



INSECT PESTS INFESTATION ON SOME PROMISING SUGARCANE CLONES UNDER NATURAL CONDITION IN BANGLADESH

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ABSTRACT

The experiments were conducted to observe the infestation of different insect pests on some promising sugarcane clones under natural condition. Considering different cropping seasons, the average lowest infestation was occurred by early shoot borer (1.33%) and the highest by rootstock borer (48.47%). The average infestation level of different insect pest on some promising sugarcane clones revealed that the lowest was by early shoot borer, black beetle, top shoot borer, stem borer (stalk), stem borer (internode), rootstock borer, mealy bug and scale insect in the clones I 212-11 (0.69%), I 198-11 (1.30%), I 106-11 (6.18%), I 106-11 (10.53%), I 131-10 (15.05%), I 106-11 (37.93%), I 103-10 (17.44%) and I 103-10 (2.36%), respectively. It was revealed that among the clones I 106-11 provided the best performance in respect of different major insect pest infestation, and this clone may be released as BSRI Akh 48 variety for commercial cultivation in sugarcane growing areas of Bangladesh.

Keywords: Promising clone, sugarcane, major pest, infestation

Introduction

Sugarcane is cultivated in about 26.0 million hectares, in more than 90 countries, with a worldwide harvest of 1.83 billion tons (FAO 2012). The yield of sugarcane is substantially reduced by different insect pest infestation. Pest infestation diminishes the cane yield as well as sugar production. According to an estimate, sugarcane production declines 20-25% by insect pests (Kumar *et al.* 2019). Avasthy (1983) mentioned that there was a considerable loss due to insect pest which was measured to about 20% in cane yield and 15% in sugar recovery. Yield loss of sugarcane is estimated to be 22-23% by early shoot borer (Patil and Hapase 1981), 12.29-43.67% by top shoot borer (Alam *et al.* 2006), about 43% by scale insect (Khanna 1957) and about 24.1% by mealy bug (Kalra and Sidhu 1964).

The farmers of Bangladesh unilaterally rely on using insecticides for controlling their insect pest that is hazardous to the environment and development of pest resistance. It is very difficult to develop a insect pest tolerant sugarcane variety due to long duration of 10-12 months perennial behavior of sugarcane. The average yield of cane was about 15.46 ton per acre during 2018-19 cropping season (Anonymous, 2020).

Screening advanced sugarcane clones against major insect pests is one of the tools for developing an insect resistant variety. For this purpose, different sugarcane clones were planted in the field to observe the natural pest incidence for consecutive three years. The aim of the study was to select a less insect pest infestation clone by evaluating ten promising sugarcane clones under natural field conditions.

Materials and Methods

The experiment was conducted for consecutive three years at Bangladesh Sugarcrop Research Institute (BSRI) farm, Ishurdi, and Regional Sugarcrop Research Station (RSRS), Madargonj, Thakurgaon from 2015 to 2018 in a RCB design with 3 replications. The plot size was maintained as 6m × 5m. In 2015-16 season, ten sugarcane clones namely, I 7-11, I 111-11, I 168-11, I 198-11, I 212-11, I 230-11, I 249-11, I 106-11, I 118-10 and Isd 39 were used as planting materials for ZYT (Zonal yield trial)-I. Then in 2016-17 cropping season the clones I 7-11, I 111-11, I 198-11, I 230-11, I 118-10, I 131-10 and Isd 39 for ZYT-II, and in 2017-18 cropping season I 103-10, I 7-11, I 111-11, I 230-11 and Isd 39 were used as planting materials for ZYT-III. These clones were collected from breeding division of BSRI. Planting was done in conventional sett placement in the trenches. Insect

and disease free two eyed setts were planted in the trench. Fertilizer application, irrigation, weeding, mulching, thinning and earthing up were done as per normal cultural practices. All the test materials were subjected to natural infestation. No pest control measure was applied during three cropping period. Data were collected on number of infested cane of different insect pest Early shoot borer (ESB), Top shoot borer (TSB), Stem borer (SB), Rootstock borer (RSB), Scale insect (SI) and Mealy bug (MB) etc. at the time of infestation period. On the other hand, white grub (WG) and black beetle (BB) number of pest population were counted per clump). The collected data on different insect pest were compiled and analyzed by statistical tool 'Statistix 10'.

