J. Crop Prot. **2025, 14 (2): 117-131**

Research Article

Oviposition preference and host susceptibility of the oriental fruit fly *Bactrocera dorsalis* Hendel (Diptera: Tephritidae) on commercial mango varieties

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Abstract: The Oriental fruit fly, *Bactrocera dorsalis* (Hendel), is a serious fruit pest in South Asia; however, studies of its oviposition behavior on different host fruits in Sri Lanka are insufficient. Hence, the present study was conducted to determine the oviposition preference and host susceptibility of *B. dorsalis* on four commercial mango varieties [Karutha kolumban (Kc), Willard (Wld), Vellai kolumban (Vc), and Betti amba (Ba)] under controlled laboratory conditions. The comparative preference and susceptibility of *B. dorsalis* to four mango varieties were tested by a series of choice and no-choice experiments. The oviposition preference was evaluated, and host susceptibility was investigated by incubating the tested fruits separately until pupation and adult emergence. Results revealed that mature females of B. dorsalis exhibited significantly different host preferences and susceptibilities among the four mango varieties tested ($P < 0.05$). Distinct host visits, visit durations, oviposition attempts, and a significantly high number of pupae and adult emergence of *B. dorsalis* were recorded for `Kc`, followed by `Ba`, `Vc`, and `Wld` mango varieties. The `Wld` was less preferred by *B. dorsalis* for oviposition. Moreover, fewer pupae and adult emergence occurred for this variety. The mango variety and fruit circumference were significantly correlated with host visits, visit durations, oviposition attempts, and the number of pupae and adults, while the impact of fruit peel thickness on these factors was negative. Study findings help design control measures for *B. dorsalis* to prevent damage to the commercial mango varieties in Sri Lanka.

Keywords: *Bactrocera dorsalis,* commercial mango varieties, host susceptibility, oviposition behavior

Introduction

Sri Lanka is a tropical country with a rich floral and faunal diversity. Mango (*Mangifera indica* L.) is recognized as the most widely cultivated fruit tree (Anonymous, 2011), and it is the second most widely distributed fruit crop in Sri Lanka after the banana (Peris, 2016). Among 18 varieties of mangoes, `Karutha kolumban`, `Willard`, 'Vellei

Handling Editor: Yaghoub Fathipour

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Received: 23 July 2024, Accepted: 21 January 2025
Published online: 04 October 2025

kolumban', and `Betti amba` are widely grown mango varieties that have maintained good market value for many years in Sri Lanka (Peris, 2016). More than 300 insect pest species have been reported to attack mango in different parts of the world. Fruit flies (Diptera: Tephritidae) are considered a group of serious fruit pests (Chaudhary *et al*., 2012), and *Bactrocera dorsalis* is reported as a dominant fruit fly species in mango cultivations in South Asia (Peris, 2016).

The origin of *B. dorsalis* is Asia (Allwood, 1997), and the species is currently distributed across Asia, Africa, and the Pacific regions (Lux *et al*., 2003; Drew *et al*., 2005). *Bactrocera dorsalis* is a serious pest because its females have a broad host range and a high reproductive rate (Leblanc, 2003). They prefer to attack mango fruits (Clarke et al., 2005), causing significant post-harvest damage.

Female *B. dorsalis* selects host fruits that are suitable for oviposition and larval performance based on the physiological features of the host. It has been shown that their host selection is influenced by the color, size, shape, and smell of fruit (Prokopy and Owens, 1983; Jang and Light, 1991; Prokopy and Vargas, 1996; Cornelius *et al*., 1999; Alyokhin *et al*., 2000; Drew *et al*., 2005; Brevault and Quilici, 2007). Female fruit flies puncture the peel of the host fruit using their ovipositor, then deposit eggs into the pulp of the fruit, where the larvae hatch and feed on the fruit pulp, causing serious fruit damage (Prokopy and Koyama, 1982), making fruits unfavorable for consumption and marketing (Amin, 2017). The fruit damage of *B. dorsalis* is also influenced by the fruit variety and its physiological characteristics (Rattanapun *et al*., 2009; Diatta *et al*., 2013). Furthermore, several studies have demonstrated that the nutritional value of the host fruit has an indirect influence on infestation by fruit flies (Drew *et al*., 2003; Brévault and Quilici, 2007). Boinahadji *et al*. (2020) reported that the oviposition preference and offspring performance of B. dorsalis are higher in mangoes, with a shorter development time compared to seven other fruits tested in their study in Senegal. Another study revealed that *B. dorsalis* prefers to lay eggs on mangoes that are stored for 7–15 days after harvest (Boinahadji *et al*., 2019). Further, the oviposition preference of *B. dorsalis* varies with the ripening stage of mangoes (Rattanapun *et al*., 2009).

