SUGARCANE MOTH BORERS IN THE SOUTHEAST REGION OF VIETNAM

Introduction

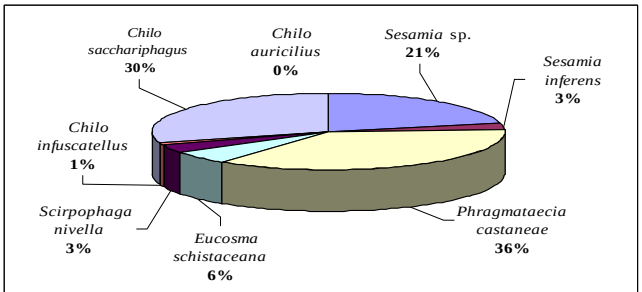
The complex of insect pests is the most important factor limiting sugarcane production in the Southeast Region of Vietnam. Of the different pest complexes, the sugarcane moth borers are considered as the most important pests. Many sugarcane moth borers have been defined in the Southeast Region, such as internode borer, pink borer, purple bore, eye bud borer, top borer, etc… Among them, *Chilo sacchariphagus*, *Phragmataecia castaneae* and *Sesamia* sp. have been the key pest species and caused heavy damage, which occurs in many areas of sugarcane fields in the Southeast Region of Vietnam. Sugar cane yield loss was estimated 20 – 40% due to them annually (Do Ngoc Diep, 2005).

The biological behaviors of *Chilo sacchariphagus*, *Phragmataecia castaneae* and *Sesamia* sp., were studied, and then survey and evaluation of their associated parasites could suggest possible solutions how to manage or control them. The results obtained from this study will be used as the basis for the development of an integrated pest management for these sugarcane moth borers in the Southeast region of Vietnam in coming years.

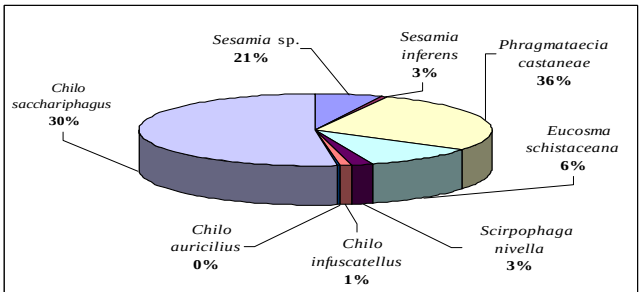
The composition species of sugarcane moth borers and their natural enemy insects in the Southeast Region of Vietnam

The composition of this complex varies in different sugarcane-growing areas of the region. It includes eight species, belongs to four entomology families (Pyralidae: 4, Noctuidae: 2, Cossidae: 1, Eucosmidae: 1), they are a shoot borer *Chilo infuscatellus* Snellen, an internode borer *Chilo sacchariphagus* Bojer, a stalk borer *Chilo auricilius* Dudgeon, a top borer *Scirpophaga nivella* Fabricius, a purple borer *Phragmataecia castaneae* Hubner, a big pink borer *Sesamia* sp., a small pink borer *Sesamia inferens* Walker, and an eye bud borer *Eucosma schistaceana* Snellen. Among them, *Chilo sacchariphagus*, *Phragmataecia castaneae* and *Sesamia* sp. are the most dangerous species, both total number of individuals and stalks infested calculated in percentage (Fig 1 and 2).

We have defined 37 species of natural enemies to the insect pest group. They compose of 21 parasitoids and 16 predators. Among them, an egg parasitoid *Trichogramma chilonis* Ishii, a larval parasitoid *Cotesia flavipes* Cameron, a pupae parasitoid *Tetrastichus howardi* Olliff, and striped ear-wig predator *Euborellia annulipes* Lucas are the most important natural enemy species of sugarcane moth borers in the Southeast Region of Vietnam. Those can be used in augmentative biological control program for sugarcane moth borers in the future.



Picture 1. Total number of individuals in percentage of 8 sugarcane moth borers species



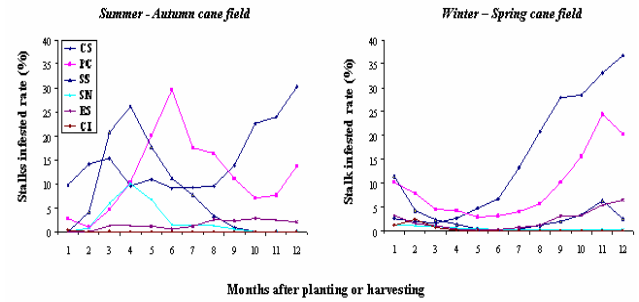
Picture 2. Total number of stalks infested in percentage of 8 sugarcane moth borers species

Occurrence and damaged rule studies

We have studies and defined the development of stalks infested rate (%) of sugarcane borers through 12 months after planting or harvesting in

Summer – Autumn and Winter - Spring cane field (Fig 3). In Summer – Autumn, *C. sacchariphagus*, *E. schistaceana* often occurred and severely damaged at the end of the season; *P. castaneae*, *Sesamia sp.*, and *S. nivella* often severely damaged at the mid of the season; but *C. infuscatellus* only at the beginning of the season. Meanwhile, in Winter - Spring, *C. sacchariphagus* occurred and severely damaged at the end of the season; *P. castaneae, Sesamia sp.* and *E. schistaceana* at the beginning and the end of the season, but *C. infuscatellu* and *S. nivella* often severely damaged at beginning of the season.

