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Biophysical mechanisms of resistance to brinjal shoot and fruit borer, *Leucinodes orbonalis* guenee in brinjal

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ABSTRACT
An experiment was carried out with twenty brinjal genotypes at Department of Entomology, Indira Gandhi Krishi Vishwavidalaya, Raipur (CG) during 2014-15 to see the effect of biophysical characters of plants on the infestation of shoot and fruit borer on different brinjal genotypes. It was observed that trichome length and trichome density exhibited strong and negative correlation i.e. (r = -0.994) and (r = -0.987), respectively, with respect to fruit infestation caused by Brinjal shoot and fruit borer Leucinodes orbonalis guenee.
***Keywords**: Brinjal, Leucinodes orbonalis, Resistance, Trichome*

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INRODUCTION

Brinjal or egg plant (*Solanum melongena* Linn.) is normally self fertilized, solanaceous crop having chromosome no. 2n=24 and it is native of India. Brinjal or egg plant is world wide known as aubergine or guinea squash which is most popular and principle vegetable crop hence regarded as "king of vegetable". Although brinjal is native of India, China is designated as the secondary centre of origin. Currently, it is extensively grown in Bangladesh, India, Pakistan, Nepal, U.S.A, Sri Lanka, Egypt and other warm countries of the world. It has been reported that damage caused by more than 140 species of insect pest viz., jassids (*Amrasca biguttula biguttula*); aphids (*Aphis gossypii*), white fly (*Bemisia tabacci*) and shoot and fruit borer (*Leucinodes orbonalis*) etc, infest brinjal during different stages of plant growth (Prempong and Buahim, 1977). Brinjal shoot and fruit borer (Lepidoptera: Pyralidae) is the most abnoxious detrimental and ubiquitous insect pest. The caterpillar bores into young growing shoots, Petioles, midrib of leaves and fruits leaving no sign of entry. It riddles the plants parts, feeds on internal tissue causing the plants to fade and wither resulting into drying and drooping of growing shoot which is the typical symptom produced. Larval stage of this pest causes the damage varies from 1 to 90 per cent in India. (Kalloo, 1988). The physiomorphic characteristics of plants and fruits are associated with attraction, feeding and egg laying of the insect pests. Development of varieties resistant to the insect pests is an important strategy of integrated pest management (Bhatti *et al*., 1976). The recognition of physical and morphological characteristics of resistance varieties may lead to introduction of resistance character to favored genotypes. Uthamasamy (1985) observed that the resistant genotypes had more hairs than the susceptible ones. Therefore, the present study was undertaken to find out the correlation of different physico- morphological plant characteristics of different brinjal cultivars having various degrees of resistance and susceptibility with the population of shoot and fruit borer (*Leucinodes orbonalis*)

MATERIAL AND METHODS

A statistically designed field experiments with randomized block design, were laid out to study the response of twenty brinjal hybrids during *rabi* 2014-15. In order to ascertain the relationship if any, between the trichomal arrangement of hybrid brinjal leaves with *L. orbonalis* Guen. infestation/resistance, experiments were conducted under lab condition. For the study of trichomal arrangement of hybrid brinjal cultivars, first of all based upon the comparative performance of the screened hybrid brinjal cultivars against shoot and fruit borer infestation different resistance degrees of categories were formulated as least susceptible, moderately susceptible, susceptible and highly susceptible during *Rabi* seasons, then one cultivar from each category was selected to study the trichomal arrangement. For the categorization of brinjal cultivars the picking data up to seventh harvesting level was taken as the base. Following rating index was formulated for different categories of cultivars

Table 1. Categorization of brinjal cultivars based on fruit infestation

Grade	Categories	Level of infestation (%)
LS	Least susceptible	1-10
MS	Moderately susceptible	11-20
S	Susceptible	20-25
HS	Highly susceptible	above 25

1. Sample preparation for microscopic observation of trichomes.

This work was undertaken in the departmental lab. of Entomology as per the method suggested by Maithi *et al.*, (1980) with some modification for clearing of leaves for microscopic observation were adapted. For this work leaf sample was taken from the apical region of the plant i.e. up to 10 cm from the tip of central shoot. Leaf sample were collected from selected categorized cultivars from each replication.

