8. ECOLOGY OF RICE STEM BORERS IN THE PHILIPPINES

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Introduction

Yield loss of rice due to rice stemborer infestation has reached alarming proportions. In the Philippines alone our loss is conservatively estimated at about 23 million cavans of palay per cropping season from our 3 million hectares of rice land. Because rice stemborers occur regularly, and infest the rice plant from seedling stage to maturity their importance is well recognized particularly in the rice growing areas in the Far East.

There are five species of rice stemborers in the Philippines, four belonging to the family Pyralidae; striped stemborer—*Chilo suppressalis* Walker, yellow stemborer—*Tryporyza incertulas* (Walker), white stemborer—*Tryporyza innotata* (Walker), and *Chilotraea polychrysa* (Meyrick) and one belongs to the family Noctuidae, pink stemborer—*Sesamia inferens* Walker. Of these five *Chilotraea polychrysa* was reported only in 1966 by Dr. Pathak. It was suspected that this species is always confused with *Chilo suppressalis* which it closely resembles.

Relative Abundance and Seasonal Occurrence

The most predominant and widely distributed species in the Philippines are *Tryporyza incertulas* and *Chilo suppressalis* which are found in all rice-growing provinces. The pink stemborer, *Sesamia inferens* is also distributed throughout the Philippines. It is prevalent in irrigated areas during the dry cropping season in some provinces at certain stage of the rice crop. Calora *et al.* (1968) observed that in the province of Nueva Ecija rice planted on irrigated fields during the month of January became heavily infested with *Tryporyza incertulas* at a very early stage of the plant, and with *Sesamia inferens* one month later. The white stemborer, *Tryporyza innotata* has limited distribution being found mainly in the province of Iloilo and Cebu and to a very limited extent in Cagayan, Leyte and Cotabato.

The distribution of *Chilotraea polychrysa* has been studied in Luzon by Kamran and Raros (1968). Although found in almost all the provinces in Luzon, it is always the least abundant of the species. Cendaña and Calora (1964) consider climatic type as a factor influencing the relative abundance of borer species; while the findings of Kamran and Raros (1968) are to the contrary. It must be pointed out, however, that while climatic types in the various regions in Philippines apparently play no decisive role in influencing the relative abundance of borer species, it is definitely certain that in areas where there is a pronounced dry season *Tryporyza incertulas* will always predominate over *Chilo suppressalis*.

In a study conducted by Calora and Ferino in 1963–64 at the Central Experiment Station of the U.P. College of Agriculture on the monthly fluctuation of infestation of rice stemborers it was found that the monthly average infestation indicates three peaks of abundance throughout the year. The first peak which was quite high took place during the month of November, 1963. The initiation of this outbreak apparently took place in September (1963), gradually increasing up to its peak in November. From

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this period the infestation receded to the month of February, 1964 after which a slight increase (second peak) was again noted in March. The third peak was a relatively low one compared with the first, but considerably higher than the second. It was initiated in May and reached it height in the month of June (1964). From this month (June) infestation tapered down then the infestation gradually increased and the peak taking place in the month of November becme evident.

Onset of Borer Infestation

The onset of borer infestation varies from region to region and from season to season. Certain studies refute the general assumption that the borers attack the rice plant from its seedling stage up to maturity. It has been shown that infestation can start severely at the seedbed, after transplanting up to maturity, and in some cases only between the 5th to the 8th week after transplanting, (Andres and Calora 1962, Calora and Ferino, 1968). This finding indicates that the timing of pesticide application in any region or season is dependent upon the characteristics of borer infestation.

Effect of Climatic Factors on the Occurrence of Rice Stemborers

The influence of climate on the seasonal abundance of the insect pests is frequently difficult to determine. This influence may be direct as is apparently the case of the aestivating lepidopterous pupae, or indirect as seen in the growth conditions or seasonal abundance of natural enemies. However, the most explosive outbreak of insect pests appears to take place during the rainy season (Uichanco, 1953).

