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Screening of Rice Genotypes and Assessment of Biophysical characters Conferring Resistance against Pink Stem borer, *Sesamia inferens* Walker (Lepidoptera: Noctuidae)

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ABSTRACT: Rice (*Oryza sativa* L.), the major staple food of Asian countries is attacked by several insect pests. The changing insect pest scenario at various cropping system encourages emergence of new insect pests. In rice, minor pests are gaining importance as major pest with significant damage. Pink stem borer (*Sesamia inferens* Walker) is causing damage to rice crop during reproductive stage and the damage is high during the panicle initiation and seed setting stage, which in turn causes great economic loss. A study was carried out with 70 rice germplasm, including Improved White Ponni (IWP), five local check varieties, one resistant (TKM 6) and one susceptible (TN-1) for their level of resistance and characterization. The results indicated that six rice genotypes were categorized as highly resistant based on dead heart damage and five lines as highly resistant according white ear infestation. The rice genotypes with highest trichome density on upper surface of leaf blade, less leaf angle, high auricle circumference, high ligule length, small stem girth and less leaf area conferred resistance to pink stem borer with minimum dead heart and white ear. The identified genotypes will be exploited for the purpose of varietal improvement in the breeding programme for resistance against pink stem borer as a new emerging rice pest.

Keywords: stem circumference, leaf angle, trichomes, oviposition

INTRODUCTION

Rice being the major staple food crop in the world owes the production of 519.3 million tonnes (FAOSTAT, 2021). In India, the rice production in the year 2021 attained 122 million metric tonnes (FAOSTAT, 2021). Among the various insect pests of rice, the stem borer species complex *viz*., YSB (Yellow stem borer, *Scirpophaga incertulas*), PSB (Pink stem borer, *Sesamia inferens*), DHB (Dark headed borer, *Chilo suppressalis*), WHB (White stem borer, *Scirpophaga innotata*) and SSB (Striped stem borer, *Chilo polychrysus*) have shown geographic variation, damage occurrence in various parts across the country. In southern regions, the dominant species recorded are YSB and PSB (Prakash *et al*., 2005). The genetic base of cultivated crops is broadened by the genepool of genotypes, landraces and wild species (Harian, 1976). The damage symptoms for pink stem borer confers to “dead hearts” during vegetative stage and “white ears” during reproductive stage (Singh, 2012). Pink stem borer is considered as major stem borer pest causing damage to millet crops. However, recent reports indicated that rice crop is also severely damaged by the species. One among important component in the management of pink stem borer is host plant resistance. Research works on identification and development of resistant varieties for the emerging pest, pink stem borer in rice is in preliminary stage. In the present study attempts were made to screen rice genotypes against pink stem borer and morphological characterisation of resistance.

MATERIAL AND METHODS

Field screening of rice genotypes were carried out at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirapalli, Tamil Nadu, during *Rabi* season 2021-22. Occurrence of pink stem borer, *S.inferens* is common in the rice growing areas of Trichy district, Tamil Nadu during *Rabi* season. A total of 61 rice genotypes, IWP, five local check varieties, one resistant (TKM 6) and one susceptible (TN-1) varieties were taken for screening experiment. The rice genotypes were sown in the nursery later transplanted in the main field in two rows at 3 m with a spacing of 20 × 10 cm and replicated thrice. The experiment was carried out in Randomised Block Design (RBD).

The rice genotypes were evaluated to assess the resistance for pink stem borer. The rice genotypes were observed for their reaction to pink stem borer. All the agronomic practices were carried out without spraying any insecticides. The symptom of dead heart and white ear observations were observed. Dead heart count were observed at 30, 45, 60 DAT whereas white ear was recorded at 75, 90 DAT, before harvest and the mean data was worked out. After counting, destructive sampling method was done for the confirmation of pink stem borer.

The pink stem borer infestation was assessed by counting the number of dead hearts (DH) in the initial stage of damage and number of white ear heads (WEH) at late stage from five randomly selected plants. The dead heart and white ear were calculated using the formula by IRRI (Table 1).

Table 1: Standard evaluation system for screening resistance to stem borers in rice by IRRI (2002).