After collecting the leaf sample, it was taken to the lab and cut in to 5x1mm^2 segments. Leaf segment of 5 x 1 mm^2 area were heated in 20 ml water in glass vials for 15 minutes in oven set. The water was poured off and added with 20 ml of 95 per cent ethyl alcohol. The leaves were boiled for approximately 20 minutes in the oven at 85 °C. the alcohol was poured off, fresh alcohol added and boiling procedure repeated to completely remove the chlorophyll from the leaf. The alcohol again poured off and 20 ml of concentrated (90%) lactic acid was added, heated again at 85ºC until the leaf segment became clear (approximately 45 minutes). The vial were cooled and stored for further observation. The segment mounted on slide in a drop of lactic acid, prepared slides for further observation under the trinocular microscope.

2. Procedure for the measurement of trichome density and trichome length

The slide with leaf segment was put under the 10 x trinocular lens, then prepared slide of leaf segment was observed through eye piece. Adjustment was made by fine adjustment knob until the fine trichome on leaf segment was clearly seen under the microscopic field. Firstly assured the point of basal junction of trichomes on the leaf segment from which trichomes arised. Counted the number of trichomes in one basal junction of trichome, then counted the point of basal junction of trichome on leaf segment manually by adjusting the forward and backward knob and the image was captured through option which seen on the desktop of trinocular microscope. Accurate number of trichomes i.e. trichome density was calculated by multiplying the trichome numbers to the point of basal junction of trichome. In same way the length of trichome was also measured with the help of digital scale of trinocular microscope. The image was captured through option which seen on the desktop of trinocular microscope.

RESULT AND DISCUSSION

The hybrid brinjal cultivars were categorized on the basis of fruit infestation and in order to ascertain the relationship between trichome character i.e. the trichome length with *L. orbonalis* infestation these cultivars were examined under the trinocular microscope and correlated with their respective per cent fruit infestation.

Per cent fruit infestation by *L. orbonalis* on the different hybrid brinjal cultivars were recorded; which was ranged from 2.56 to 25.79 per cent overall average fruit infestation in different hybrid brinjal cultivars, accordingly the cultivars were categorized as per their reaction pattern as shown in the table 2.It was found that there was no any cultivar found in susceptible category i.e. 20 to 25 per cent fruit infestation, so in order to ascertain the relationship between trichome character i.e. the trichome length with *L. orbonalis* infestation remaining cultivars were examined.

Table 2: Influence of trichome length and trichome density of hybrid brinjal on fruit infestation by *L. orbonalis* Guen. during 2014-15.

Treatment	Categories	Cultivar	Trichome length (µm)	Trichome Density (5mm^2)	Fruit infestation (%)
T1	Least susceptible	2014/BRRHYB-5	1073.02	433.23	2.56
T2	Moderately susceptible	2012/BRRHYB-3	833.57	340.19	11.82
T3	Highly susceptible	2013/BRRHYB-4	585.07	260.82	25.79
		SEm±	78.34	9.43	
		CD	271.08	32.65	

		CV	16.34	4.74	
		r	-0.-994	-0.987	

1.Trichome length

It is crystal clear from table 2. and (Fig.1 to 4.3) that the hybrid brinjal cultivars 2014/BRRHYB-5 which was categorized as least susceptible to *L. orbonalis* had minimum fruit infestation (2.56%) and the hispid type (Very long trichome) with trichome length of 1073.02 µm, which was highest in length as compared to other categories and found statistically at par with 2012/BRR/HYB-3 which was categorized as moderately susceptible to *L. orbonalis* with fruit infestation (11.82%) and trichome length of 833.57 µm however, this was found statistically at par with 2013/BRR/HYB-4 which had maximum fruit infestation (25.79%) and puberulent type trichome (short trichome) lowest trichome length of 585.07 µm.

From above results, it was clear that as the trichome length increases, infestation by the *L. orbonalis* decreases. Trichome length showed negative correlation with fruit infestation r= -0.994. The relation between trichome length and fruit infestation (Fig.4) tended to be linear as indicated by regression line equation i.e. y = -0.047x +52.97.

