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# EFFECT OF PHEROMONE BLEND SOURCES AND LOADINGS ON SUGARCANE INTERNODE BORER MOTH CATCHES IN SRI LANKA

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**ABSTRACT**

**The internode borer, *Chilo sacchariphagus indicus* Kapur is an important moth borer on sugarcane in South Asia including India and Sri Lanka. Collaborative studies to evolve locally optimum sex pheromone trapping system for this pest were undertaken in Sri Lanka during 2019-20. The first study comparing alternative pheromone blend sources showed significant differences in moth catches, with the best source consistently attracting twice or more moths than the others. The next study on pheromone lure loadings showed non-significant differences in moth catches, clarifying the adequacy of the widely adopted loading (3 mg/ septa). While these findings could guide in adopting locally optimum blend source and loading for pheromone trapping of the borer moths, the scope of future R&D to further enhance the impact potential of pheromone-based mass trapping of sugarcane internode borer moths in Sri Lanka is indicated.**

**Key words:** Pheromone trap, sugarcane, *Chilo sacchariphagus,* internode borer, moth borer, sex pheromone, blend source, lure loading, insect sex attractant, IPM, Sri Lanka

Sugarcane is known to suffer significant loss in cane yield and sugar recovery due to the internode borer (INB), *Chilo sacchariphagus indicus* (Kapur) (Lepidoptera: Pyralidae) in India (Sithanantham, 2006) and in Sri Lanka (Wanasinghe et al., 2019). While past research on INB in Sri Lanka has covered action thresholds for local control decisions (Senavirathne et al., 2001), locally available chemical insecticide use options (Kumarasinghe, 2008), and the potential for using borer tolerant genotypes (Fernando et al., 2004), the scope for pheromone-based trapping has not yet been examined locally. In India, the two major sex pheromone components emitted by females of internode borer had been identified as- Z-13-18Ac and Z-13-18OH and their synthetic blend in 7:1 ratio was found to be superior for attracting native males in India (David et al., 1985), while the scope for sex pheromone-based trapping for monitoring and mass trapping of this borer has been well documented (Mukunthan et al., 2003). The presently reported collaborative studies are on relative attractiveness of sex pheromone blend sources/ loadings available from India as tools for enhanced trapping efficiency for INB moths in Sri Lanka whose results are summarised herein.

## MATERIALS AND METHODS

The field studies were taken up in Sri Lanka in sugarcane fields at Siyambalanduwan Ethimale and Hingurana during October-November, 2019. For each location about 1 hectare area crop of the same age (4 months) and the variety- SL 96 128 was chosen. The crop was grown as per recommended crop management practices, but without application of insecticides so to ensure adequate INB infestation for the evaluations.

**Study 1. Pheromone blend sources testing:** The synthetic pheromone of *C. sacchariphagus indicus* (consisting of Z,13-octadecenyl acetate and Z,13-octadecenol) available in 7:1 blend ratio from three blend sources in India (A,B,C) were secured through collaboration with Sun Agro Biotech Research Centre (SABRC), Chennai. All three sources were dispensed at 3 mg loading/ rubber septa lure, and compared between common septa source (a) versus individual commercial source (b) for each. The following six treatments were compared for field attractancy: T1. Source-A.a (common septa); T2. Source-A.b (individual septa); T3. Source-B.a (common septa); T4.Source-B.b (individual septa); T5. Source-C.a (common septa); and T6. Source-C.b (individual septa).

**Study 2. Pheromone loadings testing:** The pheromone blend with 7:1 ratio was compared in six different loadings (mg/ septa), using common rubber septa dispensers and dispensing method. The following six loadings were compared: T1. Loading-3 mg/ septa; T2. Loading-5 mg/ septa; T3. Loading-6 mg/ septa; T4. Loading-7 mg/ septa; T5. Loading-8 mg/ septa; and T6. Loading-10 mg/ septa.

In both the locations, the comparison treatments were kept in delta traps and placed at 20 m inter-distance between them in each of four replications. The treatment positions in each replication were assigned at random initially and also interchanged at random within the replication after each weekly count of moths to minimise position effect during the total observation period of four weeks. The moth catch data were subjected to ANOVA as per Gomez and Gomez (1968).

## RESULTS AND DISCUSSION

The results of the two field studies are summarised as follows:

**Selecting more attractive pheromone blend source:** The results are summarised in Table 1. The treatment differences in moth catches were highly significant, also differing between weeks significantly, while interaction between treatments and weeks was minimally significant. The week-wise pattern of relative moth catches showed that the more promising blend (T1) source (A.a) tended to be consistently superior (Table 1, 2). The mean moth catch in this treatment was nearly twice that of next ranking source (C), while being about four times than the other treatments compared.