In Sri Lanka, several studies have been conducted on the diversity of fruit flies (Ekanayake *et al*., 2002; Ranaweera *et al*., 2017; Heshani and Sirisena, 2017; Marasinghe *et al*., 2018) and their control measures (Anonymous, 2012; Dhanapala, 1996; Karunaratne and Karunaratne, 2012; Bandara *et al*., 2006). Nevertheless, these studies did not concentrate on the oviposition preference of fruit flies in Sri Lanka. Recently, Wijekoon *et al*. (2021) reported that the fruit infestation by *B. dorsalis* was higher in the `Karuthakolumban (Kc)' variety than `Willard (Wld)` variety in Sri Lanka. In another study, Wijekoon *et al*. (2022) showed that yellow `Wld` was preferred for oviposition by *B. dorsalis* than other color types.

Hence, studies on the host preferences of *B. dorsalis* in Sri Lanka are scarce. Since several commercial mango varieties are grown in Sri Lanka, understanding the levels of host preference and performance of B. dorsalis on these varieties is crucial for local fruit growers, sellers, and exporters.

The present study was thus carried out to determine the preference for oviposition and host susceptibility of female *B. dorsalis* using a series of choice and non-choice lab experiments on four commercial mango varieties in Sri Lanka: 'Kc', 'Wld', 'Vc', and 'Ba', as well as to investigate the relationship of host susceptibility with fruit physical characteristics and oviposition behavior of female *B. dorsalis*.

Materials and Methods

Collection of mango fruits for *B. dorsalis* rearing

Mangoes (both overripe and ripe) were collected from two main sites (Kc variety, 6°45'0"N, 81°14'0"E, elevation 162 m, Wld variety; 6° 44' 15.85" N, 81° 6' 11.005" E, elevation 188 m, Intermediate zone) in Uva Province, Sri Lanka.

Rearing of fruit flies

The study was conducted from December 2021 to February 2022 under controlled laboratory conditions of temperature and relative humidity (27 ± 2 °C and 75–80%) at the Department of Zoology, University of Ruhuna, Sri Lanka.

A total of 672 mango fruits (320 Kc and 352 Wld) were collected from two subplots of each of the above two main sites. The collected mangoes were incubated in 168 containers to prepare a colony of 200 *B. dorsalis* adults. Fruits were incubated by placing four mangoes in a container (18 × 14 × 13 cm) filled with pre-sterilized sand and covered with a muslin cloth under the laboratory conditions mentioned above. After 10–15 days, the adult flies were transferred into insect cages (30 × 30 × 20 cm, seven cages), which were covered with muslin cloth to prevent adult flies from entering or escaping. The species and sexes of emerging adults were identified before transferring them into the insect cages. The emerged adult flies were identified using taxonomic keys (Leblanc *et al*., 2021; Plant Health Australia, 2018; Daud *et al*., 2020) at the research laboratory of the Department of Zoology, University of Ruhuna, Sri Lanka. Adult flies were fed using a standard artificial diet [(yeast: sugar, 1:3 by volume) + water (Ekesi *et al*., 2009)]. Both males and females of *B. dorsalis* were kept together in cages in a 2:1 male-to-female ratio for 10–17 days. Then, the females were removed from the cages and used for both choice and no-choice laboratory tests.

Mango varieties

Four commercially important mango varieties (\`Kc\`, \`Wld\`, 'Vc', and 'Ba') were chosen for the study (Fig. 1). Fruits of both \`Kc\` (209.49 ± 3.4 g) and \`Vc\` (182.68 ± 2.40 g) are larger than those of the \`Ba\` (132.67 ± 1.01 g) and \`Wld\` (123.41 ± 1.17 g) varieties. These fruits were brought from the field at the unripe stage. Individual fruits were covered with black wrapping paper to prevent infestation by fruit flies and then stored at laboratory conditions (27 ± 2 °C and 75–80% relative humidity) until fully ripe. Then, all fruits were visually examined (using a hand lens) to confirm the absence of oviposition sites by fruit flies. Fruits that did not have any oviposition marks were selected to use in choice and non-choice experiments.