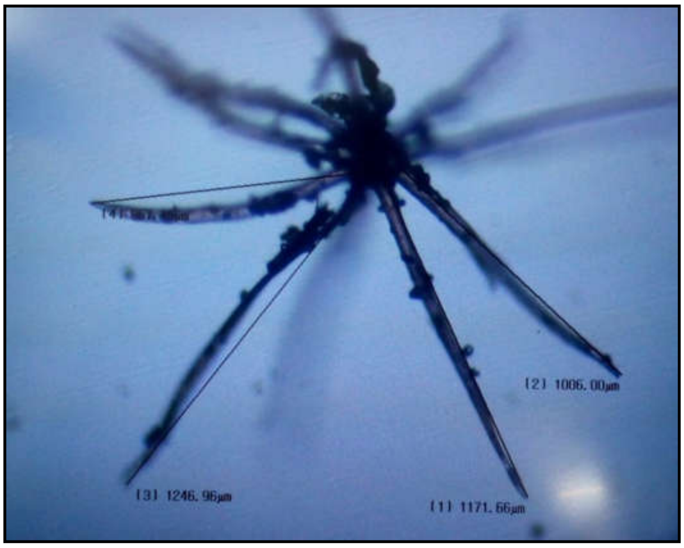

Fig. 1: Trichome length of least susceptible hybrid brinjal cultivar 2014/BRRHYB-5 during 2014-15

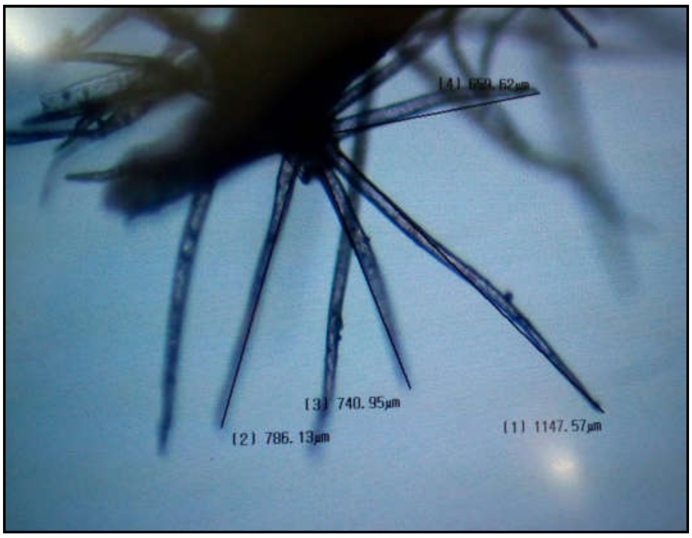

Fig. 2: Trichome length of least susceptible hybrid cultivar 2013/BRRHYB-3 during 2014-15

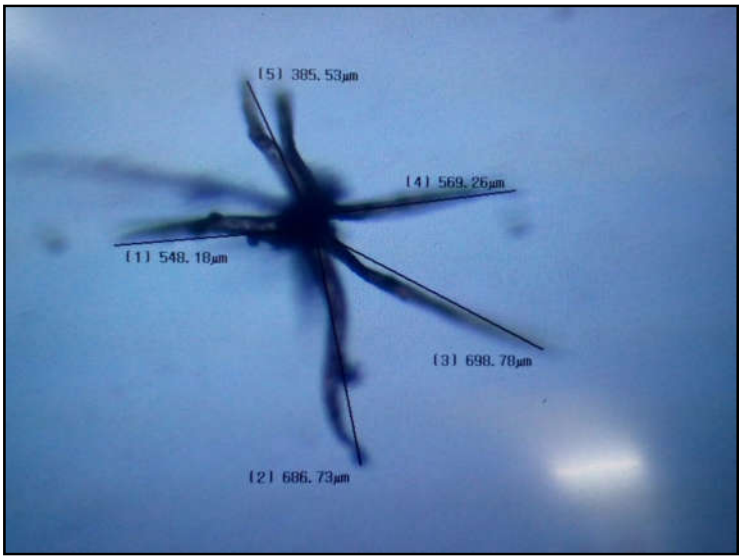

Fig. 3: Trichome length of highly susceptible hybrid brinjal cultivar 2013/BRRHYB-4 during 2014-15

