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**RESEARCH NOTE**

# Laboratory rearing of mango stem borer, *Batocera rufomaculata* De Geer using drumstick twigs

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**ABSTRACT:** Studies were conducted at ICAR-Indian Institute of Horticultural Research, Bengaluru to find an ideal laboratory host plant material to rear the mango stem borer, *Batocera rufomaculata* De Geer. Three host plants *viz.*, drum stick, jack fruit and mango were evaluated for their suitability to rear larvae of *B. rufomaculata* in the laboratory. Fifteen fresh twigs each of three host plants, approximately measuring 40 cm length and 5-6 cm in diameter were used for the experiment. Though all the three plant species tested are preferred hosts of *B. rufomaculata* under field conditions, their host status under laboratory conditions was not uniform. Among three host plants evaluated, the recovery of adults was highest (80.00%) from drumstick twigs making it a suitable host material. This is a simple technology to study the biology, behavior and larval tunneling pattern of *B. rufomaculata* and also to conduct bioassay studies in the laboratory.

**Keywords**: *Batocera rufomaculata*, laboratory rearing, adult emergence, drumstick, mango stem borer

Suitable laboratory rearing methods are essential to understand the biology and behavior of an insect pest and lack of such methods is more evident in case of many species of Cerambycids that feed on several tree species of economic importance. Since larvae of many Cerambycid beetles remain inside the stem or trunk for longer periods it is difficult to undertake precise studies on biology in natural conditions (Higashiyama *et al.,* 2012; Keena, 2017). Larval rearing methods involve either complete artificial diets or those with pulverized host material impregnated into the diet. Besides artificial diets, use of host plant cut pieces is found to be more simple and reliable method to rear about 40 species of Cerambycids. Keena (2017) listed about 140 cerambycids of different subfamilies for which rearing methods, partially or wholly, are developed. However the methods developed so far are mainly concerned with species that occur predominantly in northern hemisphere. Still effective rearing protocols are wanting for some important tropical species like *Batocera rufomaculata* (De Geer) (Coleoptera: Cerambycidae), commonly called mango stem borer, which are more prevalent in tropical conditions.

*Batocera rufomaculata* is a xylophagous insect with wide host range across several forest and fruit trees. Major hosts of horticultural importance are mango (*Mangifera indica* L.), jackfruit (*Artocarpus heterophyllus* Lam.), *Ficus* spp., papaya (*Carica papaya* L.), guava (*Psidium guajava* L.) and pomegranate (*Punica granatum* L.) (Singh *et al*., 2001). The beetles lay eggs under the bark of relatively old and stressed trees or those already infested. The larvae remain cryptic inside the stem or trunk and feed predominately on subcortical tissues, which consist primarily of the inner bark, phloem, and immature xylem and make extensive galleries and tunnels (Potter and Potter, 2008). Borer infestation often goes unnoticed until trees show external signs of damage. The damage results in girdling, die back, structural weakness, decline and eventual death of trees (Krishnamoorthy *et al*., 2014). The grub has a prolonged period ranging from 6-8 months. After pupation inside the trunk, adults emerge and fly out by making characteristic exit holes between June and August (Palaniswamy *et al.,* 1979). So far there are no effective protocols for laboratory rearing of *B. rufomaculata* from egg to adult. Gundappa *et al.* (2015) reported growing of field collected larva on an artificial diet till pupation which happened 64 days after introduction of grubs into diet. As the larval period of *B. rufomaculata* is known to last for about 8 months, the diet protocol is not clear about sustaining full larval period. Nevertheless, a host plant material will be cheaper and simpler option of rearing larva with prolonged developmental duration. With this background, studies were conducted at ICAR-Indian Institute of Horticultural Research, Bengaluru to find an ideal laboratory host material to rear *B. rufomaculata*.

Beetles of *B. rufomaculata* were collected from infested mango trees using the stem wrapping technique (Reddy *et al.,* 2015). Male and female beetles were released into wire mesh cages and provided with jackfruit leaves. They mated and laid eggs on leaves and on the sides of cages. Three host plants *viz.*, drumstick (*Moringa oleifera* Lam.), jack fruit and mango were evaluated for their suitability to rear larvae of *B. rufomaculata* in the laboratory. Fifteen fresh twigs each of three host plants, approximately measuring 40 cm length and 5-6 cm in diameter were used for the experiment (Fig. 1). A small hole was drilled at both the ends and a grub of one day old was released into each twig through these holes. The inoculated side was covered with muslin cloth to prevent accidental escape. The twigs were then placed in a bigger rearing cage (50 x 50 x 75 cm). Whenever stem pieces showed rotting or decaying symptoms, they were cut open and the larvae were transferred to fresh pieces (Ludwig *et al*., 2002). The survival of larvae was indicated by the protrudal of chewed stem tissues.

On the first examination of stem pieces after a month, it was observed that larval survival was not uniform on all hosts. There was more than 90 per cent mortality of larvae released into jack and mango twigs while all the grubs were alive and grown in size in the drum stick twigs. Out of 15 larvae released, none could reach pupal stage in case of jack while 2 and 13 of those reared on mango and drumstick pupated inside twigs, respectively (Table 1). Among three host plants evaluated, the recovery of adults was highest (80.00%) from drumstick twigs. Further close observation of the twigs of mango and jack revealed the presence of a small gallery along the length of the twig which indicates that the larvae started feeding but later on could not survive. *B. rufomaculata* had successfully completed the larval period inside drumstick twigs and reached pupal stage. The larval period ranged from 180 to 210 days. Pupal period was between 25 and 29 days. Adult survived on an average for two months. Adults emerged out of pupae in drum stick were morphologically fit and similar to the field emerged beetles. They mated and oviposition took place and second generation grubs also developed into adults.