Preference tests of oviposition

i). Choice test

In a replicate, four mangoes, one from each variety, were placed randomly on the layer of pre-sterilized sieved sand (6 cm in height) in a standard-size plastic container (18 × 14 × 13 cm), keeping at the same distance (2 cm) between each fruit. Twenty replicates were conducted using eighty fruits and twenty testing containers. Test containers were placed in water baths to protect experimental setups from ants. A mature female *B. dorsalis* (10–17 days old, Boinahadji *et al*., 2019), from the culture was released into the center of a testing container. Then, the top of each testing container was tightly covered using a muslin cloth (1mm mesh size). Elastic rubber bands were used to secure the muslin cloth, preventing flies from entering or escaping the rearing container. The number of visits, number of oviposition attempts, and visit duration in each fruit were observed and recorded over three hours (10.00–13.00 hrs, as described by Kanika *et al*., 2019).

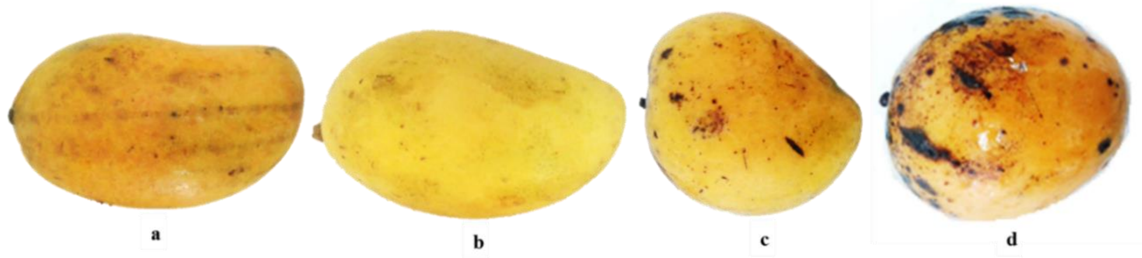

Figure 1 The selected four mango varieties: a. Karutha kolumban (Kc), b. Vellai kolumban (Vc), c. Betti amba (Ba) and d. Willard (Wld).

After 3 hours, the female fly was removed from the container, and the tested fruits were incubated in separate containers until the pupae and adults emerged. Five control replicates (four mangoes; one mango per variety, but no flies in a replicate) were used to determine whether flies emerged from 'non-exposed' test fruits.

ii). No-choice test

Each variety was placed individually in a testing container, and a mature female (10–17 days old) was introduced to each container. Twenty replicates were conducted for each mango variety (i.e., 80 total replicates). After observing their oviposition behaviors for 3 hours, the female fly was removed, and the tested fruits were incubated individually. Except for the simultaneous offering of four varieties of mangoes, the procedures and conditions were identical to those described in the choice test. Five control replicates were used per variety.

Measurements of fruit physical characters

Three parameters — fruit weight, circumference, and peel thickness — were measured for the mango varieties. Fruit weight (g) was measured by a digital balance (Mettler PE3600, Switzerland). Fruit circumference (mm) was measured using a standard measuring tape. For the fruit circumference, measurements were taken from three places, and the average values were recorded. Fruit peel thickness (mm) was measured with a Vernier Caliper (Drapper, Model Number 18066, UK). The fruit peel was removed randomly from five places, and the average peel thickness was recorded.

All measurements of mangoes (a total of 160 mangoes) were taken after testing the oviposition preference of *B. dorsalis* females and before incubating the tested mangoes for pupae and adult emergence.

Emerging pupae and adults:

All fruits tested in choice and no-choice experiments were examined carefully for possible oviposition marks. Then, they were labeled and incubated separately in plastic containers (18 × 14 × 13 cm) with pre-sterilized sand and a muslin cloth covered under controlled laboratory conditions (27 ± 2 °C and 5–80% humidity). At the end of the fourth week, the containers were carefully examined, and all pupae and emerging adult flies (males and females) were counted.

Fruits used for control tests in both choice and non-choice conditions were incubated in separate containers to confirm whether any pupae or adults recovered.