Results and Discussion

Data revealed that early shoot borer infestation was not significant that was ranged from 0.52-1.60% (Table 1). Black beetle infestation ranged from 1.18-4.45% having the lowest (1.18%) infestation was found in I 198-11 followed by I 7-11 (1.23%), I 212-11 (1.32%) and I 249-11 (1.70%). Due to top shoot borer, infestation ranged from 9.71-28.83% having the lowest (9.71%) infestation was found in I 118-11 followed by I 106-11 (10.71%) with the highest (28.83%) in I 111-11. Stem borer (stalk), infestation ranged from 19.56-32.17% having the lowest (19.56%) infestation was found in I 7-11 followed by I 106-11 (19.68%) and I 118-11 (19.98%) with the highest (32.17%) in I 198-11. In case of stem borer internodes

basis infestation, infestation ranged from 23.04-31.54% having the lowest (23.04%) infestation was found in I 106-11 followed by I 118-10 (24.27%) with the highest (31.54%) infestation was found in I 212-11. Rootstock borer infestation ranged from 16.45-26.47% whereas the lowest (16.45%) infestation was found in Isd 39 followed by I 198-11 (18.09%) and I 111-11 (19.25%) with the highest (26.47%) infestation was recorded in I 212-11 followed by I 230-11. Mealy bug infestation ranged from 1.33-6.76%. The lowest (1.33%) mealy bug infestation was recorded in I 111-11. Scale insect infestation ranged from 16.57-21.24% and the lowest (16.57%) infestation was recorded in I 118-11 (Table 1).

It was observed that early shoot borer infestation was low and ranged from 0.47-1.70% in all the test clones (Table 2). The lowest (0.47%) infestation was observed in I 7-11. Black beetle infestation was ranged from 1.26-3.70% with the lowest (1.26%) infestation was recorded in I 118-11 and the highest (3.70%) infestation was observed in I 111-11. Top shoot borer infestation ranged from 1.45-5.50%, the lowest (1.45%) infestation was observed in I 230-11 with the highest (5.50%) infestation was in I 212-11. Stem borer (stalk) infestation ranged from 1.38-3.56% with the lowest (1.38%) infestation was found in I 106-11 followed by (1.54%) in I 230-11 and (2.01%) in I 168-11 with the highest (3.56%) infestation was found in I 198-11. In case of stem borer (internode), the lowest (7.96%) infestation was found in I 168-11 followed by (8.46%) in I 111-11 with the highest (15.20%) in I 249-11. Rootstock borer

Table 1. Infestation level of some major insect pests in promising sugarcane clones (ZYT-I), BSRI farm, Ishurdi, Pabna, 2015-2016

Clones	Infestation (%)							
	ESB	BB	TSB	SB (stalk)	SB(internode)	RSB	MB	SI
I 7-11	0.52b	1.23c	16.25bc	19.56c	24.43	21.09	4.78	21.24ab
I 111-11	1.16ab	1.84bc	28.83a	30.54ab	25.38	19.25	1.33	17.42c
I 168-11	1.04ab	1.96bc	24.63ab	30.91ab	24.49	23.03	3.56	19.28bc
I 198-11	0.67ab	1.18c	27.04ab	32.17a	29.13	18.09	3.36	18.99bc
I 212-11	0.66b	1.32bc	19.93abc	23.17bc	31.54	26.47	2.64	17.13bc
I 230-11	0.85ab	3.21ab	25.26ab	28.52ab	30.87	24.09	6.76	16.67a
I 249-11	1.24ab	1.70bc	27.47a	30.03ab	29.47	20.62	3.90	21.14bc
I 106-11	1.60a	4.45a	10.71c	19.68c	23.04	18.91	2.68	16.74bc
I 118-10	0.90ab	2.13bc	9.71c	19.98c	24.27	20.07	2.45	16.57bc
Isd 39	1.13ab	1.89bc	22.90ab	23.97bc	26.41	16.45	2.67	16.94bc
LSD	0.94	1.95	10.81	8.15	NS	NS	NS	2.82

