaf hopper and capsule borer, which showed that these genotypes were found to be tolerant to leaf hopper and capsule borer. Though the entry M-574 suffered with high infestation, it recorded relatively moderate yield (1606.08 kg ha^{-1}) that may be due to presence of high number of branches and more spike length.

DISCUSSIONS

Screening of twenty one genotypes with three checks namely Haritha, kranthi and kiran against leaf hopper and capsule borer revealed that mean number of leafhopper population varied significantly among the accessions and high incidence was noticed in the cultivars DPC-9 (7.41) followed by DCH-111(6.43). The less number of population was observed in M-574 (2.97), 48-1 (2.89) and PCH-294 (2.80) and they are on par with each other. The cultivars DPC-9 and DCH-177 were highly susceptible to leafhopper infestation and recorded maximum leaf hopper injury due to zero bloom (no waxy bloom) and single bloom nature (only one part waxy stem/leaf) respectively. In the genotypes with triple bloom (all parts waxy) *i.e.*, in GCH-4, PCH-282, PCH-248, PCH-254, PCH-294, M-574, DCH-519 even though infested by more leafhopper population the less leaf hopper injury was found. Hence these accessions can be rated as tolerant to the leaf hopper. The present results are in agreement with Dorairaj*et al.*, (1963), Lakshminarayana*et al.*, (1992), Srinivasarao *et al*., (2002) who reported higher leafhopper population on zero and single bloom entries. Also triple bloom entries with moderate leaf hopper population.

The capsule damage caused by shoot and capsule borer in all the accessions was significant and the damage ranged from 13 to 32.78 per cent. High percent capsule damage was recorded in DPC-9(47.29), PCS-262(32.78) and PCS-171 (30.79). The less incidence was found in GCH-4(13.17), PCH-288(14.47) 48-1(16.78), PCH-111(17.37) and PCH-254(17.39). The remaining cultivars showed the damage per cent of 20-30. The present findings are in conformity with the findings of David (1964), Jayaraj (1968) and also Chakravarthy (2006) who reported high borer infestation in castor plants with spiny and compact spines compared to those with spineless or spiny and loose spikes.

CONCLUSIONS

Among the twenty one genotypes screened against leafhopper DPC-9 and DCH-177 suffered more compared to others. This was due to their zero and single bloom nature. Most of the cultivars in trial were double bloom in nature. The genotypes that are found to be resistant to leaf hoppers GCH-4, PCH-282, PCH-248, PCH-254, PCH-294, M-574, DCH-519 are triple bloom accessions. The leaf hopper injury was found to be dependent on the intensity of the bloom. The less infestation of shoot and capsule borer was found in the genotypes with loose/very loose spike and small non-spiny capsules whereas the maximum infestation was found in the genotypes with compact spike, spiny and bold capsules. Most of the cultivars in the trial are with semi compact spike and spiny capsules.

