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Ovipositional Preference and Larval Survival of Maize Stem Borer, *Chilo partellus* (Swinhoe) on Different Trap Crops

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ABSTRACT

Four different trap crop plants *viz*, napier grass, sudan grass, sorghum and bajra were assessed for their potential role as a trap crop in the management of spotted stem borer *Chilo partellus* (Swinhoe) on maize. Oviposition preference and larval survival tests were conducted in screen house under semi controlled conditions. Results revealed that napier grass was greatly preferred for oviposition over maize but the larval survivability was very poor. The remaining test plants *viz*, sudan grass, sorghum and bajra were not much potential as trap crops for oviposition preference and also larval survivability was more when compared with napier grass.

Introduction

Maize (*Zea mays* L.) commonly referred to as "corn", is now the third most important cereal crop in the world. It is one of the most versatile crops having wider adaptability under varied agro-climatic conditions, cultivated on nearly 150 million hectares in about 160 countries that contributes 36 % (782 million tonnes) in the global grain production. One of the major obstacles for achieving higher yields in maize has been the attack of various insect pests. Maize stem borer, *C. partellus* (Swinhoe) (Lepidoptera: Crambidae) is one of the major pest, larvae feed on leaves and stem tunnelling on maize plants results in yield losses as a consequence of destruction of growing tip, early leaf senescence, interference with translocation of water, metabolites and nutrients, that results in plant stunting, stem breakage, lodging and direct damage to cobs. Wild host plants that are highly attractive for oviposition are used in habitat management system for *C. partellus* in East Africa (Khan *et al.*, 2000). Recent studies have shown that high grass diversity surrounding maize crop is important in *C. partellus* management (Mohamed *et al.*, 2004). These grasses either influenced as trap plants or they stabilized the system for both the pest and their natural enemies (Schulthess *et al.*, 2001). Hence screen house studies were conducted to determine ovipositional preference and larval survival of maize stem borer on different trap crops *viz*, napier grass, sudan grass, sorghum and bajra

Materials and Methods

Oviposition preference tests were conducted under no-choice and dual choice conditions in oviposition cages. The trap plants material was thoroughly examined for the non-existence of eggs or larvae before using them for oviposition preference studies.

No-choice test

In no-choice tests, 20-day-old potted plants of each trap crop were placed in the cage. The cages were kept under natural light conditions. A single moth pair, emerged during the preceding night, were allowed to oviposit for the next 48 hours on potted plants. This procedure was replicated ten times. Afterwards, the plants were removed from the cages and the data for number of egg batches per plant and number of eggs per each egg batch was recorded on each plant using 10X magnifying lens. Differences among different test plants with regard to egg laying under no-choice test, was analyzed by using one-way analysis of variance (ANOVA).

Dual-Choice Test

Dual-choice experiments were conducted to determine the oviposition preference of *C. partellus* moths, when presented with a choice between trap crop and maize. In these tests, two 20 day-old potted maize and trap crop plants were placed into each cage. Two moth pairs emerged during the preceding night, were introduced into the cage and allowed to lay eggs for 48 h. Dual-choice tests for maize and napier grass, maize and sudan grass, maize and sorghum, maize and bajra were conducted and each test was replicated ten times. Plants were removed from the cages and the data for number of egg batches per plant and number of eggs per each egg batch was recorded on each plant separately for maize and trap crop using 10X magnifying lens. Student's t-test was used to determine differences between maize and other trap crop plants tested with regard to number of egg batches, total number of eggs laid.

Per Cent Dead Hearts Caused by *C. partellus* on Different Trap Crop Plants

To assess the dead hearts percentage caused by stem borers, a total 200 pots were taken, out of which 40 pots were chosen for each trap crop variety including maize in the screen house. Seeds of each trap crop plants were sown and raised for 20 days where as in case of napier grass, field collected slips were used for planting. After 20 days, each pot is thinned leaving a single plant per pot and also napier grass slips were trimmed to the size of the remaining trap crop plants.

