

7. MASS REARING OF THE RICE STEM BORER, *CHILO SUPPRESSALIS* WALKER

—REARING ON RICE SEEDLINGS—

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Introduction

Mass rearing of the rice stem borer, *Chilo suppressalis* Walker, have been developed in two courses, *viz.*, rearing on artificial diets and rearing on rice seedlings.

Initially, artificial diets were used for investigation of the nutritional requirements of the borer, but recent trend has been to use them as media for the mass rearing. Extensive study by Kamano (1969, 1971) resulted in development of artificial diets for the mass rearing of the borer in aseptic conditions through improvement of a diet presented by Ishii (1952)**.

Efforts to rear the larvae on young seedlings of rice under laboratory conditions were first made by Tamura *et al.* (1959). Their method was further improved by Sato (1964) to obtain a large number of the borer all the year round. Utilizing Sato's method with some modifications, we have succeeded to continue successive mass rearing of the borer for 6 years up to the present.

In this paper a report is made on the present rearing method using rice seedlings in our laboratory.

Method of Mass Rearing

The followings are the standard mass rearing method of the borer using the rice seedlings.

Insectary A temperature was controlled at $28^{\circ} \pm 1^{\circ}\text{C}$. Approximate illuminance obtained from fluorescent lamps was 2000 lux at the place where rearing jars were placed. A photoperiod was kept at 15 hr to prevent the larval dormancy. Because of a high humidity inside the rearing jar, it was not necessary to control humidity. Humidity, however, was kept at about 60% RH to give comfortable conditions for insectary workers.

Rearing jar A glass jar, 11 cm in diameter \times 9 cm in depth, with a screw metal cap was used for the rearing of larvae (Fig. 1). A hole of 2 cm diameter which was sealed with a cotton stopper was made on the cap for ventilation. The cotton stopper also offered pupation site of the borer.

Preparation of the seedlings The rice seeds of a good germination rate were prepared. A germination test of the seeds was carried out prior to the rearing, if necessary. Purchased rice seeds were immersed in salted water (specific gravity 1.14) to discard immature seeds. Seeds which sank in the salted water were collected and rinsed with running water thoroughly, then dried and kept in a large metal can. It was preferable to keep the canned seeds in a room of $5^{\circ}\sim 10^{\circ}\text{C}$ until they were used for the rearing, since a high temperature depressed the germination rate.

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** For the synthetic or aseptic diets, see review articles by Fukaya and Kamano (1967), Kamano (1969, 1971), and Ishii (1970).

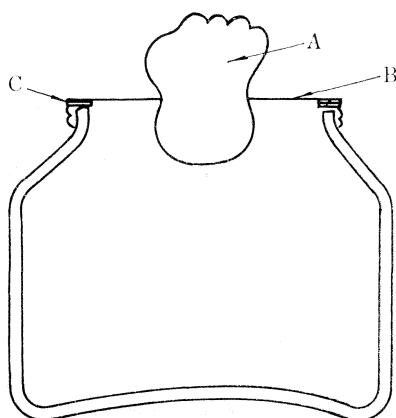


Fig. 1. Glass jar used for rearing *Chilo suppressalis* larvae on rice seedlings.

A: cotton stopper; B: screw metal cap; C: rubber ring

To prepare the seedlings the seeds were immersed in water over-night at a room temperature ($20^{\circ}\sim 25^{\circ}\text{C}$) before they were put into the rearing jar. Suitable amount of the seeds for the germination was 50~60 g per jar. After adding about 15 ml water into the seeded jar, the jar was sealed with the metal cap and kept in the insectary under the illumination.

Rearing of the larvae To start rearing the young larvae, the seedlings 3 days after the seeding were suitable. Mature ("black head" stage) egg-masses containing 300~400 eggs were placed on the seedlings in the jar. The larvae were allowed to feed the seedlings for about 10 days, or until most of them grew to the 3rd instar larvae and the seedlings were consumed by feeding. At this time, the larvae were picked up from refuse of the seedlings and transferred onto fresh seedlings prepared in the jar at arate of 50 larvae par jar.