Dead Heart (DH)			White Ear (WE)		
Damage (%)	**Scale**	**Resistance Rating**	**Damage (%)**	**Scale**	**Resistance Rating**
0	0	Highly Resistant(HR)	0	0	Highly Resistant(HR)
1-10	1	Resistant(R)	1-5	1	Resistant(R)
11-20	3	Moderately Resistant(MR)	6-10	3	Moderately Resistant(MR)
21-30	5	Moderately Susceptible(MS)	11-15	5	Moderately Susceptible(MS)
31-60	7	Susceptible(S)	16-25	7	Susceptible(S)
61-100	9	Highly Susceptible(HS)	26 and above	9	Highly Susceptible(HS)

$$\text{Dead heart (\%)} = \frac{\text{Number of dead hearts}}{\text{Total number of tillers}} \times 100$$

$$\text{White ear (\%)} = \frac{\text{Number of white ears}}{\text{Total number of productive tillers}} \times 100$$

Observations of pink stem borer eggmass

Observations were made to assess the ovipositional preference of pink stem borer on each rice genotype by counting the number of egg mass/plant under natural field condition from the screening trial. Three replications were maintained for each rice accession/variety.

Biophysical basis of resistance. Among the total of 70 genotypes, 16 genotypes were sorted out for assessing biophysical characterisation with pink stem borer damage. The data on biophysical attributes were correlated with pink stem borer damage. Three replications were maintained for each rice genotype and three plants were maintained for each replication.

Auricle circumference. It is a pair of hairy, sickle shaped appendage located near the junction of collar and rice leaf sheath. Auricle circumference was taken using measuring scale and recorded. The observations were recorded from five plants and replicated for five times.

Ligule length. A translucent membrane or a fringe of hairs known as ligule was measured according to procedure followed by Zeng *et al*. (2009). During heading stage, five plants were chosen at random, from the main tiller, length of the ligule was measured from the flag leaf.

Plant height. The plant height was measured from the soil surface to the tip of the panicle for five plants (Ntanos and Koutroubas 2000).

Stem girth. The stem diameter for each rice genotype was measured at ground level, in five plants (Ntanos and Koutroubas, 2000).

Upper blade pubescence. The trichome density of rice leaf in different genotypes was estimated as per the procedure described by Maite *et al*. (1980). Leaf blade pubescence was observed at the booting stage of the plant. Leaf samples collected were cut into bits of 5.0 cm and boiled in 20 ml of water for 15 minutes in hot water bath at 85°C. The remaining water was poured out retained with the leaves and boiled after adding 20 ml of 96 per cent ethanol for 20 minutes at 80^{o}C. The excess alcohol was poured off and the boiling process was continued. After removing alcohol 90 per cent lactic acid was added and boiled at 85°C until the leaf segments got cleared. The vials were then cooled and leaves were taken and mounted on clean slides using a drop of lactic acid to observe the trichome density. The pubescence density per cm^2 on abaxial surface of leaf segments was counted under compound microscope (45x magnification). For each rice genotypes, five replications were maintained and the descriptions were taken from the penultimate leaves from randomly chosen plants. Leaf trichome density was categorised as glabrous (scale 1), intermediate (scale 2) and pubescent (scale 3) as per standard protocol (Bioversity International, IRRI and WARDA, 2007).

Leaf angle. The openness leaf angle was measured with leaf blade tip against the leaf culm. At the growth period of 39 days, the leaf angle was measured using the protractor with its 90^{0} set vertical to the penultimate leaf and flag leaf (Yoshida, 1981). The flag leaf attitude was scored as erect (score 1), semi erect / intermediate (score 3), horizontal (score 5) and deflexed/ descending/drooping (scale 7). The position of the tip of the leaf blade relative to its base, scored on the leaf below the flag leaf (penultimate leaf) was called leaf blade attitude, which was measured at the late vegetative stage (prior to heading). It was categorised as erect, horizontal and drooping (Bioversity International, IRRI and WARDA. 2007).

Statistical analysis. The data collected in the field experiment on dead heart and white ear damage was subjected to ANOVA for significance of variation using AGRES software. The biophysical traits of different rice genotypes were subjected to correlation analysis with pink stem borer damage and oviposition preference using MS Excel software.

