Original Research Article

Screening of various genotype of castor for resistance against castor leafhopper, *Empoascaflavescens*Fabricius

ABSTRACT

A screening trial with 10 castor genotypes to assess their relative reaction to leafhoppers (*Empoascaflavescens*) was conducted atCCSHAU, Regional Research Station, Bawal during *Kharif* season, 2019.Among the 10 genotypes,leafhopper population varied from 2.3 to 8.3.The genotypes Maharaja-9 and GCH-7 were resistant to leafhopper with a mean leafhopper population of 2.3 and 2.4 leafhopper/three leaves and recorded hopper burn score of 0.16 and 0.25, respectively.The maximum infestation of leafhopper was recorded in the single bloom genotype DCH-177 with a mean population of 8.3 leafhopper/three leaves and a hopper burn score of 2.25.Further the biochemical analysis of leaves revealed that thephenols content in the castor leaveshad a significant negative correlation with leafhopper population and hopper burn score while total carbohydrates present in the leaves had a significant positive correlation with leafhopper population and hopper burn score.

Comment [as1]: Please state the conclusion at the end of the abstract!

Keywords – Castor, genotypes, leafhopper

INTRODUCTION

Castor (*Ricinuscommunis* L.) belongs to the family Euphorbiaceaeis an important non-edible oilseed crop grown mainly in arid and semi-arid regions of India.India is one of the world'sprime producers of castor, covering 10.46 lakh hectare area with annual seed production of 18.42 lakh tonnes and an average seed yield of 1761 kg/ha representing 73 per cent of production, followed by China (12%) and Brazil (6.4%)[1].Castor oil contains more than80 % ricinolic acid which confers distinctive industrialproperties to the oil. Castor oil is mainly used in the manufacturing of paints, lubricants, soaps, hydraulic brake fluids, polymers and perfumery products.Besides, an oilseed crop, castor has also been considered as the most preferred and successful host for eri silkworm rearing.

The major insect pest problems in castor are the ~~the~~ defoliators viz., semilooper, *Achaeajanata* L., tobacco caterpillar *Spodopteralitura* Fab., capsule borer *Conogethespunctiferalis*Guenand sucking pests such as leafhopper, *Empoascaflavescens* Fab. thrips, *Retithripssyriacus*Mayet and whitefly, *Trialeurodesricini*Misra. Green leafhopper is one of the serious sucking pests at vegetative stage as the nymphs and adults suck sap from leaves and characteristic symptoms of hopper burn appear owing to the toxigenic nature of the insect.Among different management practices,host-plant resistance serves as the most reliable measure for the non-preference mechanism of feeding and oviposition by insects[2] and is the eco-friendly, economical to control leafhopper[3]. So, the

identification of resistant genotypes in the breeding programme for the development of resistant varieties against the insect pests are important, economical and would be inexpensive in the long run as it would minimize the number of insecticides application, reduce the cost involved in plant protection and conserves the natural enemies besides preserving the environmental safety [4].

Comment [as2]: Please make a statement of the purpose of this research in the last paragraph of the introductory chapter.

MATERIALS AND METHODS

Ten castor genotypes*viz.*, JSB-1018, SHB-974, SLCH-158, ICH-66, ICH-68, Maharaja-9, DCH-519, GCH-7, DCH-177 and DCH-1566were selectedand the field experiment was carried out at CCSHAU, Regional Research Station, Bawal during *Kharif* season of 2019.The genotypes were sown with the spacing of 120cm between rows and 90 cm plant to plant in the rowfollowing randomized block design and each treatment (genotype) replicated thrice.The observation on leafhopper count including both nymphs and adults were recorded from three leaves per plant representing top (excluding two topmost leaves), middle (medium maturity) and bottom (leaving 1 or 2 bottom-most leaves) leaf on the main shoot. The population was recorded as the number of leafhoppers/3 leaves/plant from five randomly selected plants per treatment and the observations were recorded at weekly interval starting from 30 days after sowing. The hopper burn injury on leaves was recorded visually as per cent damage and was scored as per standard grades followed by the All India Coordinated Research Project (AICRP) on Castor.

Comment [as3]: Explain how to determine the level of resistance of a genotype!

Chart 1: Score Board

Grade (score)	Hopper burn on leaves (%injury)
0	No injury
1	Hopper burn 0-10%
2	Hopper burn 11-25%
3	Hopper burn 26-50%
4	Hopper burn above 50%

Estimation of biochemical constituents

The castor leaves from each genotype were collected and different biochemical constituents were evaluated in the laboratory. Total phenols were estimated by the method suggested by Swain and Hillis(1959) and the total carbohydrates from leaves of castor genotypes were estimated as per the method suggested by Hedge and Hofreiter (1962).