Statistical analysis

The data were coded and entered into a database created using the Statistical Package for the Social Sciences (SPSS, version 20.0) software. The normality of the data was tested using the Anderson-Darling test. Since the data followed a normal distribution, parametric tests were performed. The significance of the variation in the number of visits, visit duration, the number of oviposition attempts by female flies, and the number of pupae and adults that emerged per variety of mango, and fruit weight, circumference, and peel thickness per variety in both choice and non-choice conditions were compared using the ANOVA with multiple comparison test (Tukey`s test HSD) at the 0.05 significance level. Relationships between variables, including fruit weight, fruit circumference, and peel thickness, fruit visits, visit duration, and oviposition attempts of female flies, as well as the number of larvae and adults emerged under both choice and non-choice conditions, were analyzed using Pearson's correlation analysis at an $\alpha = 0.01$ significance level.

Ethical approval for this study was obtained from the Ethical Review Committee (UOK/ERC/FS/21/023) at the Faculty of Science, University of Kelaniya, Sri Lanka.

Results

Oviposition preference

Choice test

The mean number of host fruit visits ($F_{(3, 80)}$ = 54.012, $P < 0.05$), oviposition attempts (F = 30.651, $P < 0.05$), and mean fruit visit duration ($F_{(3, 80)}$ = 76.133, $P < 0.05$) of *B. dorsalis* varied significantly among four mango varieties. A significantly higher number of visits was recorded for the `Kc’ variety (3.7 ± 0.03) ($P < 0.05$), followed by `Ba` (2.55 ± 0.05) and `Wld`. A significantly lower number of visits was recorded for `Wld` (0.95 ± 0.02) ($P < 0.05$) compared to other varieties (Fig. 2a). The highest number of oviposition attempts was recorded for ‘Kc` variety (1.95 ± 0.03) ($P < 0.05$), whereas the lowest was recorded for `Vc` variety (0.4 ± 0.02) (Fig. 2b).

Female flies spent a longer period on the ‘Kc` mango variety (30.05 ± 0.38 min) ($P < 0.05$), the moderate duration for the ‘Ba` (13.9 ± 0.36 min) variety, and a shorter period was observed for the `Wld` (4.2 ± 0.23 min) ($P < 0.05$) (Fig. 2c).