A correlation equation between internode infested rate by sugarcane borers and cane yield decreasing was stimulated as y = –4.5004 + 0.5673x, with the relative coefficient r = 0.9489** [$r_{(n=10,\ =0.01)}$ = 0.716 > 0.7], demonstrated a very close correlation at probability of 99% (Fig 4). A correlation equation between percentage of cane stalk length in red rot colour (y) and CCS% (x) is y =11.916 - 0.0972x, with relative coefficient r = 0.90989** [very close correlation, at probability of 99% - Fig. 5].



Remarks: *Abbreviation: SS (Sesamia* spp.*), PC (Phragmataecia castaneae), CS (Chilo sacchariphagus), CI (Chilo infuscatellus), ES (Eucosma schistaceana), SN (Scirpophaga nivella).*

Figure 3. Developing of stalks infested rate of Sugarcane borers in Summer – Autum and Winter - Spring cane field

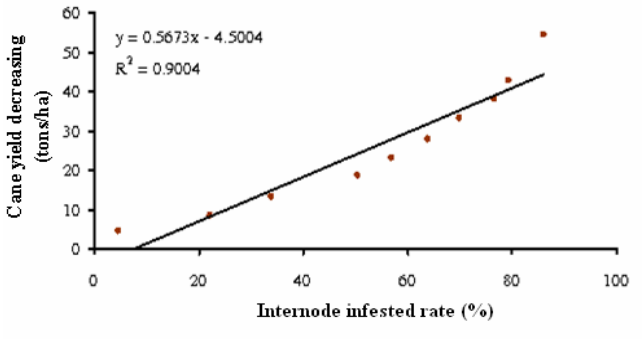


Figure 4. Correlation between internode infested rate by sugarcane borers and cane yield decreasing

In addition, we have also defined that internode infested rate by sugarcane borers of 10% is a temporary damaged threshold index of sugarcane production in the Southeast Region at present. It means that if internode infested rate by sugarcane borers in this area develop over 10%, it is reliably solid that the cane yield will be lost significantly (Fig 6).

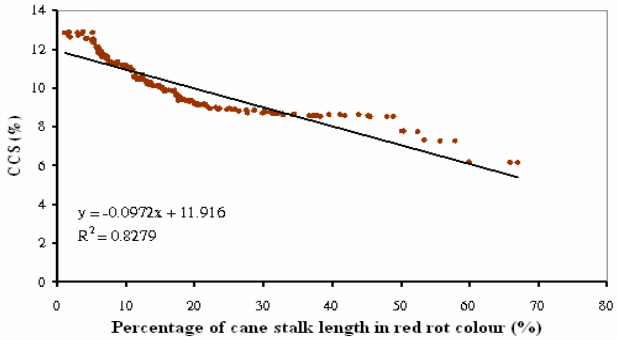
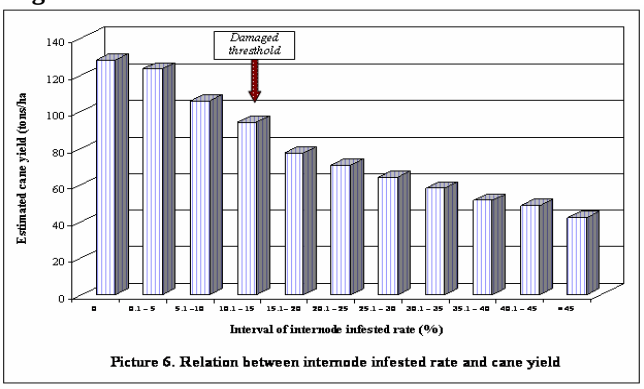


Figure 5. Correlation between percentage of cane stalk length in red rot colour and CCS



Picture 6. Relation between internode infested rate and cane yield

Biological and ecological studies

Table 1 indicated some basic biological characteristics of three major sugarcane borers at room temperature. It is obvious that the developmental periods of purple borer *P. castaneae* is the longest, with 8 larval instars, while developmental periods of internode borer *C. sacchariphagus* is nearly the same big pink bore *Sesamia* sp., with 5 larval instars.

Table 1. Developmental periods of *C. sacchariphagus, P. castaneae* and *Sesamia* sp.