The same kind of transfer was preferable about 10 days after the first transfer, because the pupation was sometimes depressed due to dietary deficiency. In these cases, somewhat larger seedlings, *viz.*, 5~6 days old seedlings, were used.

Pupation Most of the mature larvae bored into the cotton stopper and pupated. The pupae were taken off together with the stopper from the cap, and placed on a plastic tray in a oviposition box. The hole of metal cap was re-sealed with a new cotton stopper for the successive pupation.

Eggs An oviposition box was placed in the insectary. The box, 45 cm \times 90 cm \times 130 cm in height, was mainly made of opaque plastic plates, and its back was walled up with a glass plate (Fig. 2). In the upper part of the box, shelves made of wire mesh screen were framed in to hold the cotton stoppers with the pupae. The emerged moths were allowed to copulate in the box and oviposited on rice plants in the lower part. A relatively high humidity inside the box was kept by placing water in a tray on the bottom, because longevity of the pupae and the adults was suppressed by low humidities.

Egg-masses layed on the rice leaves were collected by cutting the plant. The eggs attached on the leaves were kept in a Petri dish in which a sheet of filter paper moistened with water was placed.

Care was taken to avoid a excess water which would prevent a minimum ventilation inside the dish. A small amount of water was added every day to keep moisture in

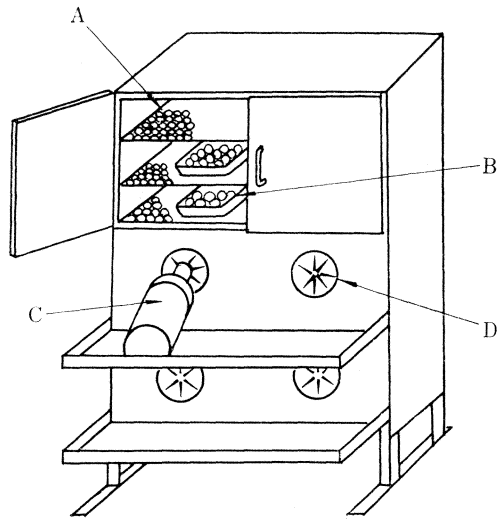


Fig. 2. Oviposition box for mass rearing of *Chilo suppressalis*.
A: wire mesh screen; B: pupae in cotton stoppers;
C: potted rice plant; D: plastic sponge

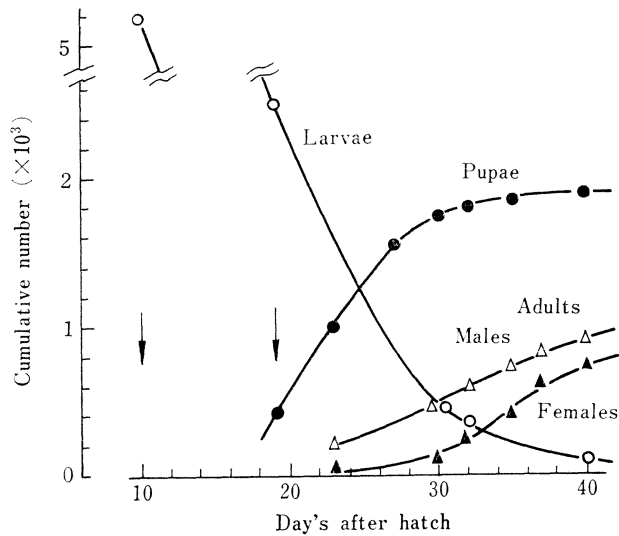


Fig. 3. Results of rearing *Chilo suppressalis* larvae on rice seedlings in glass jars at $28^{\circ}\pm 1^{\circ}\text{C}$ under 15 hr photoperiod. Rearing was started with 5921 hatched larvae released at a rate of about 400 larvae/jar. Arrows indicate time of transferring the larvae onto the fresh seedlings at a rate of 100 larvae/jar.

the dish. The larvae hatched out 5~6 days after the oviposition under the insectary conditions.

