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# Can Solanaceae Vegetables Serve as Equivalent Host to Cucurbitaceae for the Melon Fly, *Bactrocera Cucurbitae* (Coquillett) in Bangladesh?

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**Abstract:** The aim of the present research work was to observe the host suitability of Cucurbitaceae and Solanaceae family in respect to the pupal number and percent adult emergence of melon fly. An open choice oviposition method was applied to the melon fly *Bactrocera cucurbitae* (Coquillett) in a cage containing six different vegetables of the family Cucurbitaceae and Solanaceae. Snake gourd, pumpkin, bitter gourd and cucumber were chosen from Cucurbitaceae while tomato and eggplant were from Solanaceae family. After oviposition for a set period, each of the vegetables was kept separately until pupation. Total numbers of pupae collected from each host were subjected to statistical analysis and the host-wise differences were found insignificant. The insignificant numbers of pupae obtained from different hosts reflect that melon fly has no particular ovipositional preference for Cucurbitaceae plants. Based on adult emergences from each host a slight suitability order of *B. cucurbitae* was observed as follows: egg plant > pumpkin > snake gourd > cucumber > bitter gourd >tomato i.e. highest number of adults were emerged from the pupae from egg plant and lowest numbers from tomato. However, statistical analysis did not support any significant suitability order among the hosts analyzed in the study. Therefore, being reported occasional hosts in nature, two Solanaceae hosts, namely tomato and eggplant might be considered as equivalent hosts like other hosts of the family Cucurbitaceae studied.

**Key words:** Host preference, melon fly, oviposition, and vegetables.

## INTRODUCTION

Bangladesh is blessed with many horticultural crops like potato, tomato, eggplant, cabbage, cauliflower, pumpkin, bottle gourd, cucumber, pointed gourd, bitter gourd, hyacinth bean and yard long bean[8]. Fruit fly pest damages a considerable amount of vegetables grown in Bangladesh that causes yield loss of cucurbit vegetables from 19 to 75 %[9,1].

Melon fly *Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae) is a pervasive pest of vegetables infesting more than 125 species of plants most of which are inclined to Cucurbitaceae and Solanaceae[4,2]. Melon fly has been reported to hamper the production of melons, cucumbers, bitter gourd, ribbed gourd, snake gourd, sponge gourd, pumpkin and tomato[2,15]. Although plants of Cucurbitaceae have been reported to be the preferred hosts of melon fly, occasionally it can also infest hosts like eggplant, orange, papaya, mango, peach, and fig[15].

In Bangladesh, *B. cucurbitae* infests host plants like ash gourd *Benincasa hispida* Cogn., bitter gourd *Momordica charantia* Linn., kakrol, *Momordica cochinchinesis* Sprang., cucumber *Cucumis sativus* Linn., melon *Cucumis melo* Linn., ribbed gourd *Luffa acuangula* Roxby., sponge gourd *Luffa cylidrica* Linn., snake gourd *Trichosanthes cucumerina* Linn., pumpkin *Cucurbita maxima* Duch., water melon *Citrullus lantus* Mansf., eggplant *Solanum melongena* Linn., tomato *Lycopersicon esculentum* Mill., Mango *Mangifera indica* Linn[9,1]. Among these hosts eggplant and tomato are considered as occasional hosts[9].

From the regulatory point of view, a host must be considered a host regardless whether it is generally, occasionally, or only rarely infested[3]. Host range of melon fly has been studied in Bangladesh, however, the possibility of being Solanaceae plants as common host of melon fly is not documented well. Although initially host preference is determined by the oviposition behaviour, host suitability also is a known source of natural selection on host preference[7]. Therefore, in this study we intended to observe the host suitability of Cucurbitaceae and Solanaceae family in respect to the pupal number and percent adult emergence of melon fly after allowing melon fly females to oviposit of their choices.

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## MATERIALS AND METHODS

**Test Vegetable Hosts:** In this experiment six fresh vegetables were taken, four of Cucurbitaceae family and two of Solanaceae family, which are known host of *Bactrocera cucurbitae* in Bangladesh. These were: bitter gourd *Momordica charantia* Linn., cucumber *Cucumis sativus* Linn., snake gourd *Trichosanthes cucumerina* Linn., sweet gourd *Cucurbita maxima* Duch., eggplant *Solanum melongena* Linn., and tomato *Lycopersicon esculentum* Mill.