Though all the three plant species tested are preferred hosts of *B. rufomaculata* under field conditions, their host status under laboratory conditions was not uniform. Under natural conditions, larvae feed and survive on main trunk while the material used in the study was collected from lateral branches as using main trunk is practically not feasible considering the economic value of the tree. The variations in the biochemical composition of main trunk and branches could be attributed to the mortality of young larvae in case of jack and mango. Composition of secondary metabolites, nutrition and bark moisture content are important factors that influence the incidence levels of cerambycids in live trees (Helen *et al*., 2014). The moisture content and the durability of cut stems might be affecting the larval survival. According to Lawrence *et al.* (1999), reduction in bark moisture increased the survival of longhorned borer, *Phoracantha semipunctata* F. on Eucalyptus where larval mortality was noticed beyond 60 % moisture level. In addition, the hardness of wood also leads to physical damage of grubs while cutting open and transferring to new twigs as observed with mango and jackfruit. Drumstick, being soft, was found to be ideal and amenable for recovering and releasing grubs to new twigs.

The results indicate that drumstick twigs would be ideal for laboratory rearing of stem borer, *B. rufomaculata.* This is a simple technology to study the biology, behavior and larval tunneling pattern of *B. rufomaculata* and also to conduct bioassay studies in the laboratory.

**Table 1. Effect of host plant material on survival and development of larvae of *Batocera rufomaculata* in the laboratory**

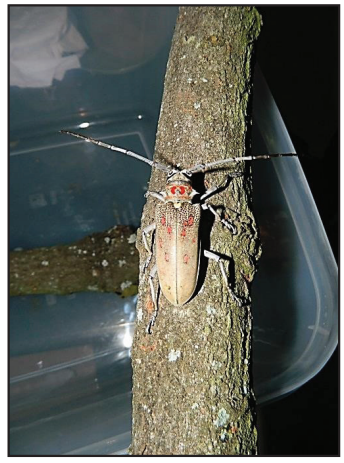
| Host plant material | No. of grubs released | Number of larvae pupated | No. of adults emerged | Adult recovery (%) |
|---|---|---|---|---|
| Drumstick | 15 | 13 | 12 | 80.00 |
| Jackfruit | 15 | 0 | 0 | 0.00 |
| Mango | 15 | 2 | 1 | 6.66 |

a. Drumstick twigs inoculated with larvae

b. Feeding symptoms on drum stick stem piece

c. Larva inside the drum stick twig

d. Pupation inside drum stick twig



e. Adult beetle emerged from drumstick grown larva

**Fig. 1. Rearing of larvae of *B. rufomaculata* on drumstick twigs (a-e)**

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**REFERENCES**

Beeson, C.F.C. 1941. The ecology and control of the forest insects of India and the neighbouring countries. Vasanth Press, Dehradun, India.

Gundappa, B., Balaji, M. R., Srivastava, K. and singh, S. R. 2015. Rearing of mango stem borer, Batocera rufomaculata (Cerambycidae: Coleoptera) on artificial diet. *Pest Management in Horticultural ecosystems,* **21** (2): 219-220.

Higashiyama, N., M. Ishida, and Y. Abe. 1984. Artificial medium for larval rearing of longhorn beetles (Coleoptera: Cerambycidae). *Research Bulletin of Plant Protection of Japan,* **20**: 39–45.

Helen, F. N., Timothy, E., Smith, A., Wiegand, Simon, A., Lawson, V., and Debuse, J. 2014. Host tree influences on Longicorn beetle (Coleoptera: Cerambycidae) attack in Subtropical *Corymbia* (Myrtales: Myrtaceae). *Environmental Entomology* , **43** (1): 37-46.

Keena, M. A. 2017. Laboratory rearing and handling of Cerambycids. In: Cerambycidae of the world (Ed. Qiao wang). CRC Press, Taylor and Group, New York. Pp. 253-290.

Lawrence, M., Timothy, D., Christopher, D., and Schuch, K. 1999. Water relations of host trees and resistance to the phloem-boring beetle

*Phoracantha semipunctata* F. (Coleoptera: Cerambycidae). *Oecologia,* **119**:400 - 407.

Ludwig, S. W., Lazarus, L., McCullough, D. G., Hoover, K., Montero, S. and Sellmer, J. C. 2002. Methods to evaluate host tree suitability to the Asian longhorned beetle, *Anoplopharu glabripennis*. *Journal of Environmental Horticulture,* **20**: 175-180.

Palaniswamy, M. S., Sundra, P. C., Babu and Subramanium, T. R. 1979. Studies on the biology of mango stem borer, *Batocera rufomaculata* De Geer (Coleoptera: Cerambycidae). *South Indian Horticulture,***27** (3-4): 100-106.

Potter, D. A. and Potter, M. F. 2008. Insect borers of trees and shrubs. University of Kentucky, Technical Bulletin - 43.*http://www.ca.uk.edu*.

Reddy, P. V., Chakravarthy A. K., Sudhagar S. and Reju M. Kurian. 2014. A simple technique to capture, contain and monitor the fresh-emerging beetles of tree borers. *Current Biotica,* 8(**2**):191-194.

Singh, R., Sashidharan, K. R., Salarkhan, A. M., and Mahalakshmi, R. 2001. *Batocera rufomaculata* (Coleoptera: Cermabycidae), a new insects record on *Casuarina equisitifolia* in India. *Indian Forester,* **127**(6): 723-724.

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