RESULTS AND DISCUSSION

The results of field screening revealed a significant difference in the level of resistance based on the damage symptoms for stem borer and destructive sampling method was followed for the confirmation of pink stem borer larva. The dead heart and white ear symptoms were clearly defined and scaled using SES

(Table 1). Out of 61 rice genotypes, at vegetative stage(dead heart %) seven lines showed nil dead heart damage *viz*., RG12, RG36, RG56, RG76, RG85, RG91 and RG188, whereas the lines with nil white ear damage *viz.*, RG12, RG15, RG56, RG76 and RG188 were categorised as highly resistant genotypes. The minimum and maximum dead heart damage recorded was 2.0 per cent in RG160 and 68.21 per cent in RG32 respectively. The minimum and maximum white ear damage was recorded in RG176 (3.06%) and RG48 (64.8%) respectively. Similarly, the resistant check TKM 6 recorded damage of 13.17% at and 4.68% at vegetative stage and reproductive stage respectively.

Observations were recorded for resistant and moderately resistant lines. From the scoring at vegetative stage, the lines which showed resistance are RG15, RG22, RG26, RG42, RG60, RG69, RG70, RG151, RG160, RG176, RG182 and RG190 and the local check variety TRY 2. The lines which are resistant during reproductive stage are RG22, RG34, RG42, RG91, RG160, RG176 and RG182 along with the local check variety TRY 2. The rice genotypes which were recorded as moderately resistant based on dead heart were RG33, RG35, RG39, RG51, RG62, RG68, RG89, RG92, RG99, RG100, RG106, RG154, RG175 and RG189 along with I.W.P. and local check variety TRY1 and TRY 5. The rice lines with the characters of moderately resistant during reproductive stage of the plant were RG2, RG33, RG36, RG151, RG190 and I.W.P. and TRY 5.

In the susceptible check, TN1 dead heart and white ear was 61.45% and 44.56% respectively. In the resistant check TKM 6, the dead heart and white ear percentage was 13.17% and 4.68% respectively. Most of the screening trials are targeted for yellow stem borer resistance in rice genotypes. Devasena *et al*. (2018) reported the dead heart damage in TN1 and TKM 6 as 28.0% and 92.0% in the artificial screening of rice genotypes for yellow stem borer resistance. Rice genotypes 38 were screened to yellow stem borer, from that 21 lines showed resistant, 9 lines showed moderately resistant, 2 lines appeared susceptible and the rest 6 lines showed moderately susceptible (Reuolin *et al*., 2019). Very few attempts were made on screening for pink stem borer resistance in rice varieties. Of the 84 rice genotypes screened in Uttar Pradesh, India against pink stem borer eight cultivars were classified as resistant, 11 cultivars as moderately resistant and the remaining cultivars were susceptible or highly susceptible (Garg, 1984). In the present study, results revealed that highly resistant varieties showed nil or less ovipositional preference towards the highly pubescent genotypes. Screening of 29 rice cultivars was done against panicle mite in West Bengal for evolving new resistant varieties (Mukhopadhyay *et al.*, 2017).

Observations on the number of egg mass/plant showed a significant difference between highly resistant, resistant, susceptible and highly susceptible genotypes (Table 2). Trichomes or leaf blade pubescence are either unicellular or multicellular in structures clearly present on various surface of plant organs which includes glumes, leaves, hulls, roots, stems and flowers (Yu *et al*., 2010). The presence of two types of hairs in rice leaves *viz*., micro and macro hairs, whereas micro hairs are located along stomatal cells and macro hairs are located on silica cells over a thin vascular bundle (Hu *et al*., 2013). Highly susceptible genotypes had maximum egg mass (8.60 no./plant) (RG32) and highly resistant genotypes had nil egg mass (0.00 no./plant) (RG12, RG15 and RG36). All the biophysical attributes were correlated with the number of egg mass per plant. Ovipositional behaviour had a significant positive correlation with dead hearts and white heads in rice (Rustamani *et al*., 2002). The less number of egg masses in the rice genotypes suffered less damage from stem borer (Hosseini *et al*., 2011). In the present study also the upper blade pubescence was found to be negatively correlated with the egg mass ($r = -0.93$). The plant heights for different genotypes varied from 67 to 149 cm. In the present study, results for plant height correlation showed a negative or relation with damage for different rice genotypes. The results obtained are in accordance with the findings of Ntanos and Koutroubas (2000).The larvae of pink stem borer is little stout when compared with other larvae of stem borer species. Results for stem diameter showed significantly positive correlation between resistant status ($r = 0.69$). Eggs are laid in two or more imbricated rows up to a total of 200 eggs, which are of uniform size and are covered by a thin waxy or gummy material (Rahman, 1945). Some cluster of eggs were also laid in groups of two to three on auricle (Joshi, 2005). The length of the auricle circumference was maximum in resistant genotypes (0.31 cm to 0.45 cm) which in turn affects the egg laying in the auricles. The susceptible genotypes had minimum auricle circumference in the range from 0.07 cm to 0.19 cm. Habib (2005) has reported that *C. partellus* reduced the maize yield, plant height and stem diameter more adversely in susceptible genotypes as compared to the resistant ones and differed significantly.