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

infestation was very high which ranging from 49.40-87.36%. The lowest (49.40%) rootstock borer infestation was observed in I 212-11 with the highest (87.36%) in I 168-11. Mealy bug infestation ranged from 38.60-74.95%. The lowest (38.60%) infestation was found in I 106-11 whereas the highest (74.95%) infestation was recorded in I 111-11. The lowest (3.22%) scale insect infestation was observed in I 168-11 and there were no significant differences were observed among the test clones/ (Table 2).

Early shoot borer infestation was low and ranged from 0.98-2.19% in all the test clones. Black beetle infestation ranged from 1.48-2.50% and there was no significant difference among the test clones. Top shoot borer infestation ranged from 7.26-15.90% and there was also no significant difference among the test clones. Stem borer (stalk), infestation ranged from 13.10-30.06%. The lowest infestation (13.10%) was found in I 17-11 with the highest (30.06%) infestation was found in I 230-11. Due to stem borer (internode), infestation ranged from 11.41-24.12% having the lowest infestation (11.41%) was found in I 198-11 with the highest (24.12%) was recorded in I 118-10. Mealy bug infestation ranged from 22.30-50.46% having the lowest infestation (22.30%) was found in I 198-11 with the highest (50.46%) was recorded in I 131-10. Scale insect infestation ranged from 1.14-4.15% and there was no statistically difference among the treatment/clones.

Data revealed that early shoot borer infestation was low which ranged from 1.14-2.40% and there was no significant difference among the test clones. Black beetle

infestation ranging from 0.84-2.06% and there was no significant difference among the test varieties/clones. Top shoot borer infestation ranged from 5.03-10.71% with no significant difference among the test varieties/clones. Stem borer (stalk), infestation ranged from 2.86-6.71%, the lowest (2.86%) infestation was found in Isd 39 with the highest (6.71%) in I 131-10. Stem borer (internode), infestation ranged from 15.04-43.13% and there was also no significant difference among the test varieties/clones. In case of mealy bug, infestation ranged from 13.83-23.32% with no significant difference among the test clones. Scale insect infestation ranged from 4.89-9.43% and there was no statistically difference among the treatment.

It was observed that ESB infestation was very low and ranged from 0.61-2.05%. Black beetle infestation ranged from 1.51-2.89% and there was no significant difference among the test clones (Table 5). Top shoot borer infestation ranged from 17.64-32.68% with the lowest (17.64%) infestation was found in I 111-11 and the highest (32.68%) infestation was recorded in I 230-11. Stem borer (stalk) infestation ranged from 24.39-32.53% and there was no significant difference among the test clones/varieties. Similarly, stem borer (internode) infestation ranged from 34.81-46.80% and there was no significant difference among the test varieties/clones. Mealy bug infestation ranged from 17.83-36.04%, the lowest mealy bug infestation (17.83%) was recorded in I 111-11 clone where as the highest (36.04%) in I 230-11 clone. Scale insect infestation ranged from 1.43-2.52% and there was no statistically difference among the clones/varieties. Rootstock borer infestation ranged from 15.47-

Table 2. Infestation level of some major insect pests in promising sugarcane clones (ZYT- I), RSRS farm, Thakurgaon, 2015-2016