Stage of development	Developmental period (days)		
	C. sacchariphagus	*P. castaneae*	*Sesamia* sp.
Egg	5.1 ± 0.47	10.6 ± 0.60	5.4 ± 0.74

Larvae	28.2 ± 2.76	63.3 ± 2.40	28.8 ± 3.17
Pupae	7.6 ± 1.33	13.9 ± 1.0	9.1 ± 1.83
Adult	2.0 ± 0.21	3.3 ± 0.23	4.4 ± 0.87
Total life cycle	*44.7 ±3.54*	*97.4 ±3.7*	*47.2 ±4.16*
No. of larval instars	5	8	5

We have conducted experiment to investigate periodically in some fixed cane field and defined the annual population dynamics of *C. sacchariphagus*, *P. castaneae* and *Sesamia* sp. in Figure 7.

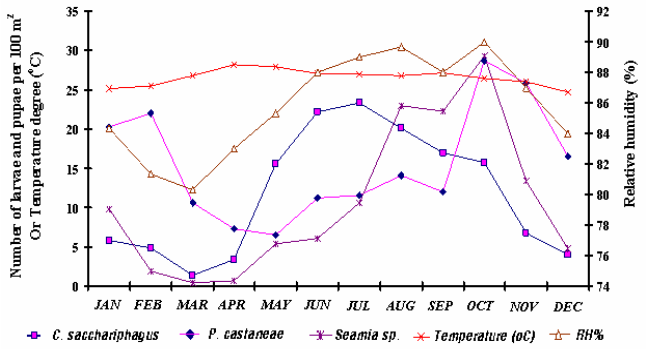


Figure 7. Annual population dynamics of *C. sacchariphagus* , *P. castaneae* and *Sesamia* sp.

Figure 7 has indicated that the population of *C. sacchariphagus* and *Sesamia* sp. in the cane field through the year closely depended on the relative humidity of atmosphere, they are stimulated through a correlation equation y = –168.65 + 2.1009x for *C. sacchariphagus* (y = number of larvae and pupae per 100 m^2, x = RH%), with relative coefficient r = 0.8508** [> 0.7 > $r_{(n=12, \ = 0.01)}$ = 0.658]; and a correlation equation y = – 195.85 + 2.4057x for *Sesamia* sp., with relative coefficient r = 0.8205** [> 0.7 > $r_{(n=12, \ = 0.01)}$ = 0.658]. Both exhibited very close correlation, significant at probability of 99%. While the population of *P. castaneae* depend closely on the temperature of atmosphere, it is expressed through a correlational equation y = 137.17 – 4.575x, with relative coefficient r = 0.668** [> $r_{(n=12, \ = 0.05)}$= 0.497], significant at probability of 95%.

Light trap

We have studied and found that light trap is only an effective control method for purple borer *P. castaneae*. The result of our studies has indicated that we can catch and skill 4.43 moths/trap/night if we do from April to September in lunar calendar. This method is not significant effective

Pest Management

Varietal resistance

VN85-1427, VN84-422 and K84-200 are considered as the best resistant varieties to sugarcane moth borers among 10 experimental varieties. Meanwhile, ROC16, ROC1 and R570 are the most susceptible for sugarcane moth borers in the Southeast Region.

Mass rearing and releasing of Trichogramma

We have mass reared and conducted an experiment on releasing of *Trichogramma chilonis* for control of egg of sugarcane moth borers such as *C. infuscatellus*, *C. sacchariphagus*, etc…the result has indicated that releasing 50,000 adult wasps/ha/week from 4^{th} moth to 11^{th} moth after planting is going to have the highest effective control, and the highest benefit for farmer with 1.356 to 2.7 million VND/ha.

Cutting of stem infested and insecticide application

We have organized and studied on an farmer trial in the cane field with five treatments include: (i) Cutting of infested shoot or stem periodically 2 times/month; (ii) Spot spraying of solution or spreading of granual common insecticide (such as diazinon, cartap,…) periodically 2 times/month from 4^{th} – 6^{th} month after planting, only on stem or clump infested, not on whole area; (iii) Spraying or spreading insecticide on whole area of cane field; (iv) Combined treatment "i" and "ii"; and the check control. The result of this trial showed that combined treatment (treatment "iv") is the best effective control method for sugarcane moth borers in the Southeast Region at present, the benefit of this method is more than 2.5 million VND. It means that if we do to control following this method, we can save not only a lot of insecticides, but we can let some free insecticides space for natural enemies living and developing.

for control of internode borer *C. sacchariphagus* or pink borer *Sesamia* sp.

Conclusions

There are 8 sugarcane moth borers often occurred and damaged in the Southeast Region of Vietnam. Among them, the internode borer *Chilo sacchariphagus*, the purple borer *Phragmataecia*

castaneae and the big pink borer *Sesamia* sp. are the most dangerous pests.

Biological and ecological characteristics and control method were studied to establish an effective system of IPM methods for this dangerous pest group in the future.

At present, we recommend to apply some effective control methods for sugarcane moth borers in the Southeast region of Vietnam are: (1) planting some high resistant varieties VN85-1427, K84-200; (ii) mass rearing and releasing *Trichogramma chilonis* at 50,000 wasps/ha/week from 4^{th} – 11^{th} after planting; and (iii) cutting of stem infested periodically 2 times/month, combining with spot applying common insecticide periodically 2 times/month from 4^{th} – 6^{th} month after planting.