A typical result of the present rearing method is shown in Fig. 3. In this experiment approximately 400 larvae were introduced into the jar, and the larvae were transferred twice onto the new seedlings after 10 and 19 days at a rate of 100

larvae/jar. It was observed that most of the mature larvae pupated and developed into the adult moths, though a survival rate of the insects after 19 days was about 50%. It should be possible to increase the survival rate, if the larvae are transferred onto the fresh seedlings more frequently.

Main shortcoming of this rearing method is that the transfer of the larvae to the new seedlings is rather laborious. To improve this point, some trials are being made to separate the larvae from the refuse of rice seedlings without manual work. One example of the trials is utilizing a behavior of the larvae that they crawl out from the refuse. In our experience, when the larvae, most of them were the 3rd instar larvae, were put into a sealed metal can of 26 cm in diameter \times 36 cm in depth together with the refuse from the rearing jars, more than 90% of the larvae crawled out and they were easily collected from a wall inside the can.

Although there would be some other shortcomings, it is not difficult to mass-rear the rice stem borer successively with the present method. An experiment in our laboratory showed that 11 generations, each were composed of about 8000 individuals at the stage of the 1st instar larvae, were successively reared a year on the rice seedlings.

References

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Discussion

- M. T. Ouye:** What would be the yield of adult if you start initially with 8000 larvae?
- M. Sakai:** About 50% larvae would develop to adult stage.
- S. Areekul:** What kind of light you used for the rearing of *C. suppressalis*?
- M. Sakai:** Common fluorescent tube light.
- T. Saito:** How many persons are required to carry out the rearing work for starting the culture of 8000 larvae?
- M. Sakai:** One person a day.
- M. D. Pathak:** You mentioned that when larvae are released on seedling they start feeding on the root of the seedlings. Why is this so?
- M. Sakai:** Since humidity is higher at the root of the seedlings, so the larvae prefer to bore and eat the root.
- V. A. Dyck:** Do you rear the complete stages of the insect on seedlings?
- M. Sakai:** Yes.
- V. A. Dyck:** Did you measure larval mortality in each instar?
- M. Sakai:** It is difficult to estimate the larval mortality for each instar. However, 10% mortality of the larvae occur. Higher larval mortality was recorded if the seedlings were not changed after the 3rd instar.

- V. A. Dyck :** How did you handle the larvae for changing the seedlings after the 3rd instar? We have found it difficult to handle the larvae without causing some mortality.
- M. Sakai :** The larvae were transferred to new seedlings by fine camel hair brush and in doing so direct larval mortality do occur. We are trying to avoid handling the young larvae to prevent unnecessary mortality.
- Kalode :** Could you please tell us specifically how many days one can keep the eggs without impairing the egg hatch at 10°C?
- M. Sakai :** The eggs can be stored for 10 days at 10°C without any serious injury. However, hatching rate decreases if you store eggs more than 10 days.
- Kalode :** What do you think about the free water condensing on the wall of rearing jar or cage containing rice seedlings?
- M. Sakai :** The larvae generally do not crawl on the wall of the jar so we do not bother about the free water condensing on the wall of rearing jars.
- F. Takahashi :** How many moths should be kept in a rearing cage for the continuation of the culture?
- M. Sakai :** To maintain healthy culture, start with 500 larvae.
- K. Yano :** Have you ever tried to rear the other rice borer or any other lepidopterous pests by this method?
- M. Sakai :** No, we have not tried. *Chilo suppressali* is the only species, we tried.
- J. S. Hyun :** What is the duration of larval period?
- M. Sakai :** 90% larvae transformed into pupae after 10 days.
- T. Hormchang :** How many times you change the seedlings?
- M. Sakai :** Twice. One in the beginning and the other at the 3rd instar stage.
- V. A. Dyck :** How does this method of rearing compare with other method like rearing on an artificial diet medium?
- M. Sakai :** This method is not better than the rearing on artificial diet.