**Test Insect:** Melon fly, *B. cucurbitae* (Coquillett) was used from the regular rearing stock maintained at 27±2°C and 75-85% RH at insect biotechnology division, Institute of Food and Radiation Biology, Atomic Energy Research Establishment, Savar, Dhaka. After adult emergence 100 pairs of flies (100 males+100 females) were kept in cage to allow mating. Sufficient liquid diet (baking yeast: sugar: water=1:3:5) was supplied regularly into cage to feed on. After 15-20 days all males were removed and only 100 gravid females were kept for the oviposition purposes. These females were not exposed to other vegetables to lay eggs before using in bioassay. In each bioassay 100 such inexperienced gravid females were used.

**Host Preference Study:**

**Cage Bioassays:** This experiment was conducted from 1995 to 1996 in the Insect Biotechnology Division, Institute of Food and Radiation Biology, Atomic Energy Research Establishment, Bangladesh Atomic Energy Commission, Dhaka, Bangladesh. Each vegetable was cut, weighed to 250gm and kept separately in a petridish. Later vegetables were placed apart from each other at equal distance in the nylon netted same wooden cage (45´45´55 cm) containing 15-20 days old 100 gravid females at 1300hrs. After 3 hours vegetables were removed and placed separately on pupation media (saw dust) in a plastic bowl. Plastic bowls were covered with thin cloths to prevent further infestation. Plastic bowls were checked regularly to remove the rotting host-juice from the petridish to avoid unnatural larval death. Pupae were collected by sieving the sawdust, counted and kept in Petri dish for subsequent adult emergence. After adult emergence the number of adults of each vegetable were recorded. The results obtained from five replicates in five individual batches were analyzed and discussed.

**Data Analysis:** Data were analyzed by using statistical software SAS (version 9.1). Analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT) were performed to see whether there is any significant difference in the numbers of pupae and adults emerged from each host vegetables.

**Results:** From all vegetables considerable number of pupae and adults were collected. Relatively greater numbers of pupae of melon fly were obtained from pumpkin and snake gourd of Cucurbitaceae and eggplant of Solanaceae families. Average numbers of pupae obtained from these three hosts ranged from 312 to 389. In cucumber and bitter gourd of Cucurbitaceae family, the numbers of pupae were 280 and 258 respectively. Total number of pupae and adults developed in six vegetables (per 250gm) is presented in the table 1. From all the vegetables more than 85% pupae developed into adults which are presented in Figure 1. Average lowest and highest adult emergences were observed between 87 and 91%.

**Discussion:** The highest number of pupae of melon fly was collected from eggplant (mean±SE: 389±88.79) and the lowest number of pupae (mean±SE: 197±55.84) was collected from tomato (Table1). Assuming the same developmental rate of larvae to pupae in all the host vegetables, the numbers of larvae happened to be at the same ratio as that of pupae in all the hosts accordingly. Therefore, based on the observations on the numbers of pupae obtained and our assumption to the larval ratio, it is most likely that all the six vegetables of both the Cucurbitaceae and Solanaceae families attracted melon fly to oviposit. It is obvious that an egg-laying female must oviposit on that host where appropriate environment is present for offspring growth and thus, errors in defining the boundary between acceptable oviposition sites from non-acceptable sites can be very costly[14,5,11]. Therefore, it could be stated that all the six test vegetables do not have the same environment for larval development as the numbers of pupae obtained from the vegetables, apparently, showed three different ranks of attraction (<200, >200, >300). However, ANOVA and DMRT found no significant differences among the numbers of pupae obtained in six vegetable hosts. Therefore, our observation indicated that vegetables from Cucurbitaceae and Solanaceae families were suitable hosts for melon fly offspring growth and development equally.