The latter observation was confirmed in an experiment conducted by Calora and Ferino (1968). Although rice stemborer infestation was generally observed to be higher during the rainy months of the year, in this experiment, no clear relationships were shown by any single factor of the environment such as relative humidity, temperature and rainfall, and the incidence of rice stemborers. This being the case, Uichanco (1926) appears justified in his observation that such a condition is apparently the result of the reaction of the organism with the complex interrelated factors and overlapping factors in the environment.

Some Aspects of the Biology of the Borers

Eggs—The eggs of rice stemborers are laid in mass, either on the leaves or on the loosened leaf sheath of the rice plant. *Tryporyza incertulas* and *T. innotata* lay their eggs near the tip of the leaf blades; *Chilo suppressalis* and *Chilotraea polychrysa* lay theirs mostly on the basal half of the leaves or occasionally on the leaf sheath and *Sesamia inferens,* in between the loosened leaf sheath and the stem.

The egg masses of *Tryporyza incertulas* and *Tryporyza innotata* are covered with short, pale orange brown felt-like hairs from the anal tufts of the female months; those of *Chilo suppressali, Chilotraea polychrysa* and *Sesamia* inferens are not covered.

Larvae—The newly hatched larvae of rice stemborers usually feed on the epidermis of the leaf blades. Some suspend themselves with a silken thread and swing with the wind to land or migrate to other plants. Some larvae crawl to the upper part of the plant where they stay for a short period, then travel down into the leaf sheath preparatory to entering into the stalk.

The larvae of *Tryporyza incertulas* and *T. innotata* are not gregarious. In most cases only one larva could be found in each tiller but it transfers from one tiller to another. In transferring it webs the margin of the leaf blade into a tube, enclosing itself inside. Then it detaches itself from the leaf, and use the tube as a boat. In maturing plants, however, once the larva is inside the stem, it does not leave anymore. It bores downward along the stem as it grows until it reaches the base of the stalk.

The larvae of *Chilo suppressalis* are gregarious only during the first three instars; they disperse during the later instars. It has been observed that if the early instars are isolated from each other their mortality is high, crowding during the later instars results in high mortality.

The newly hatched larvae of *Sesamia inferens* do not come out to the surface of the plant. Because the eggs of this species are laid between the leaf sheath and the stalk, the larvae conveniently feed on the leaf sheath and later bore into the stalk. Although often solitary, they may stay together in the same plant in small numbers during the early stage. The larvae of this species feed heavily on the growing points of the plant.

In the Philippines, under optimum condition the larval periods of the rice stemborers are as follows:

C. suppressalis	16 to 44 days
T. incertulas	60 to 66 days
T. innotata	20 to 34 days
S. inferens	14 to 58 days

There were six larval instars for *C. suppressalis* and *Sesamia inferens* and seven for *T. incertulas*. Since *T. innotata* and *T. incertulas* have similar life histories, they probably both undergo seven larval instars.

Pupae—Pupation in rice stemborers usually takes place in the stem, straw or stubble. *Sesamia inferens* occasionally pupates between the leaf sheath and stem and sometimes in between the tillers. Before pupation, the full grown larvae construct exit holes in the internodes through which the emerging moth escapes. *Chilo suppressalis* larvae pupate without cocoons but *T. incertulas* larvae are covered with tubular whitish silken cocoons and their anterior extremities are attached to exit holes.

Adult—The adults of most stemborer species are nocturnal, positively phototactic and strong fliers. Rowan (1923) observed that *T. incertulas* adults began to become active at subdown. The direction of their flight was towards the center of the rice field, where they alighted on the upper surfaces of the leaves. Oviposition took place during this time. The activities of the moths began to lessen at dawn when their flights were long and directed towards the dikes or towards thick grasses near the borders of the field. After sunrise they remained hidden either under the thick leaves of the rice plant or among grasses. *Chilo suppressalis* is also nocturnal and during the daytime they hide among grasses. The positive phototactic behavior of these species was utilized in earlier year to control them by light trapping. However, it was recorded that even with 80 light traps per hectare, only 50 per cent of the moth population could be attracted to light.

