Host plant suitability for laboratory rearing of mango stem borer, *Batocera rufomaculata* De Geer (Coleoptera: Cerambycidae)

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Batocera rufomaculata (De Geer, 1775) (Coleoptera: Cerambycidae) is a xylophagous insect with broad host range including 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). Oviposition takes place 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. Flight period of adult beetles takes place any time between June and August (Palaniswamy *et al.,* 1979). To undertake basic studies on the bioecology of any insect, availability of laboratory culture is essential. So far there are no effective protocols for laboratory rearing of *B. rufomaculata* from egg to adult. In the absence of a complete artificial diet which could support the entire grub period, it is highly desirable to have a suitable laboratory host to rear the cerambycid so that several unresolved questions related to its bioecology could be answered as well as bioassay studies would be feasible. Hence, an experiment was designed to find a laboratory host suitable for rearing larvae of *B. rufomaculata.*

The study was conducted at ICAR-Indian Institute of Horticultural Research, Bengaluru. A simple stem wrapping technique which we reported earlier (Reddy *et al,* 2015) helped in capturing the beetles which were used to initiate the culture. Male and female beetles were left in wire mesh cages and provided with jackfruit leaves. They mated and laid eggs on leaves and on the sides of cages. Three hosts viz., drum stick, jack fruit and mango were evaluated. Fifteen twigs each of three plants, approximately measuring 40cm length and 5-6 cm in diameter were used for the experiment (Fig. 1) and five twigs were considered one replication. 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 caged in large plastic container. After about a month when stem pieces showed rotting or decaying symptoms, they were cut open and the larvae were transferred to fresh pieces and this procedure was continued till the completion of larval stage (Ludwig *et al*., 2002). The survival of larvae was indicated by the chewed tissues being thrown out. The pre-pupa bearing twigs were kept in separate cage and observed for adult emergence.

On 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 fed with jack and mango 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, respectively (Table 1). 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. However, when grubs of more than 30 days old were released into mango and jack twigs, 40 per cent of adult recovery was recorded (Table 2). 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 reported to be important factors influencing the incidence levels of cerambycids in live trees (Helen *et al*., 2014). 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. 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 the upper threshold limit was found to be 60%, beyond which larval mortality was more.

In addition, the hardness of wood also would have lead to physical damage of grubs while cutting open and transferring to new twigs in mango and jackfruit. Drum stick, being soft, was found to be ideal and amenable for recovering and releasing grubs to new twigs. In our experiment, *B. rufomaculata* successfully completed the larval period inside drum stick 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. There was 80% recovery of adults from the grubs reared on drum stick, thus proving it to be an effective laboratory host for rearing of *B. rufomaculata.* This would also facilitate testing entomopathogens and repellents for their efficacy against stem borer besides other behavioural studies.

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Table 1: Survival of one day old larva of *B. rufomaculata* on different host plants in laboratory

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

Table 2: Survival of older larvae of *B. rufomaculata* on different host plants in laboratory

Host material	No of grubs released	Number of larvae pupated	No of adults emerged	Adult recovery (%)
Mango	10	5	4	40.00
Jackfruit	10	4	3	40.00
Drumstick	10	10	9	90.00

A. Drum stick 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

Fig. 1: Rearing of larvae of *B. rufomaculata* on drum stick twigs

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