From our experimental findings, on the pupal collection, we conclude that *B. cucurbitae* oviposited in all the vegetables tested with varying degree and it has apparent preferences as follows: eggplant > pumpkin > snake gourd > cucumber > bitter gourd > tomato. However, statistically this apparent preference was insignificant. Regarding the host status of Cucurbitaceae and Solanaceae vegetables for the melon

**Table 1:** Total number* of pupae and adults developed in vegetables (per 250gm)

| Vegetables | Pupae (Mean±SE) | Adult emerged (Mean±SE) |
|---|---|---|
| Eggplant | 389±88.79 | 346±83.08 |
| Pumpkin | 319±44.40 | 275±38.19 |
| Snake gourd | 312±62.51 | 292±64.35 |
| Cucumber | 280±55.98 | 257±55.32 |
| Bitter gourd | 258±53.66 | 233±44.03 |
| Tomato | 197±55.84 | 181±56.11 |

*Mean of 5 replicates

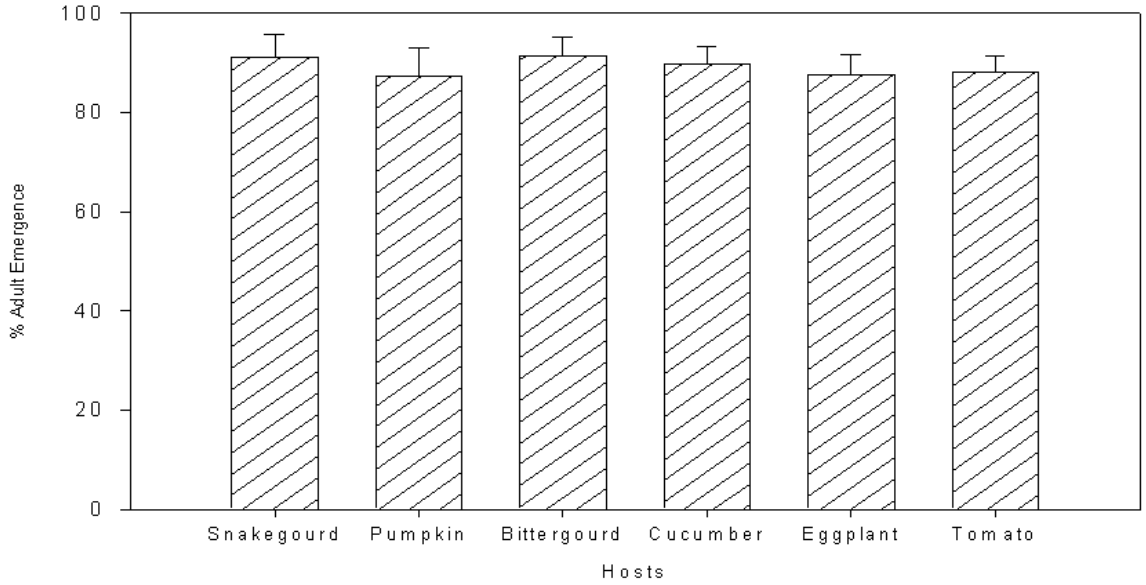


**Fig. 1:** Percent Adult Emergences of the pupae collected from different hosts of melon fly studied.

fly, published reports are contradictory. Kabir *et al*.,[9] reported pumpkin as the most preferred host of *B. cucurbitae* in the presence of other hosts like sponge gourd and cucumber. Pumpkin was also reported to be most preferred host in Hawaii[15]. Therefore our results coincide with these observations as we found pumpkin is preferred host among all the tested cucurbits. On the other hand, bitter gourd, snap melon and snake gourds were reported to be most preferred host[1,6]. Bitter gourd was also reported to be damaged highly by melon fly among cucurbits in other experiments[10,13]. Although highest (389±88.79) and lowest (197±55.84) numbers of pupae were obtained from two Solanaceae hosts, eggplant and tomato respectively, the percent adult emergences in eggplant (87.49±4.20)% and tomato (88.27±3.20)% were very close. Percent adult emergences of the pupae collected from four vegetables of Cucurbitaceae family ranged between 87 and 91% (Figure 1) with no significant difference. Hence, all the vegetables tested were found to be suitable for the development of adult melon fly. Although in Bangladesh, tomato and eggplant are considered as occasional host[9], in other countries tomato and eggplant are considered as preferred cultivated hosts[15,12]. Thus, our findings are not unusual and we conclude that eggplant and tomato of Solanaceae family should be placed as equivalent hosts of melon fly as those of other cucurbit vegetables like cucumber, bitter gourd, snake gourd or pumpkin in Bangladesh also. Therefore, when an area-wide pest management strategy is taken for managing melon fly in cucurbit vegetable farm, backyard garden or nearby commercial farm of tomato or eggplant must be taken into account.

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