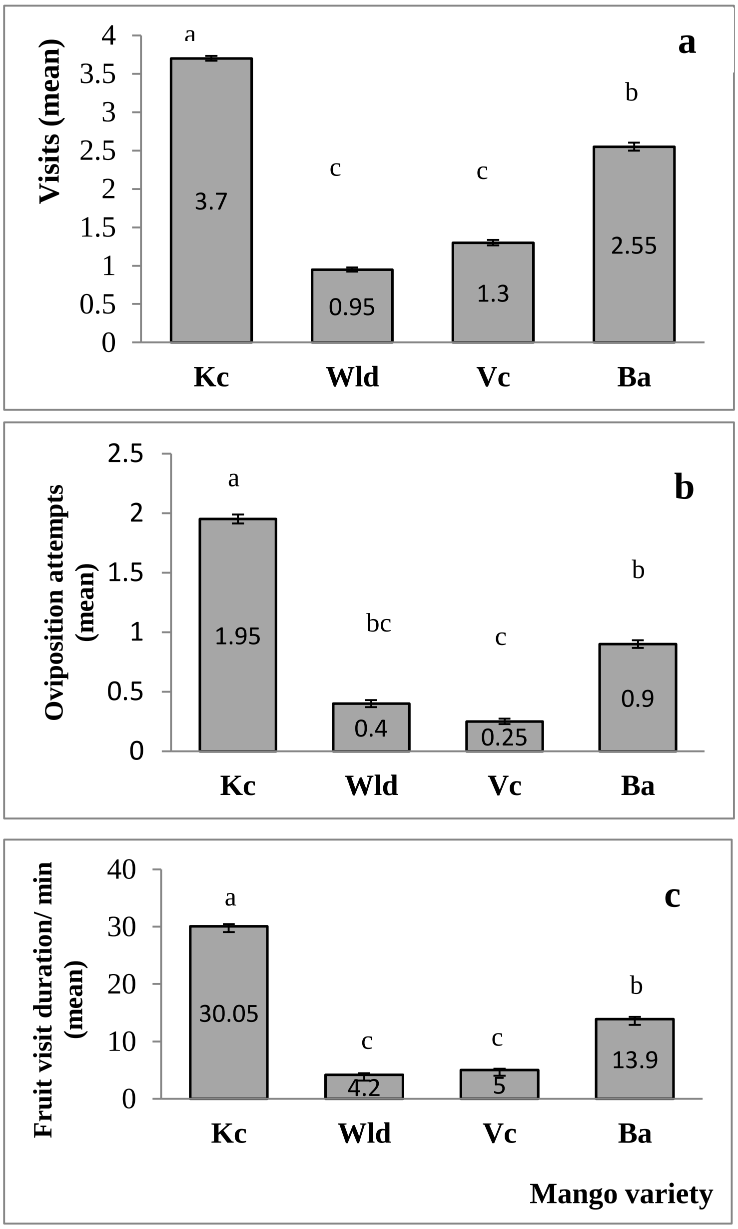

Figure 2 Mean (± SE), (a) No. of visits, (b) No. of oviposition attempts and (c) Visit duration/min by female of *Bactrocera dorsalis* on four mango varieties in the choice experiment. Means with different letters differ significantly ($P < 0.05$, Tukey`s test).

No-choice test

Females of *B. dorsalis* showed significantly different fruit visits ($F_{(3, 80)} = 9.811$, $P < 0.05$), oviposition attempts ($F_{(3, 80)} = 4.815$, $P < 0.05$), and fruit visit duration ($F_{(3, 80)} = 12.333$, $P < 0.05$) among four mango varieties. The highest number of fruit visits was recorded for the

`Kc` variety (3.4 ± 0.07) ($P < 0.05$) and the lowest visits for the `Wld` variety (1.6 ± 0.03). Moderate visits were recorded for `Ba` (2.9 ± 0.06) (Fig. 3a).