Clones	Infestation (%)							SI
	ESB	BB	TSB	SB (stalk)	SB (internode)	RSB	MB	
I 7-11	0.47b	1.34c	3.98	2.56	22.31a	83.66ab	46.96bc	4.08ab
I 111-11	1.70a	3.70a	4.16	3.29	8.46c	65.12abc	74.95a	5.04ab
I 168-11	1.01ab	3.11ab	2.40	2.01	7.96c	87.36a	55.39abc	3.22b
I 198-11	0.51b	1.27c	4.03	3.56	10.67bc	70.33abc	46.08bc	4.54ab
I 212-11	0.71b	1.62bc	5.50	1.54	10.04bc	49.40abc	49.24bc	3.98ab
I 230-11	1.25ab	1.76bc	1.45	1.88	9.18c	80.55c	58.69abc	4.91ab
I 249-11	1.10ab	2.38abc	4.69	2.68	15.20b	74.87ab	69.64ab	3.58ab
I 106-11	1.13ab	1.64bc	1.65	1.38	11.90bc	56.94bc	38.60c	9.57ab
I 118-10	0.59b	1.26c	2.84	2.07	15.43b	70.63abc	68.51ab	4.37ab
Isd 39	1.15ab	1.82bc	1.83	1.24	11.90bc	78.24ab	77.85a	17.69a
LSD	0.84	1.57	NS	NS	5.86	26.94	23.99	14.46

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 3. Infestation levels of some major insect pests in promising sugarcane clones (ZYT-II), BSRI farm, Ishurdi, Pabna, 2016-2017

Clones	Infestation (%)						
	ESB	BB	TSB	SB (stalk)	SB (internode)	MB	SI
I 7-11	1.48	1.78	7.26	13.10b	21.06ab	36.70ab	2.99
I 111-11	2.19	1.69	14.66	20.46ab	22.07ab	31.21ab	1.68
I 198-11	0.98	1.86	9.89	18.39ab	11.41b	22.30b	1.34
I 230-11	1.40	2.50	15.90	30.06a	21.93ab	31.32ab	1.49
I 118-10	1.42	1.58	14.82	16.30ab	24.12a	49.13a	4.15
I 131-10	1.48	1.48	14.41	16.44ab	13.99ab	50.46a	2.08
Isd 39	1.42	1.68	12.04	16.95ab	17.44ab	25.55ab	1.14
LSD	NS	NS	NS	14.73	10.84	26.47	NS

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 4. Infestation levels of some major insect pests to promising sugarcane clones (ZYT-II), RSRS, Thakurgaon, 2016-2017

Clones	Infestation (%)						
	ESB	BB	TSB	SB (stalk)	SB (internode)	MB	SI
I 7-11	1.14	0.84	6.10	5.34ab	15.76	16.91	7.31
I 111-11	2.25	1.72	9.76	6.25a	22.84	18.10	4.89
I 198-11	2.40	0.90	7.63	4.57ab	19.85	16.10	6.48
I 230-11	2.21	1.00	7.03	4.09ab	43.13	15.22	9.43
I 118-10	1.83	1.78	10.71	6.68a	32.51	13.83	8.28
I 131-10	1.33	1.33	5.89	6.71a	16.10	23.32	8.11
Isd 39	1.57	2.06	5.03	2.86b	15.04	15.69	8.27
LSD	NS	NS	NS	2.73	NS	NS	NS

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

20.89% and there was no statistically difference among the clones (Table 5).

Similar experiment was conducted with four clones and one standard at RSRS, Thakurgaon. Early shoot borer infestation was low and ranged from 1.27-2.52% and there was no significant difference among the test clones. Black beetle infestation was ranged from 3.27-8.84% and the lowest (3.27%) infestation was found in I 130-10. White grub insect was available only at RSRS, Thakurgaon during 2017-18. White grub infestation was low and ranging from 1.83-3.50% and there was no significant difference among the test clones/varieties. Top shoot borer infestation ranged from 5.91-19.84%, the lowest infestation (8.62%) was observed in I 111-11. Stem borer (Stalk) infestation was ranging from 4.88-16.14% and there was no significant difference among the test clones/varieties. In case of stem borer (internode), the lowest infestation (11.11%) was found in I 103-10 with the highest (32.92%) in I 7-11. There was no significant difference in mealy bug, scale insect and rootstock borer infestation among the test clones/varieties and ranged

from 9.11-21.78%, 2.75-4.34% and 78.87-94.00%, respectively (Table 6).

