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Evaluation of various captive spaces for the rearing of the teak defoliator (*Hyblaea puera*)

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ABSTRACT

For the selection of the suitable substratum for rearing the teak defoliators (*Hyblaea puera* Cramer), a major pest of teak in artificial medium, different containers (Plastic tubes, Plastic wire Mesh (15 x 7 cm), Glass bottles (20 x 10 cm), Petri plate (4.5 cm radius), Petri plate and plastic tubes) with varying number of insects was experimented. Control batch of insects were maintained on teak (natural host) leaves. Among the tested containers the combination of Petri plate (for 1st and 2nd larval instars) and rearing tube (for 3rd, 4th and 5th instars) gave good results (69.99 % survival) and was comparable with the control batch of insects (76.66 percent survival) on tender teak leaves. The suitable number of first and second instar insects in Petri plate was 30 with a survival rate of 67.98 %. Single insect rearing seems to be good for third, fourth and fifth instars in plastic tubes with 75.05 % age of larval survival.

Keywords: Insect rearing, Substratum, *Hyblaea puera*, Insect survival

1. Introduction

Teak defoliator *Hyblaea puera* Cramer (Lepidoptera: Hyblaeidae) is recognized as the most serious pest of teak (*Tectona grandis* Linn). It ranks second among the forest pest of Indian sub-continent owing to the economic loss of 3 m^3 of wood per hectare per year. In monetary terms, this is a loss of not less than 75,000 rupees per hectare per year [6, 7]. In India the economic impact of *Hyblaea* is enormous. Even when various control options were attempted in the past, none were successful until the discovery of *Hyblaea puera* nuclear polyhedrosis virus (*Hp*NPV) in the year 1988 [9]. Over the years *Hp*NPV has been field tested and the wettable powder format [5] is being attempted to manage the pest in teak plantations. The production process has been standardized [8] and a pilot scale production unit is being run at Kerala Forest Research Institute.

The major limitation in up-scaling and industrializing this production process is the lack of complete artificial diet which support all larval instars. Selection of suitable containers according to the behavior and the size of the insect is an essential factor in the rearing programs [1]. Containerization of insects in an artificial rearing system provokes complex but important changes in the insect's growth and survival [3]. One of the major steps in the artificial diet development and rearing of *H. puera* was the substrate selection. The developed diet has to be delivered into suitable containers/substrate which would serve as the environment for target insects for further developments. In the present study different captive spaces for *H. puera* rearing were studied. Size, shape, surface texture and surface grips of the rearing platform and the insect potential in them were taken into consideration.

2. Methods

2.1 *Hyblaea puera* for experiments

Pupae of *H. puera* collected from Nilambur teak plantations were surface sterilized by using 0.5% sodium hypochloride solution for 5 minutes followed by thorough washing under tap water. The pupae were then air dried and placed in glass bottles (20 cm high and 10 cm wide) for emergence. After emergence the moths were sexed by means of morphological features [10] and were transferred to a wooden cage (15 x 15 x 15 cm) for mating. They were provided with 10 % (v/v) honey solution on small sponge pieces (5 x 3 cm). On the second day moths were sexed, pairs were set and transferred to a wide mouth bottles (20 x 10 cm) for oviposition. The eggs were transferred to glass bottles provided with fresh tender teak leaves. Fresh tender teak leaves were provided as food every day.

2.3 Testing of number of insects per container

Subsequent to the selection of appropriate rearing containers, the optimum numbers of insects which could be successfully reared per each appropriate container was tested. Based on the preliminary evaluation, Petri plates and rearing tubes was selected for final assessment. Neonate larvae were used to test the Petri plates and third instar larvae were used to test the rearing tubes. Different number of first instar larva (fifteen, thirty and forty five) were attempted to grow in Petri plate and single, double and triple third instar larvae were tested in rearing tubes. Data analysis had done by SPSS.

2.4 Bioassays with selected container

Bioassays were carried out with the selected containers in the course of this study and it helped to realize the effect of selected captive space on the development of larvae. Observations were made on the response of the test insect on different life parameters for three generations. First to fifth instar larvae of *H. puera* were used for experiments. Larva reared on teak leaves - the natural host of *H. puera* - were used as control.

3. Results and Discussion

3.1 Testing of rearing containers for *H. puera* rearing

The mean survival and life span of *H. puera* larva reared on six different captive spaces is presented in table 1.

Table 1: Survival of *H. puera* larva on different substrata

Type of rearing containers	Mean survival (%)
Control (teak leaf)	76.66 ± 1.92[a]
Rearing tube	13.33 ± 3.33[b]
Glass bottle	19.99 ± 1.91[bc]
Wire mesh	3.33 ± 1.11[d]
Petri plate	25.55 ± 2.3[c]
Petri plate with impressions	24.44 ± 2.9[c]
Petri plate and rearing tubes	69.99 ± 1.92[a]

In a column, differences between values followed by the same alphabets are not statistically significant (0.05).

