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Research Article

ORIENTATION PREFERENCE OF SWEET POTATO WEEVIL, *Cylas formicarius* ADULTS IN SWEET POTATO TURS

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Abstract- Ten genotypes of sweet potato tuber crops were evaluated against sweet potato weevil for sweet potato tubers preference in the College of Agriculture, IGKV, Raipur under laboratory conditions during Rabi season of 2014-15 and 2015-16. The orientation studies were conducted to evaluate the sweet potato genotypes tuber for orientation of weevil adults and more/less preferred genotypes by weevils. The results of these studies revealed that the IGSP-C-15 had least orientation and less preferred for orientation by sweet potato weevils with 3.82 weevils per tuber. It was followed by Indira Madhur and Indira Nandini with 4.88 and 5.46 weevils per tuber. On the other hand, maximum orientation of 12.94 weevils per tuber was recorded on genotype Kalmegh, which means the weevil adults were more attracted to genotype Kalmegh. The least oriented genotypes were good for farmers field as it will be less affected by weevils and more economical.

Keywords- Sweet potato, *Cylas formicarius,* Weevil infestation, Genotype.

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Introduction

Sweet potato (*Ipomoea batatas* L.) known as "Shakarkand" is one of the most popular tuber crops in Chhattisgarh state, in the country and abroad. Sweet potato is mainly used as food, industrial raw material and as animal feed. In India, Sweet potato is chiefly grown for human consumption and used as food after boiling, baking or frying. Nearly 80 species of pests are associated with sweet potato in India [7,12,13]. Among the pests, sweet potato weevil *Cylas formicarius* fabricius (Curculionidae: Coleoptera), is the most ubiquitous and damaging pest. Weevils belonging to super family Curculionoidea contains a significant proportion of all known species of order Coleoptera and includes the largest family of animals, the Curculionidae [18]. Weevil is the most serious soil insect pest of sweet potato which attacks both in the field and during storage. These beetles are characterised by possession of long snout bearing mandibulate mouth parts at the tip and geniculate antenna. Some reports about the diversity of weevils are from the area are available [5,15,4,1]. Sweet potato weevil causes economic damage by direct feeding on the tubers. The adult weevil feed on tender buds, leaves, vines and tubers. The grub causes major damage and hampers the economical yield [2].

The damage caused on the food crop is so extensive that this weevil is known as the 'Sweet Potato Weevil'. Identification of weevil and fungal pathogen associated with sweet potato disease is important to sweet potato control strategy to avoid epidemic that may cause loss of economic return. Besides that, farmer should apply integrated pest management control for continuous production of good quality sweet potato tuber [10]. So, for the present study based on to observe the less preferred genotype which will be less prone to weevil and the study helps to identify the genotype via orientation study.

Materials and Methods

The study was conducted in horticultural farm, Department of Horticulture. IGKV, Raipur. To study the relative preference of sweet potato weevil, the infested tubers were collected from the experimental field. The infested tubers were kept in glass jars at ambient temperature (28-32^{0}C) and RH 67-72% for 15-20 days. Freshly emerged adult weevils were released on fresh sweet potato tubers. These adults were used for the study of orientation preference on 10 sweet potato genotypes, which were maintained in the plastic container filled with sand, soil and FYM. The sweet potato genotypes (buried in soil mixture) were placed at the periphery of the container. Hundred freshly emerged adults were released in the middle of the container; this facilitated them to move freely within the container covered with muslin cloth. The orientation of weevils was recorded after 24, 48 and 72 hours of their release. All the adults were removed after seven days. This study was conducted for two seasons.

Results and Discussion

The findings of the present study were based on orientation of weevils in tubers. To see the relative preference of adult weevils, the orientation of weevils was recorded on ten genotypes at different hours (i.e. 24 h, 48 h and 72 h). The data thus obtained is presented in [Table-1]. The orientation of weevils at different hours depicted that at 24 h of release of weevils, genotype IGSP-C-15 with 3.65 weevils per tuber was least preferred. It was significantly followed by POL-21-1, Indira Madhur and Indira Nandini with 5.60, 5.65 and 6.67 weevils per tuber, these differing non-significantly. Genotype Indira Nandini was at par with Indira Naveen but differed significantly from Sree Rethna and IGSP-14 with 8.66 and 8.96 weevils per tuber. The genotype Kalmegh with 13.69 weevils per tuber was most preferred and was at par with IGSP-11 and IGSP-C-16 with 12.91 and 13.31

weevils per tuber.