The trichomes were more on the upper surface of the leaf ranging from 11.39 to 86.70 no./cm^2/leaf which confers resistance (Table 2). The highly susceptible genotypes had trichome density ranging from 10.26 to 14.56 no./cm^2/leaf as against 87.56 to 91.25 no./cm^2/leaf in highly resistant variety and categorised as glabrous (scale 1). Those results are in accordance to the finding, that the leaf pubescence plays a major component in the antixenosis resistance in rice genotypes to rice yellow stem borer (Sharmitha *et al*., 2019), rice striped stem borer (Zhu *et al*., 2007). Rao and Panwar (2000) found positive correlation between pubescence

and leaf injury score which is the main contributing factor. Dalin *et al.* (2008) reported decreased plant damage by herbivorous insects significantly negative with increasing trichome density. Rakesh *et al*. (2021) reported on correlation for trichome density and yellow stem borer damage whereas, stem girth was significantly positively correlated at vegetative stage and negatively correlated at the reproductive stage and plant height showed a significant positive correlation.

Table 2: Screening of rice genotypes for their reaction to pink stem borer, *S. inferens*

Sr. No.	Accession No.	Local Name	Dead Heart damage (%)*	Scale	Resistance rating	White Ear damage (%)*	Scale	Resistance rating
1.	RG1	*Mapillai samba*	49.66	7	S	52.86	9	S
2.	RG2	CK 275	29.04	5	MS	10.00	3	MR
3.	RG3	*Senkar*	25.32	5	MS	12.69	5	MS
4.	RG4	*Murugankar*	55.334	7	S	27.04	9	HS
5.	RG5	CHIR 6	54.94	7	S	16.70	7	S
6.	RG6	CHIR 5	33.60	7	S	29.36	9	HS
7.	RG7	*Kudai vazhai*	20.54	5	MS	12.58	5	MS
8.	RG12	*Vellai chithiraikar*	0.00	0	HR	0.00	0	HR
9.	RG14	*Jothi*	43.63	7	S	38.11	9	HS
10.	RG15	*Palkachaka*	2.50	1	R	0.00	0	HR
11.	RG18	CHIR 11	46.65	7	S	14.00	5	MS
12.	RG20	*Kalvalai*	25.68	5	MS	18.12	7	S
13.	RG22	IR 36	5.00	1	R	3.67	1	R
14.	RG25	*Sorna kuruvai*	47.48	7	S	31.91	9	HS
15.	RG26	*Rascadam*	19.41	3	R	24.07	3	MR
16.	RG31	*Chinthamani*	46.35	7	S	25.00	7	S
17.	RG32	*Thogai samba*	68.21	9	HS	52.76	9	HS
18.	RG33	*Malayalathan samba*	20.00	3	MR	6.19	3	MR
19.	RG34	RPHP 125	22.50	5	MS	5.00	1	R
20.	RG35	CK 143	15.56	3	MR	13.17	5	MS
21.	RG36	*Kattikar*	0.00	0	HR	9.61	3	MR
22.	RG39	*Kaatu ponni*	11.26	3	MR	13.12	5	MS
23.	RG42	*Earapalli samba*	8.20	1	R	4.88	1	R
