Egg Parasitism of *Scirpophaga incertulas* Walker (Lepidoptera:Pyralidae) by Hymenopterous Parasitoids in IRRI Rice Fields

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金洪善・E.A. 하인리크・P. 밀바가남 : 國際米作硏究所圃場에 있어서 寄生蜂에 의한 *Scirpophaga incertulas*의 卵寄生率에 대하여

ABSTRACT We surveyed the IRRI farm to determine the extent of parasitization of yellow stemborer egg masses. The egg masses were randomly collected at weekly intervals from July to October 1984 from rice fields, 15～20 days after transplanting, and brought to the laboratory for collection of emerging parasites. Three species of hymenopterous parasitoids— *Tetrasticus schoenobii, Telenomus rowani,* and *Trichogramma japonicum*—were found from 700 egg masses.

We introduced a method to calculate percent parasitism as based on parasite biology and behaviour. Among the three species, the combination of *T. rowani* and *T. japonicum* was the highest multiparasitization of yellow stem borer egg masses, and *T. rowani,* a solitary parasite had the highest number based on immature and adult stages counted. However, *T. schoenobii* may be the most efficient parasite because two to four host eggs are needed to complete the larval period, and it took 10～14 days for one generation.

INTRODUCTION

The yellow stemborer (YSB) is considered as one of the most destructive and widely distributed species among the stemborers associated with rice. It attacks the rice plants from seedling stage to maturity causing a considerable loss in yield. The larvae feeding inside or boring into the stem during the early stages of the plant usually cause drying-up of the youngest leaf which is referred to as "deadhearts". On the other hand, infestation occurring during the later stages results in the formation of empty grains or panicles termed as "whiteheads".

Control of this insect could be achieved through cultural practices such as cutting infested shoots, destroying stubbles, burning, flooding, ploughing after harvest, rotation and alteration of planting dates. Planting of varieties resistant to this insect is also being considered.

In many countries, application of insecticides proved to be an effective control measure against stemborers; however, the use of chemicals alone has many disadvantages. It is hazardous to man's health, creates environmental pollution and in addition, is very expensive. Also, continuous application of insecticides may result in the development of insect resistance to certain chemicals, Nonselective insecticides wipe out the population of natural enemies which check the bulid-up of certain insect pests (Waterhouse, 1967). Beneficial insects are essential elements of the rice ecosystem and efficiently control. stemborers in many ecological situtations (Yasumatsu, 1967).

In the United States, good results were obtained when *Trichogramma pretiosum* was liberated against several lepidopterous pests

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of cotton and other crops (Stinner et. al., 1972; 1974; Parker and Pinnel, 1974). In Bangladesh, egg parasites reduced the numcers of *Scirpophaga incertulas* and thus probably improve the yield of deepwater rice (Catling et. al., 1983). Kamran and Raros(1969, however, found that incidence of parasitism in Luzon Island in general was very low, suggesting that beneficial insects have a limited role in the control of rice stem borer.

It is important to evaluate the importance of the stemborer egg parasites as a biological control agent. There are different types of parasitic behaviour, such as a solitary, gregarious, and predatory. When we estimate the parasitism without biology or behaviour consideration, we may be mislead their actual efficiency. Therefore, we introduced a calulating method of egg parasitism in *S. incertulas* and estimated their parasitic efficiency.

MATERIALS AND METHODS

S. incertulas egg masses were randomly collected from IRRI rice fields at LOS BANOS, LAGUNA, PHILIPPINES at one week intervals; the plants from which the egg masses collected were about 15 to 20 days after transplanting.

Collected egg masses were placed singly in petri dishes with filter paper and covered with a 11×10cm plastic funnel inserted to a 6.5×7cm vial to keep the parasites alive(Fig. 1).

After 10 days, all egg masses were dissected to count the unhatched rice stemborer eggs and parasites. Parasite adults were introduced into vials with a newly-laid egg mass of *S. incertulas* to study the biology. One day after parasite adults introduced, the egg mass of *S. incertulas* was dissected slighly with sharp pin twice daily to observe the development of the parasite under a microscope.
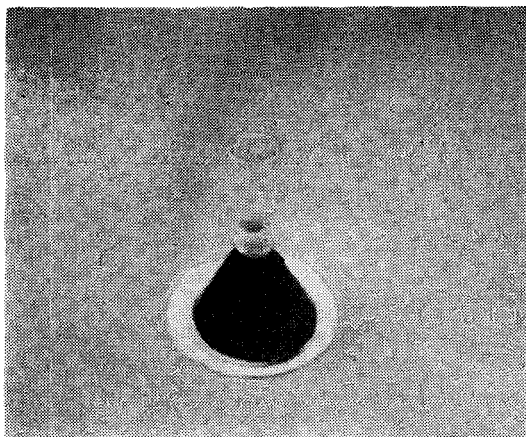

Fig. 1. Set up for parasitism of *S. incertulas*

RESULTS AND DISCUSSION

We found three species of egg parasites in *S. incertulas* egg masses; *T. shoenobii, T. rowani* and *T. japonicum*. They had multiparasism among them. Eighty-eight percent of the egg masses were parasitized by one or a combination of parasite species in July-August. The hignest parasitization(23~25%) was by a combination of *T. rowani* and *T. japonicum* in July to October (Table 1),

The biology and behaviour of the egg parasites should be considered in taking records on parasitization. The egg parasites of *S. incertulas* emerged from the egg mass which

Table 1. Multiparasitization of yellow stemborer egg masses(n=700) by 3 parasites, IRRI, July-Oct., 1984.