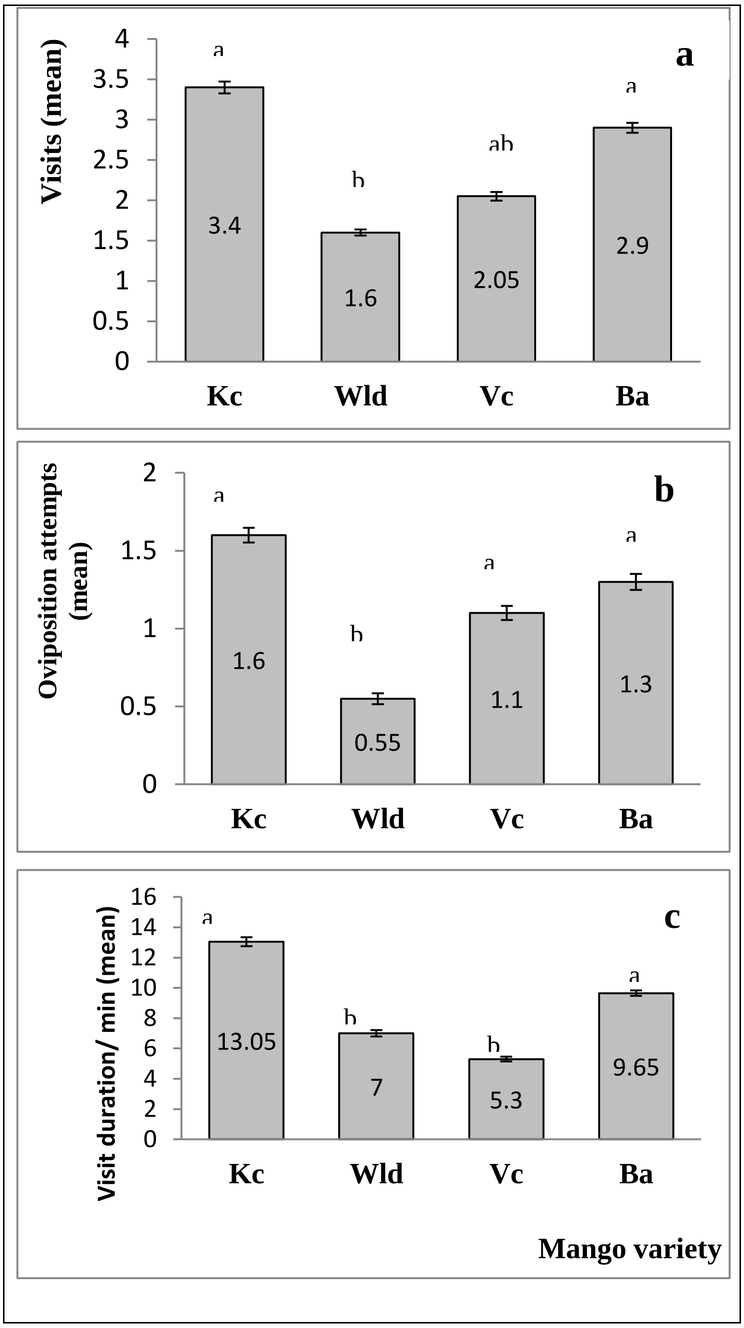

Figure 3 Mean (± SE), (a) No. of visits, (b) No. of oviposition attempts and (c) Visit duration/min by the female of *Bactrocera dorsalis* on four mango varieties in the no-choice experiment. Means with different letters differ significantly ($P < 0.05$, Tukey`s test).

The highest oviposition attempts were recorded for the `Kc` mango variety, which was significant (1.6 ± 0.04) ($P < 0.05$) compared to the `Wld` variety. The lowest oviposition attempts were recorded for the `Wld` variety (0.55 ± 0.03) (Fig. 3b). The visit duration for the `Kc` variety (13.05 ± 0.29 min) was significantly higher ($P < 0.05$) compared to the `Vc`. The shortest visit duration was recorded for the `Vc` mango variety (5.3 ± 0.16 min) (Fig. 3c).

Host susceptibility

In choice condition

i.) Physical parameters of host fruits

The mean of fruit weight, fruit circumference, and peel thickness were significantly different among the four mango varieties ($P < 0.05$) (Table 1). A significantly high fruit weight was recorded for the `Kc` ($P < 0.05$) compared to the other three varieties. The fruit circumference of each mango variety was statistically significant ($P < 0.05$). The peel thickness of each mango variety was non-significant ($P > 0.05$) (Table 1).

ii. Emergence of pupae and adults

The number of pupae and emerged adults was significantly different among the four mango varieties ($P < 0.05$) (Table 2). A significantly higher number of pupae (17.25 ± 0.57, $P < 0.05$) and adults (10.65 ± 0.37, $P < 0.05$) were recorded for the `Kc` mango variety than the other three varieties. The lowest number of pupae (2.53 ± 0.20) and adults (1.50 ± 0.13) were recorded for the `Wld` mango variety. The highest percentage of adults emerged from their pupae in the `Vc` variety (70.9%). The sex ratio of emerged adults showed that the female emergence was higher than the male emergence of *B. dorsalis* for all tested mango varieties (Table 2).

Table 1 Fruit weight, fruit circumference, and peel thickness of four commercial mango varieties in the choice test.

Mango Variety	Weight of fruit (g) (Mean ± SE)	Fruit circumference (mm) (Mean ± SE)	Peel thickness of fruit (mm) (Mean ± SE)
Kc	209.49 ± 3.4 a	268.15 ± 0.28a	1.41 ± 0.006 a
Wld	123.41 ± 1.17 c	196.85 ± 0.27c	1.48 ± 0.003 a
Vc	182.68 ± 2.40 b	173.20 ± 0.41d	1.42 ± 0.007 a
Ba	132.67 ± 1.01c	232.40 ± 0.34b	1.33 ± 0.004 a
F value	94.11	796.4	5.74
P value	0.001	0.000	0.001

Means within each column with different letters differ significantly ($P < 0.05$, using Tukey`s test).

Table 2 The emergence of *B. dorsalis* pupae and adults from four mango varieties under choice condition.

Variety	No. of pupae (Mean ± SE)	No. of adults emerged (Mean ± SE)	Pupae to adult emergence (%)	Sex ratio (M: F)
Kc	17.25 ± 0.57a	10.65 ± 0.37 a	61.8	0.7:1.0
Wld	2.53 ± 0.20b	1.50 ± 0.13b	59.3	0.4:1.0
Vc	2.75 ± 0.29b	1.95 ± 0.22 b	70.9	0.6:1.0
Ba	8.00 ± 0.30b	5.0 ± 0.22 b	62.5	0.6:1.0
F value	17.792	13.910		
P value	0.0001	0.0001		

Means within columns with different letters differ significantly ($P < 0.05$, using Tukey`s test).

iii. Relationship between fruit flies and host plant characteristics

The Pearson correlation results of adults and pupae of *B. dorsalis* with physical characteristics of host fruits and characters of female oviposition behavior under choice conditions are given in Table 3.