The data after 48 hours of release of weevils revealed that the least orientation or least preferred genotype was IGSP-C-15 with 3.23 weevils per tuber. The genotype Kalmegh was recorded as most preferred by adult weevils with 13.66 weevils per tuber and after 72 hours after release the least preferred genotype was POL-21-1 with 4.28 weevils per tuber and maximum preference was recorded in Kalmegh with 11.63 weevils per tuber.

The mean data based on three different hours of release revealed that the genotypes Kalmegh and IGSP-11 with 12.99 and 12.82 weevils per tuber were most preferred by weevils whereas, the genotype IGSP-C-15 with 3.95 weevils per tuber was recorded as least preferred by weevils. It was already proved that the suitability of plants as host to insects is determined by an array of interaction between insect responses to various plant characteristics. Plant resistance to insects could be due to description of one or more of the physiological and behavioural responses of the insects to the plant characteristics [6]. Similarly [3] and [9] reported that the sweet potato weevil preferred for feeding on plants with enlarged storage roots, especially the periderm of the root.

During second year of study on orientation of sweet potato weevils to different genotypes of sweet potato, IGSP-C-15 with 4.16 weevils per tuber was least attracted by the weevils at 24 h after release. It differed non-significantly from Indira Madhur and POL-21-1 with 5.29 and 5.79 weevils per tuber but differed significantly from Indira Nandini (6.63 weevils per tuber). Genotype Kalmegh with 13.66 weevils per tuber was most preferred and was at par with IGSP-C-16 and IGSP-11 with 12.64 and 13.31 weevils per tuber, respectively. It is clear in [Table-1].

It revealed that after 48 h of release of sweet potato weevil adults, more or less similar trend in the orientation of weevils towards various genotypes was observed. After 72 h, genotype IGSP-C-15 with 2.64 weevils per tuber was least preferred. Genotype Kalmegh with 11.63 weevils per tuber had the maximum orientation of weevils and was at par with IGSP-11, IGSP-C-16 and IGSP-14 with 10.64, 9.93 and 8.98 weevils per tuber, respectively. Based on above three observations, genotype IGSP-C-15 with 3.70 weevils per tuber was least preferred and Kalmegh with 12.89 weevils per tuber was most preferred by the sweet potato weevil. Similarly, even if adults prefer a given cultivar for food and oviposition, the pests cannot increase rapidly unless the quality of the storage root also provides for larval development. Sweet potato resistance to weevils has been reported in the laboratory and field depends on ovipositional stimulant present in sweet potato tuber act as attractant or deterrent, as reported [11].

Table–1 *Orientation studies of sweet potato weevils at different hours*

Tr. No.	Genotypes	First year			Second year			Mean orientation		
		No. Weevils per tuber			No. Weevils per tuber			No. Weevils per tuber		
		24 h	48 h	72 h	24 h	48 h	72 h	1st year	2nd year	Overall
T_1	Indira Madhur	5.65^{b}	4.65^{ab}	4.58^{a}	5.29^{ab}	4.97^{a}	4.16^{abc}	4.96	4.80	4.88
		(2.481)	(2.271)	(2.255)	(2.407)	(2.339)	(2.159)	(2.33)	(2.30)	(2.31)
T_2	Indira Naveen	8.32^{cd}	8.98^{cd}	6.98^{b}	8.326^{cd}	8.62^{cd}	3.14^{cd}	8.09	7.65	7.87
		(2.971)	(3.079)	(2.735)	(2.971)	(3.020)	(2.613)	(2.92)	(2.86)	(2.89)
T_3	Indira Nandini	6.67^{bc}	4.97^{ab}	4.97^{ab}	6.634^{bcd}	5.6^{ab}	3.96^{ab}	5.53	5.39	5.46
		(2.676)	(2.339)	(2.339)	(2.671)	(2.470)	(2.112)	(2.45)	(2.41)	(2.44)
T_4	IGSP-C-15	3.65^{a}	3.23^{a}	4.97^{ab}	4.161^{a}	4.32^{a}	2.64^{a}	3.95	3.70	3.82
		(2.038)	(1.932)	(2.339)	(2.159)	(2.196)	(1.774)	(2.10)	(2.04)	(2.07)
T_5	SreeRethna	8.66^{d}	6.60^{bc}	4.62^{a}	7.979^{cd}	6.98^{bc}	4.65^{bc}	6.62	6.53	6.57
		(3.027)	(2.666)	(2.264)	(2.912)	(2.735)	(2.271)	(2.65)	(2.63)	(2.65)
T_6	IGSP-14	8.96^{d}	9.625^{d}	9.625^{c}	9.32^{d}	9.66^{d}	8.98^{de}	9.41	9.32	9.36
		(3.079)	(3.182)	(3.182)	(3.135)	(3.188)	(3.079)	(3.14)	(3.13)	(3.14)
T_7	Kalmegh	13.69^{e}	13.66^{e}	11.63^{c}	13.66^{e}	13.39^{e}	11.63^{e}	12.99	12.89	12.94
		(3.760)	(3.763)	(3.483)	(3.763)	(3.719)	(3.483)	(3.66)	(3.65)	(3.66)
T_8	IGSP-C-16	13.31^{e}	11.27^{de}	10.29^{c}	12.647^{e}	12.647^{e}	9.93^{e}	11.62	11.74	11.68
		(3.717)	(3.431)	(3.286)	(3.626)	(3.626)	(3.230)	(3.47)	(3.49)	(3.48)
T_9	POL-21-1	5.60^{b}	5.65^{b}	4.28^{a}	5.79^{abc}	4.97^{a}	5.19^{bc}	5.17	5.31	5.24
		(2.470)	(2.481)	(2.187)	(2.508)	(2.339)	(2.386)	(2.73)	(2.41)	(2.39)
T_{10}	IGSP-11	12.91^{e}	14.28^{e}	11.27^{c}	13.31^{e}	13.63^{e}	10.648^{e}	12.82	12.52	12.67
		(3.662)	(3.845)	(3.431)	(3.717)	(3.760)	(3.339)	(3.64)	(3.60)	(3.62)
	SEm±	0.114	0.138	0.146	0.161	0.113	0.161			
	CD (5%)	0.34	0.41	0.43	0.48	0.34	0.48			
	CV	6.66	8.26	9.20	9.36	6.71	10.58			