24.	RG44	*Mangam samba*	27.46	5	MS	36.71	9	HS
25.	RG48	*Kalarkar*	25.72	5	MS	64.8	9	HS
26.	RG51	RPHP 134	18.66	3	MR	59.00	9	HS
27.	RG56	RPHP 59	0.00	0	HR	0.00	0	HR
28.	RG57	RPHP 103	21.91	5	MS	46.33	9	HS
29.	RG59	RPHP 68	20.05	7	S	23.50	7	S
30.	RG60	*Rama kuruvaikar*	7.58	1	R	42.21	9	HS
31.	RG62	Purple puttu	14.00	3	MR	55.57	9	HS
32.	RG63	IG 71(EC 728651-117588)	29.34	5	MS	14.25	5	MS
33.	RG65	IG 56(EC 728700-117658)	32.60	7	S	24.60	7	S
34.	RG66	*Jeevan samba*	52.33	7	S	53.70	9	HS
35.	RG68	IG 63(EC 728711-117674)	14.41	3	MR	44.90	9	HS
36.	RG69	RPHP 48	7.50	1	R	37.65	9	HS
37.	RG70	*Karthi samba*	8.22	1	R	24.06	7	S
38.	RG76	*Matta kuruvai*	0.00	0	HR	0.00	0	HR
39.	RG85	RPHP 104	0.00	0	HR	14.00	5	MS
40.	RG89	IR 83294-66-2-2-3-2	12.5	3	MR	30.12	9	HS
41.	RG91	IG 23(EC 729391-121419)	0.00	0	HR	4.98	1	R
42.	RG92	IG 49(EC 729102-121052)	11.62	3	MR	11.65	5	MS
43.	RG99	IG 31(EC 728844-117829)	12.33	3	MR	15.00	5	MS
44.	RG100	IG 7(EC 72598-121648)	18.63	3	MR	43.63	9	HS
45.	RG102	*Varakkal*	30.00	5	MS	24.61	7	S
46.	RG103	*Mattaikar*	12.86	3	MR	18.26	7	S
47.	RG106	*Katta samba*	29.53	5	MS	49.26	9	HS
48.	RG108	Red sirumani	24.83	5	MS	22.35	7	S
49.	RG117	IG 65(729024-120958)	21.99	5	MS	30.62	9	HS
50.	RG142	Sasyasree	57.50	7	S	23.68	7	S
51.	RG151	IG 32(EC 728838-117823)	4.50	1	R	5.56	3	MR
52.	RG154	IG 48(EC 729203-121195)	18.33	3	MR	18.19	7	S
53.	RG160	IG 72(EC 7286250-117587)	2.00	1	R	9.60	1	R
54.	RG174	IG 51(EC 728772-117742)	27.72	5	MS	34.83	9	HS
55.	RG175	*Vellai kudaivazhai*	11.00	3	MR	22.57	7	S
56.	RG176	*Kodai*	5.78	1	R	3.06	3	R
57.	RG182	ARB 59	2.50	1	R	3.33	1	R
58.	RG183	RPHP 163	23.55	5	MS	32.67	9	HS
59.	RG188	RPHP 80	0.00	0	HR	0.00	0	HR
60.	RG189	IG 41(EC 728800-117776)	18.33	3	MR	17.77	7	S
61.	RG190	IG 26(EC 590943-121899)	7.86	1	R	8.65	3	MR
62.	IWP	-	20.06	3	MR	7.65	3	MR

63.	TN1	-	61.45	7	S	44.56	7	S
64.	TKM 6	-	13.17	1	R	4.68	1	R
65.	MDU 3	-	36.01	7	S	23.00	7	S
66.	TRY 1	-	23.29	3	MR	15.00	5	MS
67.	TRY 2	-	5.68	1	R	8.70	1	R
68.	TRY 3	-	62.09	9	HS	38.06	9	HS
69.	TRY 4	-	30.96	7	S	19.88	7	S
70.	TRY 5	-	21.00	3	MR	8.10	3	MR
SEd			0.52	-	-	0.64	-	-
CD(p=0.05)			1.03	-	-	1.27	-	-

*Mean of three observations and replications
HR - Highly Resistant; R – Resistant; MR – Moderately Resistant; MS – Moderately Susceptible; S – Susceptible; HS – Highly Susceptible