Parasite combination	Parasitization of egg masses(%)		
	July–Aug.	Sept.	Oct.
T. rowani + *T. schoenobii* + *T. japonicum*	9.8	2.5	10.0
T. rowani + *T. japonicum*	34.6	29.1	23.3
T. rowani + *T. schoenobii*	17.7	19.8	3.0
T. schoenobii + *T. japonicum*	11.5	7.3	9.4
T. schoenobii alone	9.5	12.3	22.1
T. rowani alone	3.2	17.0	9.4
T. japonicum alone	1.2	7.0	9.4
Total parasitism	87.5	95.0	86.6
Non parasitized egg masses	12.5	5.0	13.4

Table 2. Percent parasitization of yellow stemborer egg masses and the sex ratio of the parasitoids, IRRI, July-Oct., 1984.

Parasite	Egg masses (no.)	Egg parasi-tized[a] (%)	Stem borer larvae (no./egg mass)		Parasite(no./egg mass)		
			Hatched(A)	Unhatched(B)	Emerged (C)	Unemerged (D)	Sex ratio (female: male)
T. schoenobii	84	94.7	1.5	2.0	18.7	2.0	5.1 : 1
T. rowani	42	45.3	18.4	19.1	20.8	10.3	5.3 : 1
T. japonicum	24	8.1	63.8	9.9	10.0	3.0	4.7 : 1

[a] Calculated as:

$$T.\ schoenobii = \frac{(C \times 3) + (D \times 3)}{(A+D) + (C \times 3) + (D \times 3)} \times 100$$

$$T.\ rowani = \frac{C+D}{A+B+C+D} \times 100$$

$$T.\ japonicum = \frac{C/2+D}{A+B+(C/2)+D} \times 100$$

Where, A = No. of hatched stem borer larvae,
B = No. of unhatched stem borer larvae,
C = No. of emerged parasites,
D = No. of unemerged parasites

was covered with pale orange brown hairs from the anal tufts of the female moths. It is difficult to separate and observe the individual eggs in egg masses.

When solitary parasites are involved records on host and parasite emergence may be adequate. However, when gregarious parasite or those that behave like predators, e.g., *Tetrasticus* sp., are involved, it might be necessary to record total eggs in each egg mass, eggs destroyed and eggs parasitized.

T. schoenobii tends to destroy eggs entirely so that it is necessary to estimate the approximate number of eggs originally Present by some means other than countings. Therefore, we collected 700 egg masses in the rice fields. Among them, eighty-one egg masses were not parasitized and 60 larvae/egg mass of *S. incertulas* hatched out. It means that one egg mass consists of 60 eggs. An average of twenty parasites(T. schoenobii) emerged from one egg mass but no YSB larvae hatched out from the egg masses. It suggests that one *T. schoenobii* consumes 3 eggs of *S. incertulas*.

We estimate the *T. schoenobii* may be the most efficient parasite because two to four (AV. of three) host eggs are needed to complete the larval period. Thus, in calculating percent parasitization by *T. schoenobii*, the number of emerged and unemerged parasites

are multiplied by 3(Table 2). *Telenomus rowani* was the most abundant parasite as based on immature and adult stages counted. Second to *T. schoenobii*, *T. rowani* caused 45.3 percent egg parasitism. It is a solitary parasite and the ratio between female and male is 5.3 : 1.

Trichogramma japonicum appeared not to be as efficient as the other two species. This could be attributed to the fact that a very low density was observed for this species. More than one *T. japonicum* emerged from one host egg being a very minute parasite exhibiting a super parasitism behavior. It usually lays 2 eggs (75.3%), one egg (9.1%), 3 eggs (9.4%) and 4 eggs (4.2%) in an egg of *S. incertulas*. Catling et al. (1983) also observed that 1-4 parasites could develop from one egg. Thus, in calculating percent parasitism by *T. japonicum*, the number of emerged parasites is divided by two. It means that one parasite (*T. japonicum* adult) deposit 2 eggs into one egg shell of *S. incertulas*.

As shown in table 2, *T. schoenobii* is the most efficint parasite of the *S. incertulas* egg mass. It was the largest among the egg parasites and was found outside of the egg mass when the larvae were overcrowed. As shown in table 3, the egg to adult stage took 10~14days, incubation period is 1~2days, and

Table 3. Developmental period (days) of *Tetrasticus schoenobii*. IRRI, July-Oct., 1984.

Stages	Ranges	Mean
Incubation period	1~2	1.14±0.14
Larva	2~3	2.16±0.14
Prepupae	3~4	3.30±0.21
Pupa	4~5	4.30±0.20
No. eggs per female	4~41	25.5

larval stage last for 2~3days. Its, prepupal and pupal period last for 3~4 and 4~5 days, respectively (Table 3).

摘　要

필리핀에 있는 國際米作研究所 논 圃場에서 移秧後 15~20日 된 苗에서 *Scirpophaga incertulas*의 卵을 1984年 7월부터 10월까지 採集하여 卵寄生蜂의 寄生率 및 生態를 조사한 結果는 다음과 같다.

*Scirpophaga incertulas*의 卵에서 나온 벌목 天敵으로 *Tetrasticus schoenobii, Telenomus rowani, Trichogramma japonicum* 三種이 發見되었고 寄生蜂의 生物的인 習性에 基礎를 둔 寄生率 計算방법을 소개하였다.

卵寄生蜂 三種의 共寄生 組合은 *T. rowani* + *T. japonicum* 組合이 가장 많았고 *T. rowani* 는 單寄生性 天敵으로 羽化成虫 數가 가장 많았지만 三種의 寄生蜂中 *T. schoenobii*는 幼虫期 間 중 *Scirpophaga incertulas*의 卵을 2~4個 消耗시키므로 가장 有用한 天敵이었으며 이 天敵의 1世代期間은 10~14日이었다.

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