Black-head stage egg batches (25-30 eggs per batch) of *C. Partellus* were collected from the mass rearing unit and a single egg batch per plant was pinned in the central whorl of each potted plant. Neonate larvae emerged from egg batches immediately entered in to the leaf whorl and feed on growing point and cause dead hearts. Per cent dead hearts formed on different trap was calculated at 5, 10 and 15 days after release (DAR) of larvae. The percentage of dead hearts was calculated by using the following formulae

$$\text{Per cent dead hearts} = \frac{\text{No. of plants showing dead hearts}}{\text{Total No. of plants}} \times 100$$

Survival of *C. partellus* larvae on different trap crop plants

To find out survival percentage of stem borers on different trap crop plants, a screen house study was conducted with 200 pots in semi controlled condition. Forty pots were allocated to each trap crop variety including maize. These 40 pots were arranged in a set with four rows and each row with 10 pots. All the test plant seeds *viz*, napier grass, sudan grass, jowar, bajra and maize were sown in their allocated pots and raised for 20 days. After 20 days, each pot was thinned to a single plant per pot. Black-head stage egg batches were collected from mass rearing unit and a single egg batch with 25 eggs were pinned to the central whorl of each potted plant. Emerged larvae are allowed to feed on the plants. Data for larval survival was done by destructive sampling at 5, 10, 15 and 20 days after release. At 5 DAR of larvae, plants from first row pots in each set were uprooted and carefully destructed to count the live larvae. Likewise, destructive sampling for larvae was done at 10, 15, and 20 DAR for second, third and fourth row of potted plants respectively from each set of trap crop plants. Differences among per cent larval survival was analyzed using one-way analysis of variance (ANOVA).

Results and Discussion

No-choice test

Different trap crop plants tested for ovipositional preference for *C. partellus* showed significant difference in the number of egg batches per plant. More number of egg batches (3.70 ± 0.15) was recorded on napier grass than on the remaining test plants *viz*, sudan grass (2.30±0.15), sorghum (2.10±0.1), bajra (3.10±0.1) and maize (2.20±0.13) (Table 1). Likewise, napier grass was found to be with highest number of eggs per plant (259.80±13.36) than sudan grass (218.10±12.87), sorghum (233.70±11.92), bajra (224.20±8.32) and maize (242.10±16.22) (Table 1).

Dual-choice test

Results from dual-choice tests indicated that *C. partellus* female moths preferred to oviposit more number of egg batches and number of eggs per plant on napier grass (4.5±0.26 and 354.6±10.38) instead of maize (2.3±0.15 and 148.4±8.14). But the results from dual-choice test conducted between maize and bajra revealing that female moths preferred to oviposit more number of egg batches and number of eggs per plant on maize plants (3.9±0.35 and 349.5±8.60) than bajra (1.8±0.13 and127.3±8.66). However the dual-choice tests were found to be non-significant in case of maize and sorghum, maize and sudan grass (Table 2).

Per cent dead hearts caused by *C. partellus* on different trap crop plants

No dead heart damage was observed among all the treatments at 5 DAR of *C. partellus* larvae. The data at 10 DAR and 15 DAR clearly showed the dead heart damage as 80 and 100 per cent in case of sudan grass, 74 and 100per cent in case of sorghum, 60 and 86per cent in case of maize, 16 and 22 per cent in case of bajra. But in napier grass, no dead hearts were recorded at 10 and 15 DAR (Table 3).

Survival of *C. partellus* larvae on different trap crop plants

Destructive sampling at 5 DAR indicatedthat there was more number of larval survival on maize (18.60), sudan grass (18.20) and sorghum (17.60). Least number of live larvae was recovered from napier grass (4.50) and bajra (6.60).