Table 1: Mean Scores to Leaf Hopper Injury of Different Genotypes of Castor

Genotype	30 DAG	37 DAG	44 DAG	51 DAG	58 DAG	65 DAG	72 DAG	79 DAG	86 DAG	93 DAG
PCS-106	0	0.6	1.0	1.3	1.6	2.3	2.6	3.6	3.8	4.0
PCH-222	0	0.7	1.0	1.2	1.66	1.9	2.3	2.5	3.6	4.0
PCH-282	0	0.3	0.9	1.3	2.0	2.0	2.5	3.0	2.6	2.0
PCH-248	0	0.3	1.0	1.0	1.2	1.8	2.2	2.8	3.0	3.0
PCS-262	0	0.6	1.3	1.3	2.0	2.6	2.66	3.0	3.66	4.0
48-1	0	0.4	1.0	1.6	2.0	2.3	2.6	3.0	3.8	4.0
PCH-254	0	0.3	0.6	1.0	1.3	2.0	2.6	3.3	3.0	3.0
DPC-9	0	1.0	1.66	2.3	3.0	3.8	4.0	4.0	4.0	3.0
PCS-171	0	0.6	0.8	1.0	1.0	1.3	1.6	2.0	2.33	3.0
Kranthi	0	0.3	1.0	1.3	2.0	2.6	3.0	3.6	3.0	3.3
M-574	0	0.3	0.6	1.0	1.2	1.6	2.3	2.6	3.0	3.0
DCH-177	0	1.0	1.3	2.0	2.6	3.0	3.6	4.0	4.0	3.3
PCH-294	0	0.3	0.6	0.9	1.3	1.8	2.3	3.3	3.0	3.0
DCS-107	0	0.6	1.3	1.6	2.0	2.3	2.6	3.3	3.6	3.3
Kiran	0	0.7	1.0	1.33	2.66	3.33	3.66	4.0	3.66	3.0
DCS-78	0	0.9	1.6	2.0	2.6	3.3	3.6	4.0	3.6	3.8
DCH-519	0	0.3	0.3	0.6	1.0	1.6	2.3	2.6	3.3	3.0
PCH-111	0	0.6	1.3	1.6	2.66	3.3	4	3.6	3.3	2.4
GCH-4	0	0.3	0.6	0.9	1.2	1.6	2.0	2.3	3.0	3.0
PCH-288	0	0.6	1.0	1.3	1.6	2.3	2.6	3.0	3.3	3.66
Haritha	0	0.6	1.0	1.6	2.3	2.6	3.6	4.0	3.3	3.2

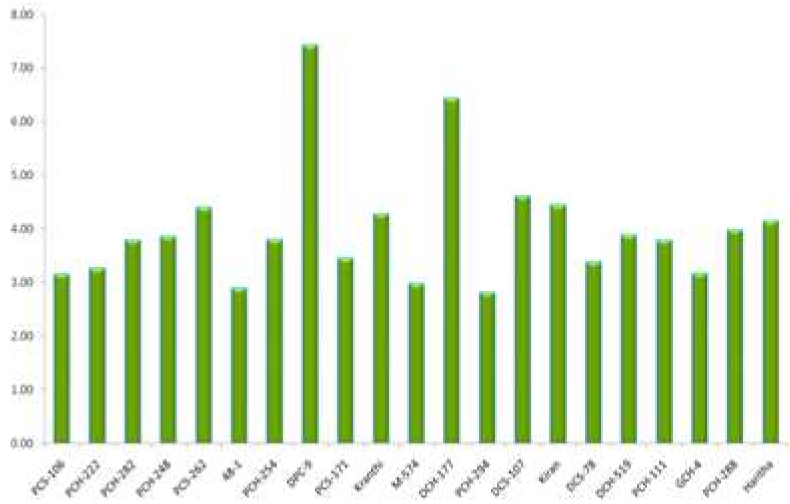

Figure 1: Incidence of Leaf Hopper (Mean Number of Insects per Plant) in Different Accessions of Castor during Kharif, 2013

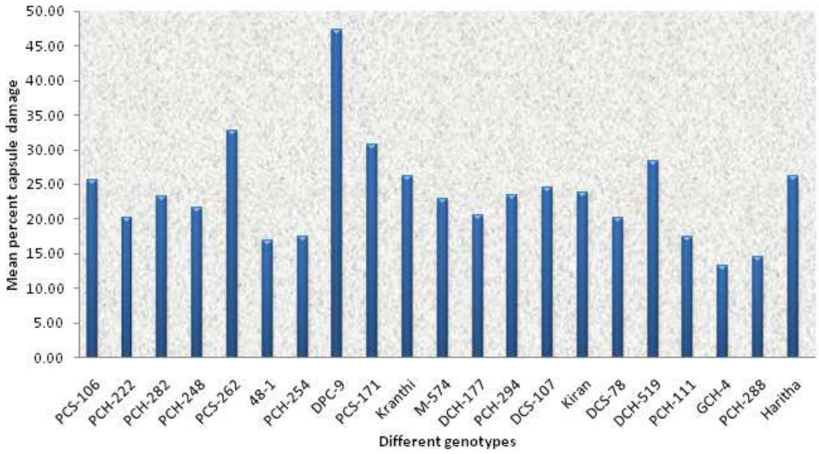

Figure 2: Mean per Cent Capsule Damage Recorded in Different Accessions of Castor

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