The average infestation level of different insect pest on some promising sugarcane clones revealed that the lowest early shoot borer, black beetle, top shoot borer, stem borer (stalk), stem borer (internode), rootstock borer, mealy bug and scale insect in I 212-11 (0.69%), I 198-11 (1.30%), I 106-11 (6.18%), I 106-11 (10.53%), I 131-10 (15.05%), I 106-11 (37.93%), I 103-10 (17.44%) and I 103-10 (2.36%), respectively (Table 7). On the other hand the average highest infestation of different major insect pest was observed by early shoot borer, black beetle, top shoot borer, stem borer (stalk), stem borer (internode), rootstock borer, mealy bug and scale insect in I 111-11 (1.91%), I 106-11(3.05%), I 103-10 (23.94%), I 103-10 (19.80%), I 230-11 (27.54%), Isd 39 955.76%), I 131-10 (36.89%) and I 106-11 (13.16%), respectively (Table 7).

It was found that the average infestation level of different insect pest on some promising sugarcane clones was found in three consecutive years that the early shoot borer, black

Table 5. Infestation levels of some major insect pests in promising sugarcane clones (ZYT-III), BSRI farm, Ishurdi, Pabna, 2017-2018

Clones	Infestation (%)							
	ESB	BB	TSB	SB (stalk)	SB (internode)	MB	SI	RSB
I 103-10	1.13ab	1.88	28.03a	32.53	35.73	20.00b	1.57	18.94
I 7-11	1.29ab	2.33	27.10ab	28.22	46.80	21.53b	1.49	18.88
I 111-11	2.05a	2.89	17.64c	24.39	34.81	17.83b	1.43	15.47
I 230-11	0.75b	1.51	32.68a	26.10	40.33	36.04a	2.52	15.76
Isd 39	0.61b	2.11	20.08bc	25.48	46.01	20.35b	2.19	20.89
LSD	0.96	NS	7.25	NS	NS	9.34	NS	NS

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect. Means within the same column followed by the same letter(s) are not significantly different at 5% level according to LSD test.

Table 6. Infestation levels of some major insect pests in promising sugarcane clones (ZYT-III), RSRS, Thakurgaon, 2017-2018

Clones	Infestation (%)								WG population/5 clumps/plot
	ESB	BB	TSB	SB (stalk)	SB (internode)	MB	SI	RSB	
I 103-10	1.27	3.27b	19.84a	7.06	11.11b	14.88	3.14	89.17	1.83
I 7-11	2.29	8.84a	17.64ab	9.98	32.92a	21.78	4.34	86.79	2.67
I 111-11	2.09	4.89ab	8.62ab	4.88	15.27b	12.39	2.75	78.87	2.33
I 230-11	1.98	6.65ab	19.11ab	16.14	19.79ab	9.11	4.04	90.17	2.67
Isd 39	2.52	5.69ab	5.91b	6.58	12.38b	11.59	3.69	94.00	3.50
LSD	NS	4.30	13.36	NS	14.41	NS	NS	NS	NS

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect. Means within the same column followed by the same letter(s) are not significantly different at 5% level according to LSD test.