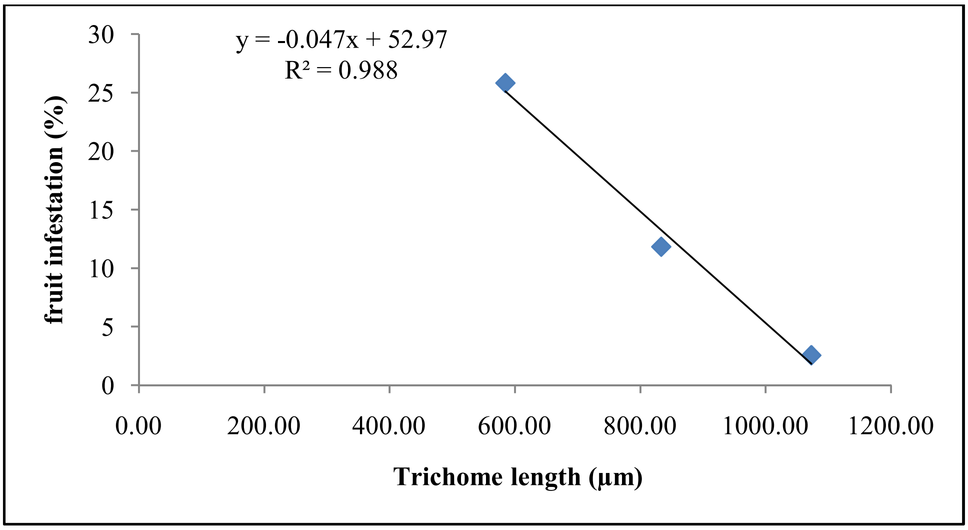

Fig. 4: Trichome length of hybrid brinjal cultivars in relation to fruit infestation during 2014-15

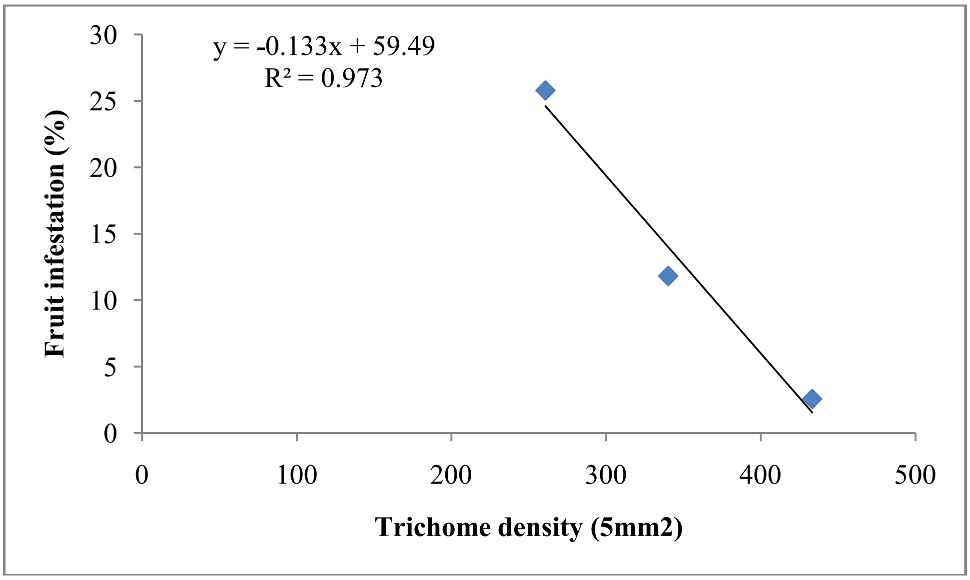

Fig. 5: Trichome density of hybrid brinjal cultivars in relation to fruit infestation during 2014-15