Based on two years of study genotype IGSP-C-15 had least orientation of sweet potato weevils with 3.82 weevils per tuber. It was followed by Indira Madhur and Indira Nandini with 4.88 and 5.46 weevils per tuber. On the other hand, maximum orientation of 12.94 weevils per tuber was recorded on genotype Kalmegh. It was followed by IGSP-11 and IGSP-C-16 with 12.67 and 11.68 weevils per tuber respectively.

Regarding the orientation of sweet potato weevil in tuber, [16] studied varietal susceptibility of sweet potato germplasm against sweet potato weevil and found that none of the germplasms of sweet potato was resistant to *Cylas formicarius*. Germplasm 79-OP-217, Kalmegh and X-69 were moderately tolerant while germplasms X-25, Cross-4 and 76-OP-21 were susceptible and the remaining six germplasms S-30, C-71, H-85-168, V-35, H-82-2 along with local cultivar, were highly susceptible as per standard of 0-30% tuber damage. Germplasms V-35 had maximum weight loss as compared to 79-OP-217. In the present study, genotype Kalmegh received maximum percent infestation. Thus, the orientation study of sweet potato weevil, it was clearly showed that the genotypes showing less orientation were less preferred by weevils and was good for cultivation of sweet potato. Similarly reported the level of infestation in the different sweet potato genotypes was reported to be related to the concentration of kairomones in the periderm of the tubers [17].

In advance studies, “boehmeryl acetate”, a kairomone responsible for oviposition as ovipositional stimulant for weevil and “triterpenol acetate” on the root surface of genotype “Contennial” shown similar function of the other kairomones responsible for weevil orientation or more preferred genotype for weevils as reported by [8]. This suggest that selection of sweet potato genotypes for farmers field would be based on the less oriented or less preferred genotype, so that it will be less infested by weevils. Similarly, reported that when adult weevils were allowed to choose between paired test arenas containing sweet potato roots and *Metarhizium anisoplae* isolates on cores, weevil avoided arenas with the highly virulent isolates QS155, showing a preference for roots[14].

Conclusion

In all the understanding of the orientation study, the biology of sweet potato weevil along with concentration of kairomones on the periderm of sweet potato were responsible for infestation and significantly facilitate sweet potato resistance to weevils. The study shows the presence of kairomones over the surface of sweet potato tubers were responsible for weevil more or less orientation on sweet potato tuber. This study was all about the variety more or less preferred by weevils.

Application of research: The selection of sweet potato variety is important for the control of sweet potato weevils.

Research Category: Tuber crops

Abbreviations:
IGKV: Indira Gandhi Krishi Vishwavidyalaya
RH: Relative Humidity
°C: Degree Centigrade
FYM: Farm Yard Manure
h: Hour
SEm: Standard Error of the Mean
CV: Coefficient of Variance
CD: Coefficient of Dispersion
i.e.: That is

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