The penultimate leaf angle of highly resistant genotypes/varieties ranged from 1.33^0 to 3.33^0 (scale 1- erect leaf attitude) and highly susceptible genotypes ranged from 77.50° to 86.70° (scale 7 – drooping/deflexed/descending) (Table 3). Resistant and susceptible genotypes had semi-erect and horizontal leaf attitudes. The leaf angle of highly resistant cultures were categorised as vertical/erect leaf attitude. Resistant (R) genotypes showed semi erect leaf attitude, susceptible (S) and highly susceptible (HS) genotypes/ varieties showed horizontal leaf attitude. The leaf inserted at an angle was most important feature which is related to yield. Erect leaved plants showed higher silica content and hence higher interception of light and Photosynthetically Active Radiation (PAR) absorption which leads to reduced preference for egg laying. The susceptibility was observed more when leaf angle is maximum and resistant characters was observed where leaf angle was more. Plants with this nearly obtuse leaf attitude have greater Leaf Area Index (LAI), which reduces the photosynthetic rate because leaves shadow one another and absorption of PAR is also less and has low silica content, hence were preferred for egg laying (Keulen,1986). The content of silica in rice leaves causes vertical positioning of the leaves and hence the larger portion of the leaf is exposed to sun and least or not preferred for oviposition (Thilagam *et al*., 2014). In resistance screening for rice stem borers, the leaf angle and stem diameter plays an important role for varietal development (El-Adl *et al*., 2011). The nutrient silica addition to the plants, decreases the leaf angle, which relatively modifies the architecture of the leaves and the erect leaves are predominant when supplied with silica (Zanao Junior *et al*., 2010). Leaf angle and stem diameter plays an important role for varietal development for resistance to stem borers (El-Adl *et al*., 2011). The stem diameter for different genotypes varied from 0.8 to 3.5 cm.

Table 3: Biophysical attributes of selected rice genotypes for resistance to pink stem borer, *S. inferens.*

Sr. No.	Rice genotypes	Resistant status	Plant height (cm)	Stem girth (cm)	Auricle circumference (cm)	Ligule length (mm)	Upper blade pubescence (no./cm^2/leaf)	Penultimate leaf angle (^{0})	Leaf area (cm^2)	Egg mass (no./plant)
1	RG1	S	146.00	3.50	0.19	13.50	33.20	42.50	36.05	5.60 (2.47)
2	RG4	HS	131.00	3.70	0.07	11.10	11.32	77.50	11.28	8.10 (2.93)
3	RG7	S	120.00	2.90	0.15	20.50	32.56	53.55	21.73	7.10 (2.76)
4	RG12	HR	105.00	1.80	0.45	11.70	87.56	2.50	31.40	0.00 (0.71)
5	RG14	S	149.00	2.40	0.16	20.50	34.56	52.50	15.37	6.50 (2.65)
6	RG15	HR	145.00	1.60	0.37	12.30	88.65	1.33	36.43	0.00 (0.71)
7	RG22	R	81.00	0.90	0.28	11.70	62.89	10.67	22.72	1.50 (1.41)
8	RG26	R	126.00	1.80	0.31	11.30	63.59	7.25	22.44	1.40 (1.38)
9	RG31	S	131.00	2.40	0.16	9.50	32.68	44.56	15.11	7.10 (2.76)
10	RG32	HS	110.00	2.80	0.09	16.25	10.26	86.70	9.68	8.60 (3.02)
11	RG36	HR	120.00	2.10	0.38	13.06	87.65	1.50	40.60	0.00 (0.71)
12	RG42	R	121.00	2.00	0.29	14.35	31.58	8.50	32.00	1.60 (1.45)
13	RG56	HR	102.00	1.40	0.31	13.65	91.25	3.33	35.77	0.00 (0.71)
14	RG59	S	106.00	2.60	0.18	18.75	34.57	47.65	13.48	6.30 (2.61)
15	RG70	R	103.00	1.90	0.28	21.20	64.52	8.30	22.43	1.45 (1.40)
16	RG76	HR	129.00	0.80	0.42	20.90	89.26	1.50	31.88	0.00 (0.71)
SEd										0.22
CD (p=0.05)										0.44

*Mean of three replications
Figures in the parantheses are $\sqrt{(x+0.5)}$ transformed values

The maize germplasm showing more resistance against *Chilo partellus* has less height, broader leaves and less compact whorl (Sharma and Chatterji, 1972). The correlation studies for flag leaf angle and cholorophyll content index has significantly positive correlation with grain yield.