Table 1. ANOVA results from two locations (pooled data)

| Factors | Significance | C.D | F value |
|---|---|---|---|
| Treatments (6) | ** | 1.53 | 7.47 |
| Weeks (4) | ** | 1.25 | 14.12 |
| Treatments x weeks | * | 3.06 | 2.47 |

**= Significant at p=0.01; *= Significant at p=0.05; C D=Critical difference (p=0.05)

Table 2. INB Moth catches for six pheromone sources (pooled data)

| Treatments (blend source vs. lure type) | Week 1 | Week 2 | Week 3 | Week 4 | Mean |
|---|---|---|---|---|---|
| T1 (A.a) | 10.60 | 4.00 | 3.40 | 0.20 | 4.55 |
| T2 (A.b) | 1.80 | 0.40 | 0.40 | 0.40 | 0.75 |
| T3 (B.a) | 2.60 | 0.80 | 1.00 | 0.60 | 1.25 |
| T4 (B.b) | 0.00 | 1.40 | 1.20 | 0.00 | 0.65 |
| T5 (C.a) | 4.40 | 2.80 | 3.40 | 0.20 | 2.70 |
| T6 (C.b) | 6.40 | 1.60 | 2.00 | 0.00 | 2.50 |
| Overall mean | 4.30 | 1.83 | 1.90 | 0.23 | 2.07 |

Blend Source: 1-A; 2-B; 3-C; Lure type-a: common source; b: individual source

**Comparing different pheromone loadings in lure:** The study on six loadings in the lure showed non-significant differences. The mean catch/ week was 2.55/ trap, and the respective mean weekly catches for the six loadings (3,5,6,7,8 and 10 mg/ lure) were 2.25, 2.58, 2.28, 2.10, 2.30 and 3.78. While moth catch differed significantly between weeks, the interaction between treatments and weeks was insignificant, indicating that the overall trend of relative ranking among the treatments did not seem to vary across the weeks. These data confirm the consistency in lack of significant differences in catches between the loadings tested. Thus, widely adopted loading (3 mg) appeared adequate.

The main outcome from this study is the identification of a more promising pheromone blend (Z-13-18Ac: Z-13-18OH) source (T1) which caught significantly and consistently more male moths among the alternative blend sources availed from India. This result has created a critical knowledge base in Sri Lanka on promising pheromone blend source to attract male moths of *C. sacchariphagus* in the field, and so could be deployed for monitoring or mass trapping of the borer populations in Sri Lanka. This result is comparable in utility to the earlier field attractancy studies in India on the same two female pheromone components (Z-13-18Ac: Z-13-18OH) in a blend ratio of 7:1 by David et al. (1985). The present findings are also in agreement with the findings in Mauritius populations of *C. sacchariphagus* (Nesbitt et al., 1980) wherein the same blend in 7:1 ratio was superior in field attraction to males and comparable in attractancy to the native virgin females.

The apparent consistent superiority of the selected pheromone blend source (A.a) observed from the present four week duration of study, along with the benefit from dispenser choice could guide in availing more efficient blend-dispenser combination for future use locally. The utility of such testing of alternative commercial blends for local optimization of pheromone trap catches has been well documented for the globally invasive pest the fallarmy worm *Spodoptera frugiperda* (J E Smith), wherein strain differences in blend ratios are known (Andradea et al., 2000; Malo et al., 2001).

Further, the present results on loadings indicate lack of significant differences between loadings tested. It could be recommended that the currently widely adopted loading of 3 mg could be used for season-long trapping of this borer in Sri Lanka. These results are comparable to lure dispenser comparison studies for this borer by Manikandan et al. (2014), as basis for their cost-competitiveness. The present findings also provide a basis to promote pheromone-based trapping for local monitoring of the borer in Sri Lanka, which is already recommended elsewhere by Way et al. (2003) as a low cost option due to ease of operation, and sensitivity at low population levels. This is being already adopted for monitoring the population dynamics of this borer in India (Chatterjee et al., 2007).

Further R&D on pheromone-based mass trapping (Beevoor et al., 1990) and integration with *Trichogramma*-based biocontrol (Bhavani et al., 2016) could help evolving more holistic pheromone-based trapping technology for this borer, as proposed earlier for sugarcane borers in India by Mukunthan et al. (2003).

The present findings of identifying the more promising pheromone blend source from India and the adequacy of 3 mg loading/ lure can provide an interim basis for local pheromone trapping needs in Sri Lanka. There is scope for further collaborative R&D on intraspecies diversity of pheromone blend ratio pattern of native female populations and the response scenario of local male populations to alternative blend sources/ ratios/ loadings in major agroecologies of sugarcane cultivation towards more robust pheromone-based trapping technology as key components for biointensive IPM for this borer pest of sugarcane in Sri Lanka.

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