Survival rate of control (insects on teak leaves) was 76.66 % and they behaved normally in all aspects. There was no considerable difference in survival rate between the cluster of control insects (on teak leaf) and the Petri plate (for 1st and 2nd larval instars) followed by rearing tube (for 3rd,4th and 5th instars) raised insects. The lowest survival recorded was from the batch of insects reared on wire mesh (3.33%). The 1 mm sized holes of wire mesh holds less amount of diet which dried up easily and seeing as unpalatable for 1st instar larva.

The group of insects reared on Petri plate and Petri plate with corrugated diet surface gave 25.55 % and 24.44 % survival rate respectively. Which was significantly lower than that of the control batch. Up to second instar, larval rearing in Petri plates gave good results. As larvae grow up the space inside Petri plates seem to be insufficient for larval movements. Even if some of the late instar larvae survived, they weighed significantly less than the normal ones.

Insects reared in glass bottles and rearing tube had 19.99 % and 13.33 % survival rates respectively. Glass bottles provide large area for larval development. Even though the moisture build up inside the bottle was more. It brought larval mortality to the vulnerable larval stae (1st instar) of teak defoliator.

The result suggested that the rearing of early instars (1st and 2nd) in Petri plate and mature larval stages (3rd, 4th and 5th instars) in rearing tubes gaves better overall survival rate. Early instars might prefer the higher surface area of diet available the Petri plate while the later instars would prefer the space for movement provided by the rearing tubes.

3.2 Testing of ideal number of insects (*H. puera*) in Petri plate (1st and 2nd instar)

The mean survival of 1st instar larva of *H. puera* reared in Petri plate, in order to analyze the viable number of insects that can rear in it is presented in figure 6.

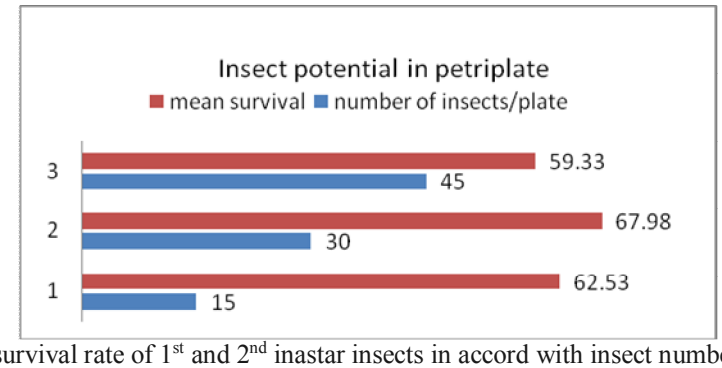

Fig 6: Mean survival rate of 1st and 2nd inastar insects in accord with insect number in Petri plate

Graph shows the influence of number of insects in rearing substratum- on Petri plate on survival. When 15 numbers of 1st instar larvae were introduced in to Petri plate, the survival rate was 62.53 % and with 30 number of larva the survival rate was 67.98 %. Survival rate was reduced to 59.33 when 45 insects were put in to a single Petri plate. The maximum survival rate obtained was 67.98 with 30 insects. Even if there is no statistical difference from the three set of treatments, the results suggest that 30 first instar larvae in a Petri plate of 4.5 cm radius would be the ideal combination for rearing defoliatoras.

The result of rearing larvae of *H. puera* on selected substratum, right from the first instar is presented in the Table 2. In the first and second generations the mortality rate in the early stage of larvae was more than that of control. Even though the first generation on artificial diet recorded slight reduction on larval survival (62%) than the generation on teak leaf (74%), from second generation onwards the survival rate (65 %) was satisfactory and comparable with that in the control group (64 %). Mortality of early instars was comparable with the control batch from the third generation onwards. The pupation rate in all generations of the experimental batch was equal or more than the control group. The fecundity rate of experimental batch was also reduced than the control, but it was negligible.

4. Conclusion

The success of all insect rearing programs relies on artificial diets and its environment/containers [2, 3, 4] since natural host could invite contamination under laboratory conditions. In the case of lepidopteron defoliators which feed on deciduous crops, non-availability of fresh leaves during the offseason makes their rearing difficult. Hence the development of species specific artificial diet has always received much attention. The present study was focused on the selection of suitable containers/ substratum for rearing of teak defoliator *H. puera* - the exceptionally destructive pest of teak (*Tectona grandis*).

Present study on larval rearing in different containers indicated the use of 4.5 cm radius Petri plate for first and second instar larva and plastic rearing tubes for third, fourth and fifth instar larva. As per experiments thirty first instar larvae can be reared in a single Petri plate while individual rearing is good for late instars.

When two numbers of insects were introduced into a single rearing tube along with the decline in survival rate, reduction in body size of one of the larvae in the tube was also noticed. Otherwise, both of the insects turned out were smaller than the normal. When three larvae were inoculated in single rearing tubes the survival and size rates of the insects come down than the normal. Rearing of all the instars entirely in Petri plate or in rearing tubes would considerably reduce the survival rate. Early instars might prefer the higher surface area of diet provided by the Petri plate while the later instars would prefer the space for movement provided by the rearing tubes. Bioassays with thirty first instar larva in 4.5 cm radius Petri plate followed by three piece rearing tube gave comparable survival rate against the larvae reared in teak leaf. Hence the present study suggests Petri plate rearing for early larval instars and rearing tubes for late larval instars of *Hyblaea puera*.

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