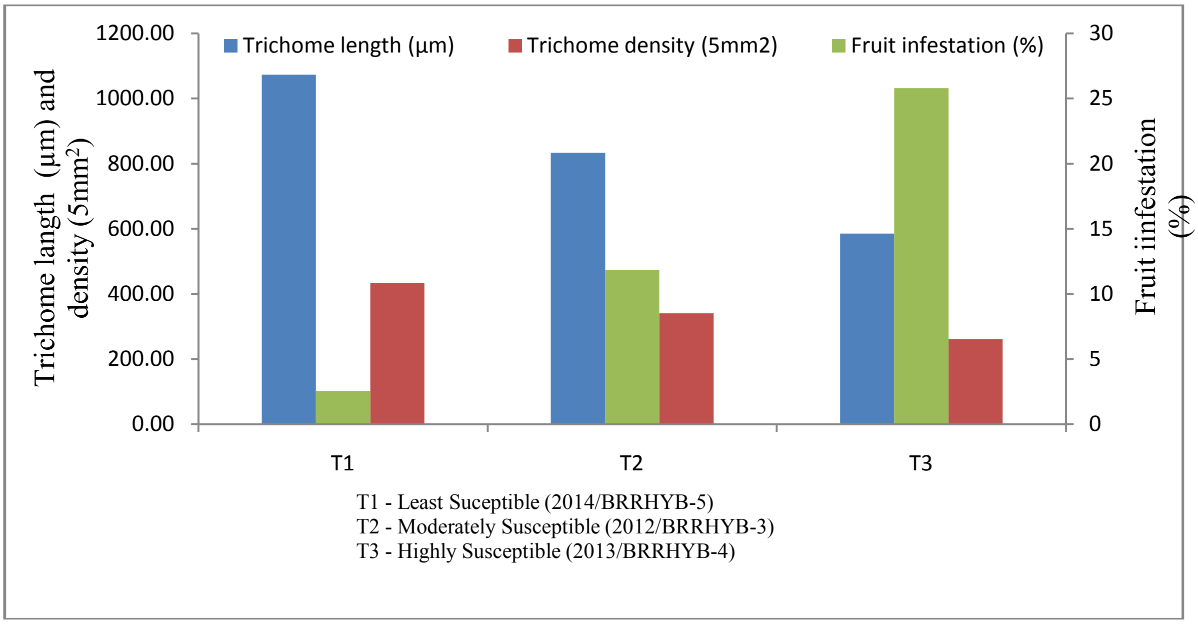

Fig. 6: Influence of trichome characteristics of hybrid brinjal cultivars on fruit infestation during 2014-15

2.Trichome density

It is crystal clear from table 2, that the hybrid brinjal cultivars 2014/BRRHYB-5 which was categorized as least susceptible to *L. orbonalis* had minimum fruit infestation (2.56%) and highest trichome density i.e. 433.23/5mm^2 on the lower surface of leaf, which was statistically significant and highest as compared to other categories. The 2012/BRRHYB-3 hybrid brinjal cultivars was recorded with trichome density of 340.19/5mm2, which showed moderately susceptible reaction to *L. orbonalis* infestation i.e.11.82 per cent. The 2013/BRRHYB-4 was highly susceptible cultivar to *L.orbonalis* infestation with maximum fruit infestation (25.79%), it had the lowest trichome density 260.82/5mm^2. Maximum trichome density observed on 2014/BRRHYB-5 in comparison to 2012/BRRHYB-3 and 2013/BRRHYB-4. From above results, it was clear that as the trichome density increases, infestation by the *L. orbonalis* decreases. Trichome density showed negative correlation with fruit infestation (r= -0.987). The relation between trichome length and fruit infestation (Fig. 5) tended to be linear as indicated by regression line equation i.e. y = -0.133x +59.49.

In present study it was also observed that 2014/BRRHYB-5 showed least susceptible reaction to the fruit infestation with longest trichome length of 1073.02 µm and trichome density of 433.23/5mm^2. Similar findings were recorded by, Shelke (1989) who found that all the resistance varieties of brinjal had large number of hairs on the lower surface of leaf and which had less hairs on the leaf had showed a greater susceptibility and negative correlation was observed between infestation and number of hair per leaf, similarly, Panda and Das (1974), Mote (1978), Kale *et al.,* (1986), Mote (1981) Jyani *et al*. (1995) and Wagh *et al.* (2012) reported that more hairiness of leaf in resistant varieties.

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