Table 7. Average infestation level of different major insect pest of sugarcane in some promising sugarcane clones in the cropping season of 2015-2018

Clones	ESB	BB	TSB	SB(stalk)	SB(internode)	RSB	MB	SI
I 7-11	1.20	2.73	13.06	13.13	27.21	52.76	24.78	6.91
I 111-11	1.91	2.79	13.95	14.97	21.47	46.34	25.97	5.54
I 168-11	1.03	2.54	13.52	16.46	16.23	55.20	29.48	11.25
I 198-11	1.14	1.30	12.15	14.67	17.77	44.21	21.96	7.84
I 212-11	0.69	1.47	12.72	12.36	20.79	37.94	25.94	10.56
I 230-11	1.41	2.77	16.91	17.80	27.54	52.86	26.19	6.51
I 249-11	1.17	2.04	16.08	16.36	22.34	47.75	36.77	12.36
I 106-11	1.37	3.05	6.18	10.53	17.47	37.93	20.64	13.16
I 118-10	1.19	1.69	9.52	11.26	24.08	45.35	33.48	8.34
Isd 39	1.40	2.54	11.30	12.85	21.53	55.76	25.62	8.32
I 131-10	1.41	1.41	10.15	11.58	15.05	54.06	36.89	5.10
I 103-10	1.20	2.58	23.94	19.80	23.42		17.44	2.36

*ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect.

beetle, top shoot borer, stem borer (stalk), stem borer (internode), rootstock borer, mealy bug and scale insect infestation level was 1.33%, 2.34%, 13.25%, 14.33%, 22.37%, 48.47%, 26.62% and 7.68%, respectively (Table 8).

The finding at this study further revealed that the ESB infestation was significant during 2015-16 in both locations, whereas not significant in both locations during 2016-17 but significant at Ishurdi and not significant at Thakurgaon during 2017-18. In case of BB, the infestation was significant during 2015-16 but not significant during

2016-17 in both the locations. Whereas, significant at Thakurgaon but not significant at Ishurdi during 2017-18. TSB infestation was significant at Ishurdi but not significant at Thakurgaon during 2015-16, whereas not significant during 2016-17 in both locations. In 2017-18 cropping season it was significant in both locations. SB is a deleterious insect pest for sugarcane. It attacked stalk and internode. It significantly affected a stalk at Ishurdi during 2015-16 and at both locations during 2016-17. On the contrary, its effect was not significant at Thakurgaon

Table 8. The average infestation level (%) of different major insect pest considering two locations with three cropping seasons of 2015-2018

Locations	ESB	BB	TSB	SB(stalk)	SB(internode)	RSB	MB	SI
Ishurdi	1.18	2.01	19.42	23.95	27.49	19.87	18.03	9.37
Thakurgaon	1.48	2.68	7.08	4.70	17.26	77.07	35.22	5.99
Average (%)	1.33	2.34	13.25	14.33	22.37	48.47	26.62	7.68

*ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect.

during 2015-16 and at both locations during 2017-18. In case of infestation in internode of cane it was significant in both locations during 2015-16 and at Ishurdi during 2016-17 and at Thakurgaon during 2017-18. On the other hand, not significant at Thakurgaon during 2015-16 and during 2017-18 at both locations. RSB infestation was not significant at Ishurdi but significant at Thakurgaon during 2015-16. Meanwhile, in 2017-18 cropping season in both locations it was not significant. Mealy bug infestation was not significant at Ishurdi but significant at Thakurgaon during 2015-16 cropping season. On the other hand, it was significant at Ishurdi in 2016-17 and 2017-18 cropping season and not significant at Thakurgaon in 2016-17 and 2017-18 cropping season. Scale insect was significant in both the location during 2015-16 but not significant in the cropping seasons of 2016-17 and 2017-18. This investigation is the systematic observation of major insect pest of sugarcane to promising sugarcane clones under natural environment and the result are supported by the findings of Biswas *et al.* (2004) and Monowara *et al.* (2011).

Conclusion

Based on the findings of the study it was concluded that among the 10 sugarcane clones I 106-11 showed the best performance in respect of low infestation by different major insect pests, and this clone may be released as BSRL Akh 48 variety for cultivation by the farmers.

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