Geographical Differentiation of the Rice Gall Midge, *Orseolia oryzae* (WOOD-MASON) (Diptera: Cecidomyiidae)

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Adults of the rice gall midge collected at Prae Rice Experiment Station in Thailand were distinctly larger in body size such as fore wings, halteres, femora and tibiae than those of the Central Rice Research Institute at Cuttack and the Chakli farm at Sambalpur in India. Number of ovarian eggs per female was more abundant in Thailand than in India. Abdomen of the insect collected in Thailand was covered with long and soft hairs in contrast to minute and smaller hairs in India. A peak of insect occurrence in paddy fields was seen earlier 30 days, the middle of September, in Thailand than in India where the peak was in the middle of October. It is indicated that geographical differentiation of the rice gall midge has occurred between Thailand and India.

INTRODUCTION

The rice gall midge, *Orseolia oryzae* (WOOD-MASON), is one of the major insect pests of rice in the tropical Asia. The newly hatched larvae of the rice gall midge penetrate into the growing points of rice plants, on which the larvae feed, and form galls which are called the onion tube. Panicle primordium is not formed in rice plants when severely attacked by the insect. Rice yield, therefore, is remarkably reduced (HIDAKA, et al., 1974). Rice plants severely infested become dwarf with abnormal tillerings and wither completely. Sever damage caused by the insect has been reported in India, Thailand and Indonesia.

At present, utilization of resistant variety against the rice gall midge has mainly been conducted as practical control measures. It is observed that damage to a resistant variety is clearly different from place to place due to occurrence of the biotypes (HIDAKA, 1974). In particular, it can be questioned whether or not the rice gall midge is differentiated ecologically and physiologically among the Asian countries in the tropics.

One of the writers, Hidaka as a visiting scientist under the Tropical Agriculture Research Center, visited India, Sri Lanka and Thailand for studying on incidence of

the rice gall midge from August to October in 1975. In this paper is dealt with differentiation of the adults of the rice gall midge between Thailand and India.

METHODS

The adults of the rice gall midges collected by light trap were soaked in 45 percent of alcohol. Places where the adults collected were the Central Rice Research Institute and the Chakli farm in India and Prae Rice Experiment Station in Thailand. Number of adults collected at one place was more than 50 heads. The alcoholic specimens of the adults were brought back to Japan. Twenty females for each place were measured on the fore wings, halteres, fore-, middle- and hindlegs through a binocular microscope with 150 magnifications. Number of ovarian eggs per female was also counted. The peak of adult occurrence was examined between India and Thailand where the adults were collected under the condition of severe incidence of the insect and the maximum tillering stage of rice plants. In Sri Lanka, number of adults collected was not enough to examine along the purpose due to low infestation in paddy fields. The measured value shown in Figs 1 to 4 is expressed as the confidence limit in 95% of confidence coefficient. Adult specimens examined are kept in the Tropical Agriculture Research Center, Japan.

RESULTS

Number of ovarian eggs per female

As given in Fig. 1, number of ovarian eggs per female was 261 in the average at Prae Rice Experiment Station, followed by 236 at the Chakli farm and 189 at the Central Rice Research Institute. It can be said that number of ovarian eggs is significantly more abundant in Prae than in the Central Rice Research Institute.

Length of fore wings

As shown in Fig. 2, the fore wings at Prae Rice Experiment Station were 4-mm long which showed the longest in comparison with those from India. The shortest fore wing in length was observed in the specimens collected at the Central Rice Research Institute, it was as long as 3.3 mm in the average. Length of the fore wings from the Chakli farm was 3.4 mm. It is indicated that the fore wings were also significantly longer in Thailand than in India.

Length of halteres

The halteres at Prae Rice Experiment Station were 0.62 mm long which showed the longest in comparison with those from India. The halteres at the Central Rice Research Institute and the Chakli farm were as long as 0.58 mm and 0.60 mm respectively.

Length of femora

As given in Fig. 3, the fore femora were as long as 1.8 mm at Prae Rice Experiment Station and 1.5 mm at the Central Rice Research Institute and the Chakli farm. It can be said that the fore femora are longer in Thailand than those in India. The middle and hind femora were also longer those in Thailand than in India.

Fig. 1. Differences of number of ovarian eggs of the rice gall midge collected at Prae Rice Experiment Station (Prae) in Thailand, Central Rice Research Institute (CRRI) and Chakli farm (CF) in India.

Fig. 2. Differences of length of fore wing of the rice gall midge collected at Prae, CRRI and Chakli farm.

Fig. 3. Differences of length of fore femur of the rice gall midge collected at Prae, CRRI and Chakli farm.

Fig. 4. Differences of length of fore tibia of the rice gall midge collected at Prae, CRRI and Chakli farm.

Length of tibiae

As shown in Fig. 4, the fore tibiae were as long as 1.6 mm at Prae in Thailand, followed by 1.5 mm at the Central Rice Research Institute and the Chakli farm. A

significant difference was recognized in length of the fore tibiae between Thailand and India. The middle and hind tibiae were longer in Thailand than those in India.