The peel thickness of host mangoes showed a non-significant and negative correlation with fruit visits, oviposition attempts, visit duration, emerged adults, and pupae of *B. dorsalis* ($P > 0.05$). Fruit circumference showed a strong positive correlation with fruit visits ($r = 0.77$; $P < 0.05$), oviposition (r = 0.69; P = 0001), and visit duration ($r = 0.81$; $P < 0.05$) of female *B. dorsalis*.

The host fruit visits by female *B. dorsalis* showed a significant positive correlation with their visit duration ($r = 0.87$; $P < 0.05$) and oviposition attempts ($r = 0.69$; $P < 0.05$). The number of oviposition attempts positively correlated with the number of pupae (Pearson, $r = 0.71$; $P < 0.05$) and the number of adult flies (Pearson, $r = 0.69$; $P < 0.05$) that emerged from host fruits.

Table 3 Correlation analysis of emerged pupae and adults of *Bactrocera dorsalis* with physical characters of mangoes and behavioral characters of female oviposition preference in the choice condition.

Variables		PCHF			BFOP			EPA	
		1	2	3	4	5	6	7	8
PCHF									
1. Fruit weight	*r*								
2. Fruit circumference	*r*	0.37**							
3. Peel thickness	*r*	-0.08	-0.16						
BFOP									
4. No. of fruit visits	*r*	-0.05	0.77**	-0.28**					
5. Ovipo. attempts	*r*	-0.11	0.69**	-0.13	0.69**				
6. Visit duration	*r*	-0.07	0.81**	-0.14	0.87**	0.75**			
EPA									
7. No. of pupae	*r*	-0.04	0.61**	-0.11	0.60**	0.71**	0.65**		
8. No. of adults	*r*	-0.01	0.56**	-0.11	0.57**	0.69**	0.63**	0.96**	

PCHF: Physical characters of host fruits, BFOP: Behavior of female oviposition preference, EPA: Emergence of pupae and adults. ***r*:** Pearson Correlation value, ** significance at the 0.01 level.

In no-choice condition

i. Physical parameters of host fruits

The fruit weight, circumference, and peel thickness were significantly different ($P < 0.05$) among four mango varieties (Table 4). The highest fruit weight ($P < 0.05$) and circumference ($P < 0.05$) were recorded for the \`Kc\` mango variety with moderate peel thickness ($P > 0.05$). The fruit circumference is distinct in each variety of mango ($P < 0.05$) (Table 4).

ii. Emergence of pupae and adults

The emergence of pupae and adults of *B. dorsalis* was significantly different among four mango varieties ($P < 0.05$) (Table 5). The significantly high number of pupae (22.90 ± 0.68, $P < 0.05$) and adults (14.70 ± 0.44, $P < 0.05$) was recorded for the \`Kc\` variety, whereas the lowest number of pupae (4.05 ± 0.25) and adults (2.45 ± 0.16) was recorded for the \`Wld\` variety. The highest percentage of adults emerged in \`Ba\` (75.3%), whereas the lowest was in \`Wld\` (60.5%). When considering the male-female ratio, the number of female adults emerged to be higher than that of males in all tested mango varieties (Table 5).

In the no-choice test, the number of fruit visits, their spending time on the fruit, and the oviposition attempts of *B. dorsalis* were comparatively higher for all mango varieties than for the choice test.

iii. Relationship between fruit flies and host plant characteristics

The Pearson correlation results of adults and pupae of *B. dorsalis* with the physical characteristics of host mangoes in four varieties and the characters of female oviposition behavior under a no-choice condition are mentioned in Table 6.

Table 4 Mean comparison of fruit weight, fruit circumference, and peel thickness among four commercial mango varieties tested under non-choice conditions.

Mango variety	Mean (± SE) weight of fruit/g	Mean (± SE) fruit circumference/ mm	Mean (± SE) peel thickness of fruit/ mm
Kc	212.33 ± 3.94 a	269.40 ± 0.33a	1.35 ± 0.003 a
Wld	116.63 ± 1.68 c	196.85 ± 0.27 c	1.45 ± 0.005 a
Vc	190.24 ± 1.76 b	176.70 ± 0.32 d	1.36 ± 0.006 a
Ba	125.15 ± 1.26 c	231.65 ± 0.31 b	1.32 ± 0.004 a
F value	75.89	873.58	4.54
P value	0.0001	0.001	0.006

Means within columns with different letters differ significantly ($P < 0.05$, using Tukey`s test).