Table.1 Ovipositional response of *C. partellus* to different host plants under no-choice test

T.No	Test plant	Number of egg batches per plant	Number of eggs per plant
1	Napier grass	3.70 ± 0.15 [c] (1.92)	259.80±13.36[b] (16.12)
2	Sudan grass	2.30±0.15[a] (1.52)	218.10±12.87[a] (14.77)
3	Sorghum	2.10±0.1[a] (1.45)	233.70±11.92[ab] (15.29)
4	Bajra	3.10±0.1[b] (1.76)	224.20±8.32[a] (14.97)
5	Maize	2.20±0.13[a] (1.48)	242.10±16.22[ab] (15.56)
	SEm±	0.04	0.04
	CD (P=0.05%)	0.11	1.14
	CV (%)	7.58	8.32

Values in parentheses are square root transformed values, the values in a column followed by the same letter are not significantly differed (LSD test; *P*=0.05)

Table.2 Ovipositional response of *C. partellus* to maize and other trap crop plants in Dual-choice test

T.No	Test plants	Number of egg batches on maize vs. other trap crop plant	Number of eggs on maize vs. other trap crop plant
1	Maize Napier grass	2.3±0.15* 4.5±0.26	148.4±8.14* 354.6±10.38
2	Maize Sudan grass	2.7±0.15 ns 2.4±0.16	258.6±5.17ns 231.3±5.43
3	Maize Sorghum	2.4±0.16 ns 2.3±0.15	256.9±4.57ns 236.3±3.61
4	Maize Bajra	3.9±0.35* 1.8±0.13	349.5±8.60* 127.3±8.66

The values in different treatment combinations in a column followed by an asterisk are significantly different (*P*= 0.05); ns- non significant by t- test.

Table.3 Influence of different trap crop plants on larval survival of *C. partellus*

T.No	Test plant	Larval survival at 5 DAR	Larval survival at 10 DAR	Larval survival at 15 DAR	Larval survival at 20 DAR
1	Napier grass	4.50 (2.12)[a]	0.50 (0.71)[a]	0.50 (0.71)[a]	0.50 (0.71)[a]
2	Sudan grass	18.20 (4.27)[c]	10.10 (3.18)[c]	5.80 (2.41)[c]	4.80 (2.19)[c]
3	Sorghum	17.60 (4.20)[c]	11.90 (3.45)[d]	8.80 (2.97)[d]	6.90 (2.63)[d]
4	Bajra	6.60 (2.57)[b]	3.90 (1.97)[b]	3.00 (1.73)[b]	2.50 (1.58)[b]
5	Maize	18.60 (4.31)[c]	14.90 (3.86)[e]	11.40 (3.38)[e]	10.20 (3.19)[e]
	SEm±	0.08	0.05	0.06	0.05
	CD (P=0.05%)	0.22	0.13	0.16	0.15
	CV (%)	7.06	5.42	7.98	8.22

Values in parentheses are square root transformed values, the values in a column followed by the same letter are not significantly differed (LSD test; *P*=0.05). DAR- Days after release

Similar trend was observed in larval survival at 10, 15 and 20 DAR *i.e*maize with highest larval number while no larval recovery in case of napier grass.

Results of the current study clearly reveal that napier grass was most preferred trap crop plant for oviposition by the adult *C. partellus* moth. This study corroborate the findings of khan *et al.*, (2006) and van den Berg (2006) who reported a significant preference for napier grass over maize for oviposition by *C. partellus*. Adult ovipositional preference for napier grass was most likely influenced by plant volatiles that they emit in to the environment. Study on larval survivability on different trap crop plants clearly indicating that napier grass was unfit for larval survival since there was no live larval recovery at 10, 15 and 20 DAR. These results are in support with the findings of Khan *et al.*, (2000) who ascribed the mortality of stem borer larvae on napier grass to sticky sap that is produced by the grass in response to penetration by first and second instar larvae. Larvae are trapped and die in the sticky fluid. Similar results were obtained by Hari and Jindal (2009), van den Berg (2006) who reported that napier grass was found to be unfavourable for larval survival though the adult moth prefere napier for oviposition.

Once the oviposition has taken place, the suitability of the host plant for larval feeding and development is one of the most important aspects of a trap crop plant. Poor larval survival and development are essential for a successful trap crop. The high preference of *C. partellus* moths for napier grass in this study indicates that moth select the most suitable site for egg survival but not necessarily for larval development. Hence it can be concluded that napier grass can be utilized as most effective trap crop in the management *C. partellus* on maize.

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