RESULT AND DISCUSSION

Comment [as4]: Why is there no ANOVA result displayed? The authors should show the results of the ANOVA test obtained so that the reader can see whether or not there are significant differences between the genotypes tested.

Comment [as5]: What are the conclusions of this study?Write the conclusion chapter before the references!

The perusal of the data obtained from different treatments indicated that the incidence of leafhopper washighest during the 44th standard meteorological week. Among the 10 genotypes

Maharaja-9 and GCH-7 were found to be resistant to leafhopper with a mean leafhopper population of 2.3 and 2.4 leafhopper/three leaves/plant and recorded hopper burn score of 0.16 and 0.25, respectively whereas the genotype ICH-68, DCH-519 and ICH-66 were moderately resistant to leafhopper with a mean leafhopper population of 3.9, 4.0 and 5.1 leafhopper/three leaves/plant and a hopper burn score of 0.50, 0.58 and 0.58, respectively. The genotypes DCH-177 and SHB-974 were found susceptible with a mean infestation of 8.3 and 7.8 leafhopper/three leaves/plant and mean hopper burn score 2.25 and 1.92, respectively.Dorairaj *et al*. (1963) and Lakshminarayana *et al*. (1992) also reported similar findingwhere genotypes with waxy bloom showed resistance to leafhopper which is evidenced in the current study. Lakshmi *et al*.(2005)also classified DCH-177 as highly susceptible based on the population of *E. flavescens* and hopper burn incidence and GCH-4 as resistant. The pest population decreased with the increase in the intensity of waxy coating; this trait had a greater effect on pest incidence than the other morphological characters (growth habit, stem colour, number of nodes to primary raceme, leaf shape, nature of spike, nature of capsules, seed size, seed colour and seed weight). All genotypes (except DCH-177) had a waxy coating in all parts of the plant (triple bloom), whereas DCH-177 had a waxy coating only on the stem (single bloom).Lakshminarayana(2005) andShilpakala and Murali Krishn (2016)also reported that triple bloom genotypes were less preferred by leafhopper and exhibited a lower degree of hopper burn while single bloom genotypes were more preferred with more hopper burn.

Comment [as6]: Does this information need to be submitted? This genotype was not included in the genotype tested in this study, so this statement can be omitted.

Biochemical components

The highest content of carbohydrates was recorded from the leaves of DCH-177 (65.70 mg/g) followed by SHB-974 (49.83 mg/g), while the lowest carbohydrates content of 30.08, 30.16, and 30.52 mg/g was recorded in leaves of Maharaja-9, DCH-519 and GCH-7 respectively. Total carbohydrates showed a significant positive correlation with leafhopper population and hopper burn score. Masood(2014)reported the association of low sucrose content and high phenol content in cotton aphids which are in close confirmation in castor also.

The highest amount of phenol content was recorded in the leaves of GCH-7 (2.10 mg/g) and Maharaja-9 (2.04 mg/g) while the lowest amount of phenol content was recorded in the leaves of DCH-177 (1.31 mg/g) and SHB-974 (1.33 mg/g). Phenols showed a negative correlation with the leafhopper population and with the hopper burn score. Rohini *et al*. (2011) reported that maximum phenol content was found in leafhopper resistant variety while minimum phenol content was reported in varieties which are susceptible to leafhoppers in cotton.

Table IPopulation dynamics of leafhopper, *Empoascaflavescens*Fab. on different castor genotype during *Kharif*, 2019