Since different broods of rice stemborer moths overlap, moths are collected throughout the year. There were two peak periods of *T. incertulas* moth abundance, the first occurring from August to December and the second from March to May. The moths were fairly abundant from January to March and least in June to July. Correlation of the peak periods with the development period of the pest (80 to 85 days) indicated that *T. incertulas* caterpillars must have been most abundant in the field from June to October, 1960 in the first peak and from October to February in the second peak. The overlapping broods of *Chilo suppressalis* adults are also reflected in the light trap catches. Although *C. suppressalis* moths may be found in any month of the year, there were also two peaks of abundance, the first from November to December and the second, from April to May. On the basis of the total developmental period (average of 47 days) of the pest, *Chilo suppressalis* larvae must have been in the field from late September to November for the first peak and from late February to April for the second peak.

Mating in most species of rice stemborers generally occurs between 7 to 9 p.m. Padilla recorded in 1966 that females of *Chilo suppressalis* and *Sesamia inferens* were by nature multimated while those of *T. incertulas* and *T. innotata* mated only once. In laboratory tests using varying sex ratios of *C. suppressalis,* individual females and males mated as many as four and eight times respectively. It was also found that male moths were strongly attracted to virgin females, the attraction being maximum on the evening of its emergence but declining in subsequent days. In bait traps in the field, virgin females used as bait attracted several wild males. No moths of either sex, however, were attracted to unbaited traps or to traps containing male moths.

Oviposition of most stemborers species occurred in the evening. In *Chilo suppressalis* there was a preovipositional period of one to two days. While unmated females also laid eggs on the average they laid less than those mated. The peak of oviposition usually occurred on the first day after mating. In *T. incertulas,* female moths deposited only one egg mass per night and oviposition occurred up to five nights from emergence. It took the females 10 to 35 minutes to complete oviposition.

The relative abundance of species of rice stemborers, the seasonal fluctuation of infestation and other characteristics of the borers in the various regions in the Philippines are interesting subject to study. So far we only know that the species composition varies from region to region depending upon cultural practices, the stage of the rice crops at which observation is made and to a certain extent the climatic conditions. The expansion of the irrigation system and the gradual production of short season varieties are gradually changing the cultural practice in the Philippines. These factors will affect the balance of insect population. We are all aware that the shift of the predominating species from year to year, and at any one stage of the rice plant will affect insect control procedures.

Discussion

S. N. Banerjee, India (Comment): I agree with Dr. Calora on his observations about the effect of climatic factors like Temp., Min. Temp. and Relative Humidity. While working on the activity of *T. incertulas* with light traps over 20 years in India, I have noticed that these factors have little influence on the activity of the moths, because in the tropics these factors do not fluctuate day to day as in temperate areas.

M. B. Kalode, India: Did you observe any time the surviving larvae of *Tryporyza incertulas* in seedbeds?

Answer: The survival of *Tryporyza incertulas* larvae in the seedbed is very very low if ever there is such survival. I have not observed them developing up to the next generation.

T. Hidaka, Japan: How about the egg-parasite activity against the stem borer in the Philippines during dry and wet seasons?

Answer: At the moment I would not bother to answer the question since I only remember that there is only one important egg-parasite of important consequence. We presented more detailed information on this in our presentation at the IRRI Symposium, May I refer you to that paper?

D. B. Reddy, FAO: Has any difference in light response been noticed for the sexes or the species?

Answer: Females are attracted in greater numbers but no specific studies were made on the different sources and intensities of light influencing the attractiveness.

T. Saito, Japan: Could you explain the more detailed method on the bait trap in the field?

Answer: As explained by Dr. Pathak, the trap consists of pineapple cans with funnels at both ends for moth entrance. Inside this trap is a small cage where a

female moth is confined. There is no light in this trap.

G. S. Lim, Malaysia: 1) You have reported that infestations by rice borers in seedbeds can be very severe in some parts of the Philippines. Such severe infestations in seedbeds have never been observed in Malaysia. Can you give any explanation on such an occurrence in your country? 2) How often are such severe infestations by rice borers in the seedbeds noted?

Answer: 1) The occurrence of heavy infestation by rice borers in seedbed in certain regions in the Philippines is due to the wide area of unplanted field during the dry season that harbors the mature larvae and pupae. At the time of seedbed preparation in the month of December tremendous moths emerge of the larvae and pupae population of the previous season. 2) I have observed this at least for three years.

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