

Pupal development time, mortality, sex ratio and absence of parasitoid parasitism of *Bactrocera latifrons* (Insecta, Diptera, Tephritidae)

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ABSTRACT Host fruits of *Bactrocera latifrons* were collected in the field and returned to the laboratory for determination of infestation, pupal development time, mortality, sex ratio of emerging flies and parasitoid parasitism. The pupal development time under uncontrolled laboratory conditions ranged from 7 to 18 days in *B. latifrons* from *Capsicum annuum*; the majority of the pupae (81.80%) underwent 10-12 days of development. There was a slight excess of males to females in the emerging adult flies, but not significantly different ($\chi^2 = 1.18$; $0.30 > P > 0.20$). The pupal mortality was 24.67% (37/150 pupae). The infestation rate of chillies in Malaysia is low, ranging from 0.17 fly/fruit to 0.20 fly/fruit, and averaging 0.17 fly/fruit. No parasitoids were recovered in the present study.

Keywords fruit fly – pupal development time – pupal mortality – sex ratio – braconid parasitoids

INTRODUCTION

Fruit flies of the family Tephritidae are represented by over 4400 species worldwide [1]. Some 200 species of fruit flies are considered pests, causing direct losses to a wide variety of fruit, vegetable and flower crops [2]. The larvae of about 35% of the species attack soft fruits, and about 40% of species develop in the flowers of Asteraceae/Compositae [3].

Of the Dacinae fruit flies, the genus *Bactrocera* (previously genus *Dacus*) is of especial economic importance. It occurs in Malaysia and other parts of Southeast Asia and infests a great variety of fruit and vegetable crops. The damage may be tremendous and limit production and cultivation of affected crops.

Among the economically important species are: *B. dorsalis* complex (*B. carambolae*, *B. dorsalis*, *B. papayae* etc), *B. caudata* (infesting cucurbits), *B. cucurbitae* (infesting cucurbits), *B. latifrons* (infesting mainly solanaceous

fruits), *B. tau* complex (infesting cucurbits) and *B. umbrosa* (infesting *Artocarpus* fruits). *Bactrocera latifrons* (Hendel) is of primarily Asian distribution [2]. Its range has however expanded through introductions into Hawaii [4], Japan [5], Tanzania [6] and Kenya [7]. A total of 59 plant species from 14 plant families are identified as hosts of *B. latifrons*, based on reported field infestation data [8]. We report here the pupal development time, mortality, sex ratio and absence of parasitoid parasitism of *B. latifrons* (Figs. 1, 2) infesting chillies.

MATERIALS AND METHODS

Ripe chillies (*Capsicum annuum*) were collected weekly over six months in the gardens and brought to the laboratory for observation. They were placed in screened containers with suitable substrate for the larvae to develop and pupate [9]. Pupae were collected daily and placed in plastic tubes for development. Emerging adult flies were collected daily and their sexes were recorded. For mortality study the total number of pupae was recorded.

RESULTS AND DISCUSSION

The pupal development time under uncontrolled laboratory conditions ranged from 7 to 18 days in *B. latifrons* from *Capsicum annuum* (Table 1). The majority of the pupae (81.80%) underwent 10-12 days of development. This agrees reasonably well with the development time of 10.2 days reported by Vargas and Nishida [10].

Of the emerging adult flies, there was a slight excess of males to females (Table 1), but not significantly different ($\chi^2 = 1.18$; $0.30 > P > 0.20$). The pupal mortality was 24.67% (37/150 pupae).

The infestation rate of chillies in Malaysia is low. In three localities in the state of Selangor, 107 flies were recovered from 640 fruits (Table 2). The infestation rate ranged from 0.17 fly/fruit to 0.20 fly/fruit, averaging 0.17 fly/fruit. In four regions of Thailand (Chiang Rai, Chiang Mai, Bangkok and Songkhla), the infestation rate for infested *Capsicum annuum*, 9 *Solanum* species and others, was 0.43, 0.37, 0.12 and 0.23 *B. latifrons* per fruit, respectively [11]. We did not study the infestation rate in *Solanum* species. However, the male:female sex ratio of *B. latifrons* recovered from *Solanum melongena* from Pahang was 1.25:1 (5 males, 4 females), and from Kuala Selangor 0.60:1.00 (15 males, 25 females; $\chi^2 = 3.34$, $0.10 > P > 0.05$).

In the present study we did not recover any parasitoids. Opiine parasitoids – *Diachasmimorpha longicaudata* (Ashmead), *Psytalia makii* (Sonan), *Psytalia* sp. nr *fletcheri*, *Psytalia* sp. or *makii*, *Utetes bianchii* (Fullaway) – have been recorded for *B. latifrons* infesting *C. annuum* in Thailand but not Malaysia [12].



Figure 1. *Bactrocera latifrons* female on chilli. (photo: H. S. Yong)



Figure 2. *Bactrocera latifrons* female ovipositing on chilli. (photo: H. S. Yong)

Table 1. Pupal development time of *Bactrocera latifrons* infesting chilli in University of Malaya campus.

Days	Male	Female	Total	% Total
7		2	2	1.40
8	2	3	5	3.50
9	5	6	11	7.69
10	18	11	29	20.28
11	36	25	61	42.66
12	15	12	27	18.88
13	2	4	6	4.20
14		1	1	0.70
18		1	1	0.70
Total	78	65	143	100.01

Table 2. Cumulative number of *Bactrocera latifrons* recovered from chillies from different localities in Selangor, Peninsular Malaysia.

Locality	No. fruits	No. flies	Flies/fruit
Kuala Selangor	76	15	0.20
Bukit Rotan	89	13	0.15
Petaling Jaya	475	79	0.17
Total	640	107	0.17

In Hawaaii, larval parasitization of *B. latifrons* had been reported to be extremely low, <1% by *D. longicaudata* and also by *Tetrastichus* sp. [13]. In another study, out of 1895 *B. latifrons* pupae recovered from the turkeyberry collections and held individually, less than 6.0% were parasitized. The dominant parasitoid, *Fopius arisanus* Sonan accounted for 4.5% (86 out of 1895 pupae) of the parasitism [14].

Braconid parasitoids were present in the locality from which the chillies of the present study were collected. In a small sample of carambola fruits collected at the same locality and same time with the chillies, three common opiine parasitoids – *D. longicaudata*, *F. arisanus* and *Fopius vandenboschi* (Fullaway) – were recovered. The fruit flies were mainly *B. carambolae* with a few *B. papayae*. Parasitoids were however not recovered from a small sample of *S. melongena* infested by *B. latifrons* (2 males and 3 females from 7 pupae, pupal mortality 28.57%).

In summary, the infestation rates of chilli by *B. latifrons* in Malaysia is low. The pupal mortality of *B. latifrons* is high. The absence of parasitoid parasitism indicates that biological control of *B. latifrons* with opiine parasitoids may not have the anticipated impact.

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