Hairiness on abdomen

Abdomen was sparsely covered with long and soft hairs in the specimens collected at Prae. On the other hand, the rice gall midge from India has minute and small hairs on its abdomen.

A peak of insect occurrence in paddy fields

In Thailand, rice plants are transplanted in July and harvested in December. The rice gall midge begins to appear from May and disappear in early December. A peak of insect occurrence is in the middle of September. Rice cultivation in the Central Rice Research Institute is done as same as in Thailand. The rice gall midge in India appears from June to early December with a peak of insect occurrence in the middle of October. Appearance and peak of insect occurrence are earlier 30 days in Thailand than in India.

DISCUSSION

So far as the writers observed, body size is not affected by the growing stages and plant height of rice plants. Body size and coloration, however, of the rice gall midge are entirely affected by the wild host plants and resistant variety. The gall midge raised in the resistant variety is clearly smaller in body size and number of ovarian eggs than those of the susceptible variety. The galls are also shorter in the resistant variety than in the susceptible variety. Smaller body of the insect was obtained when the insect was reared in the wild host plants such as *Leersia hexandra* and *Paspalum distichum*. It is considered that the body size and coloration of the insect are highly influenced by the nutrition of the host plants.

In the rice insect pests, studies have fragmentally been carried out on ecological and physiological variations in the infra-species between Japan and foreign countries, such as susceptibility of the rice stem borers, the green rice leafhoppers and the brown planthoppers to insecticides between Japan and Taiwan (KOIKE, 1975), the hopper-burn formation of the brown planthoppers between Japan and Taiwan (MIYAKE and FUJIWARA, 1954), diapause reaction of the smaller brown planthoppers in Japan, Taiwan and the Philippines (KISIMOTO, 1976).

Ecological and physiological variations of the rice insect pests in Japan have also been studied from the viewpoint of the diapause of the rice stem borers (INOUE and KAMANO, 1957), *Nilaparvata bakeri* MIUR (NASU, 1960), and the green rice leafhoppers (NASU, 1963). It was revealed that these insects showed different types of the diapause in northern and southern Japan. It is indicated that physiological isolation of the insects has been occurring in both places in Japan.

The body size of adults of the white-back planthoppers becomes smaller in weeds than in rice plants (SUENAGA, 1963). The larval growth of the rice stem maggot becomes more speedy in the three-generation area than in the two-generation area (IWATA, 1963).

Further studies on ecological and physiological variations of the insect must be conducted to determine the origin of occurrence and population fluctuation. It is also interesting to note that effect of ecological and physiological variations on morphological

differences of the infra-species of the insect must be studied.

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REFERENCES

- HIDAKA, T., P. VUNGSILABUTR and S. KADKAO (1974) Studies on ecology and control of the rice gall midge in Thailand. *Tech. Bull. TARC.*, **6**: 1-113.
- HIDAKA, T. (1974) Recent studies on ecology and control of the rice gall midge, *Orseolia oryzae* WOOD-MASON. *Rev. Plant Protection* **7**: 99-143.
- INOUE, H. and S. KAMANO (1957) The effect of photoperiod and temperature on the induction of diapause in the rice stem borer, *Chilo suppressalis* WALKER. *Jap. J. appl. Ent. Zool.* **1**: 100-106 (In Japanese with English summary).
- IWATA, T. (1963) Ecological studies on the local variation in the seasonal history of the rice stem maggot, *Chlorops oryzae* MATSUMURA. *Bull. Hokuriku Agr. Exp. Stn* **4**: 110-189 (In Japanese with English summary).
- KISIMOTO, R. (1976) Geographical variation of the diapause of the smaller brown planthopper I. *Sokatsu Kentokai Shiryo, Entomology* **1975**: 49 (Mimeo. in Japanese).
- KOIKE, H. (1975) Susceptibility of the rice insect pests to insecticides in Taiwan. *Nekken Shuho, TARC.* **27**: 141 (In Japanese).
- MIYAKE, T. and A. FUJIWARA (1954) Local differentiation in white-back planthopper, *Sogatia furcifera* Horváth. *Oyo-Kontyu* **10**: 89-92. (In Japanese with English summary).
- NASU, S. (1960) Overwintering and ecotype of the rice planthoppers. *Japanese Soc. Appl. Ent. Zool. 4th Symposium*: 3-7 (In Japanese).
- NASU, S. (1963) Studies on some leafhoppers and planthoppers which transmit virus diseases of rice plant in Japan. *Bull. Kyushu Agr. Exp. Stn* **8**: 1-349 (In Japanese with English summary).
- SUENAGA, H. (1963) Analytical studies on the ecology of two species of planthoppers, the white-back planthopper (*Sogatia furcifera* HORVÁTH) and the brown planthopper (*Nilaparvata lugens* STAL), with special reference to their outbreaks. *Bull. Kyushu Agr. Exp. Stn* **8**: 1-152 (In Japanese with English summary).