Plant height in relation to damage and egg mass showed a positive correlation and egg mass against the plant height also showed positive correlation (Table 4). The incidence was more when the circumference of stem was more and less in the genotypes with less circumference and showed a significantly positive correlation (r = +0.69). Auricle circumference and the intense of damage by the pink stem borer was significant and negative correlated (r = -0.76) which reveals that the maximum circumference leads to the less number of egg mass and the correlation for egg mass against auricle circumference showed significantly negative correlation (r = -0.91). The ligule length when correlated with eggmass showed a negative correlation. The upper blade pubescence against damage and egg mass revealed a significantly negative correlation (r = -0.79) and (r = -0.93) respectively. The penultimate leaf angle showed a significant and positive correlation for both damage (r = +0.66) and egg mass (r = +0.65) respectively. A significant positive correlation between damage (r = +0.52) and egg mass (r = +0.61) was observed. The PSB egg mass and damage were significant and positively correlated (r=+0.80).

Table 4: Correlation studies of biophysical traits with pink stem borer, S. inferens.

Biophysical traits	Biophysical attributes *vs.* damage	Egg mass *vs.* Biophysical attributes
Plant height	r = +0.08	r = +0.18
Stem girth	r = +0.69*	r = +0.79*
Auricle circumference	r = -0.76*	r = -0.91*
Ligule length	r = -0.08	r = -0.04
Upper blade pubescence	r = -0.79*	r = -0.93*
Penultimate leaf angle	r = +0.66*	r = +0.65*
Leaf area	r = +0.52*	r = +0.61*
Egg mass*vs.* damage	r = +0.80*	-

*Significant at p=0.05%

CONCLUSION

Screening of rice genotypes against pink stem borer concluded that the genotypes RG12, RG36, RG56, RG76, RG85, RG91 and RG188 showed nil dead heart damage whereas RG12, RG15, RG56, RG76 and RG188 recorded with nil white ear damage and categorized as highly resistant genotypes. The resistant genotypes identified were RG15, RG22, RG26, RG42, RG60, RG69, RG70, RG151, RG160, RG176, RG182 and RG190 at vegetative stage and during reproductive stage were RG22, RG34, RG42, RG91, RG160, RG176 and RG182. The biophysical characters *viz*., auricle circumference, stem circumference, upper blade pubescence and leaf angle influenced the resistant nature of the genotypes against pink stem borer (Fig. 1). These genotypes with resistant traits can be utilized for varietal improvement in the breeding programme for resistance against pink stem borer as a new emerging rice pest.

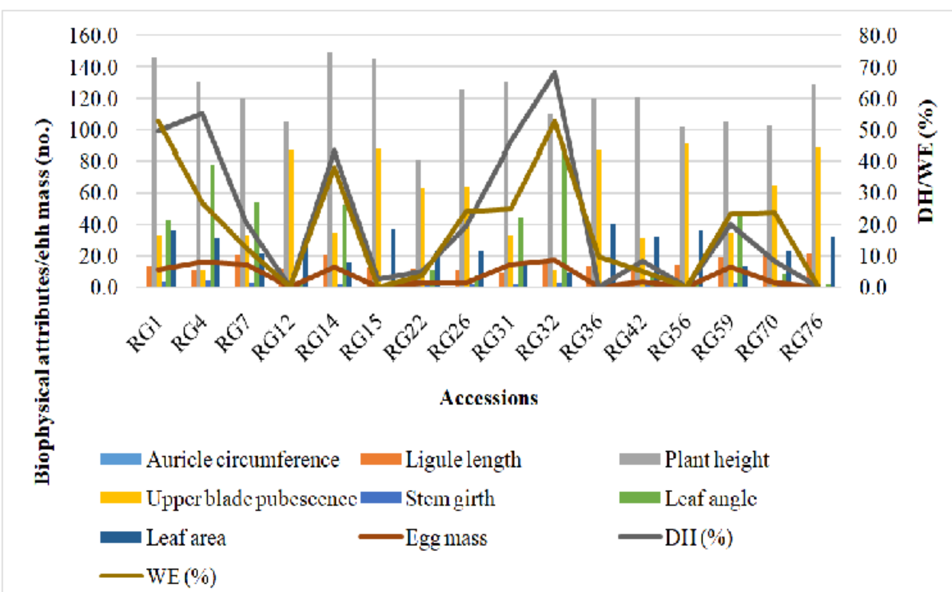

Fig. 1. Influence of biophysical attributes on the preference of pink stem borer, *S. inferens* on rice.

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Conflict of Interest. None.

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