Genotype	Mean number of leaf hopper/three leaves/plant during the different standard meteorological week																							Overall Mean	Yield (q/ha)
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7		
JSB-1018	2.7	1.9	4.5	3.7	5.5	4.7	17.2	16.2	15.2	13.4	12.0	10.0	6.0	5.0	4.0	4.7	4.3	4.2	3.7	3.6	2.2	2.3	0.0	6.2	33.3
SHB-974	3.7	3.1	5.7	5.3	6.9	6.1	23.1	20.2	20.5	17.1	13.0	12.0	7.0	5.0	4.2	5.7	5.1	5.1	4.1	4.1	3.1	3.2	1.0	7.8	30.7
SLCH-158	1.6	1.1	3.2	2.7	4.7	4.1	14.7	13.3	12.5	10.3	9.3	8.5	6.0	4.0	3.3	4.3	3.8	3.2	3.2	3.2	2.5	2.1	1.0	5.1	28.8
ICH-66	1.4	1.1	3.3	2.3	4.3	4.2	14.3	13.6	12.3	10.4	9.7	8.8	6.0	4.0	4.0	4.1	3.6	3.2	3.1	3.5	2.2	2.1	0.0	5.1	40.0
ICH-68	1.1	0.5	1.7	1.1	5.2	4.1	12.4	10.6	9.3	7.3	6.5	6.1	5.0	4.0	3.2	3.6	3.2	2.7	2.3	2.1	1.3	1.1	0.0	3.9	38.8
Maharaja-9	0.5	0.1	1.2	1.1	3.1	2.3	6.1	7.3	5.1	4.1	4.2	3.7	2.1	2.0	1.3	3.1	2.3	2.3	1.3	1.2	1.0	0.1	0.0	2.3	41.1
DCH-519	1.3	0.6	1.3	1	4.1	5.1	12.7	10.3	9.6	7.2	6.7	6.2	5.0	4.0	4.5	4.1	3.3	2.7	2.3	2.1	1.4	1.2	0.0	4.0	37.8
GCH-7	0.6	0.3	1.1	0.9	3.3	2.4	6.3	7.5	5.7	4.2	4.5	3.2	3.0	3.0	2.3	3.2	2.6	2.1	1.3	1.5	0.7	0.3	0.0	2.4	40.4
DCH-177	4.1	3.2	6.2	5.9	7.2	6.3	25.3	23.3	21.1	17.5	14.0	13.0	7.0	5.0	4.3	6.6	5.7	5.2	4.6	4.3	3.1	3.3	1.0	8.3	40.0
DCH-1566	2.6	1.7	4.3	3.2	5.3	4.3	17.7	16.5	15.2	13.7	12.0	10.0	6.0	5.0	4.2	4.5	4.1	3.9	3.7	3.2	2.4	2.3	0.0	6.1	32.1

SMW- Standard Meteorological Week

Table IIBiochemical parameters and morphological characters of leaf on different castor genotypes during *Kharif*, 2019

Genotype	Phenol (mg/g)	TSS (mg/g)	Type of waxy bloom
JSB 1018	1.66	42.08	Triple
SHB 974	1.33	49.83	Triple
SLCH 158	1.43	38.33	Triple
ICH 66	1.41	38.67	Triple
ICH 68	1.86	36.50	Triple
Maharaja-9	2.04	30.08	Triple
DCH 519	1.76	30.16	Triple
GCH 7	2.10	30.52	Triple
DCH 177	1.31	65.70	Single
DCH 1566	1.69	42.17	Triple

Table IIICorrelation studies of biochemical parameters with leafhopper population

Sr. no.	Variable	Correlation coefficient
1	Phenol content	-0.814**
2	Total carbohydrates	0.910**

**Significance at p= 0.01 level

Table IVHopper burn score of different castor genotypes at different days after sowing during *Kharif*, 2019

Genotype	30 DAS	60 DAS	90DAS	120 DAS	150 DAS	180DAS	Mean
JSB-1018	0	0.0	1.0	1.0	2.5	2.0	1.08
SHB-974	0	1.5	1.5	2.0	4.0	2.5	1.92
SLCH-158	0	0.0	0.5	1.0	2.5	1.5	0.91
ICH-66	0	0.0	0.0	0.5	1.5	1.5	0.58
ICH-68	0	0.0	0.0	1.0	1.0	1.0	0.50
Maharaja-9	0	0.0	0.0	0.0	0.5	0.5	0.16
DCH-519	0	0.0	0.0	0.5	1.5	1.5	0.58
GCH-7	0	0.0	0.0	0.0	1.0	0.5	0.25
DCH-177	0	1.5	2.0	2.5	4.0	3.5	2.25
DCH-1566	0	0.0	0.5	1.5	2.5	2.5	1.16

DAS- Days after sowing

Table VCorrelation studies of biochemical parameters with hopper burn scores

S. no.	Variable	Correlation coefficient
1	Phenol content	-0.744*
2	Total carbohydrate	0.946**

*Significance at p= 0.05 level, **Significance at p= 0.01 level

REFERENCES

Comment [as7]: Pay attention to the way of quoting in the text. Is the citation superscripted? Write down the name and year of publication? Or use the [ ] ?
If possible, add the most recent reference

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