Table 5 The emergence of *Bactrocera dorsalis* pupae and adults from four mango varieties under no-choice condition.

Variety	Mean No, (± SE) of pupae emerged	Mean No. (± SE) of adults emerged	Pupae to adult emergence (%)	Sex ratio M: F
Kc	22.90 ± 0.68 a	14.70 ± 0.44 a	64.2	0.8:1.0
Wld	4.05 ± 0.25 b	2.45 ± 0.16 b	60.5	0.7:1.0
Vc	11.65 ± 0.48 b	8.15 ± 0.36 b	70.0	0.8:1.0
Ba	7.90 ± 0.27 b	5.95 ± 0.22 b	75.3	0.7:1.0
F value	15.836	13.488		
P value	0.0001	0.001		

Means within columns with different letters differ significantly ($P < 0.05$, using Tukey`s test).

Table 6 Correlation coefficients (r) of emerged pupae and adults of *Bactrocera dorsalis* with physical characters of mangoes and female oviposition preference in the choice condition.

Variables	PCHF			BFOP			EPA	
	1	2	3	4	5	6	7	8
PCHF								
1. Fruit weight								
2. Fruit circumference	-0.29^{**}							
3. Peel thickness	-0.04	-0.18						
BFOP								
4. No. of fruit visits	0.12	0.48^{**}	-0.23^{**}					
5. Ovip. attempts	0.26^{**}	0.29^{**}	-0.23^{**}	0.83^{**}				
6. Visit duration	-0.11	0.55^{**}	-0.007	0.25^{**}	0.21^{**}			
EPA								
7. No. of pupae	0.36^{**}	0.44^{**}	-0.14	0.61^{**}	0.64^{**}	0.39^{**}		
8. No. of adults	0.33^{**}	0.41^{**}	-0.17	0.57^{**}	0.64^{**}	0.44^{**}	0.96^{**}	

PCHF: Physical characters of host fruits, BFOP: Behavior of female oviposition preference, EPA: Emergence of pupae and adults. *r*: Pearson Correlation value, ** significance at the 0.01 level.

The peel thickness showed a non-significant correlation with the emergence of adults and pupae of B. dorsalis, whereas a significant negative correlation was observed with fruit visits ($r = -0.23$; $P < 0.05$) and oviposition attempts ($r = -0.23$; $P < 0.05$). Fruit circumference showed a positive correlation with fruit visits, oviposition, visit duration, number of pupae, and adults of *B. dorsalis*.

The number of host fruit visits by female *B. dorsalis* showed a weak correlation with their visit duration ($r = 0.25$; $P < 0.05$) and a significant correlation with oviposition attempts ($r = 0.83$; $P < 0.05$). The number of oviposition attempts showed a significant and good correlation with the number of pupae ($r = 0.64$; $P < 0.05$) and the number of adult flies ($r = 0.64$; $P < 0.05$) that emerged from the host fruits.

Discussion

The present study revealed the variation in the oviposition preferences of *B. dorsalis* on four selected commercial mango varieties in Sri Lanka. In this study, laboratory experiments were conducted, allowing for the equalization of the abundance and availability of different fruits and a sharper focus on host preferences (Stanton, 1982; Ahman, 1985).

It is well documented that the oviposition preferences of fruit flies depend mainly on the type of host fruits that promote the survival and growth of their offspring (Fontellas-Brandalha and Zucoloto, 2004; Joachim-Bravo *et al*., 2001). As evident by the present study, the number of fruit visits, visit durations, attempts to oviposit, and number of emerged larvae and adult flies varied significantly among the selected four commercial mango varieties. This result aligns with the findings of Kumar et al. (2011), who reported that the damage caused by fruit flies varies across different mango varieties.

Our study revealed that *B. dorsalis* preferred to visit and oviposit in `Kc` mangoes compared to the other three varieties tested. Hence, the offspring's performance was also higher in `Kc` mangoes than in the other tested varieties. These results are in accordance with the findings of Diaz-Fleischer and Aluja (2003) that the most suitable host fruit environment provides the best larval performance of fruit flies. As revealed by the study, `Kc` mangoes have high fruit circumference, fruit weight, and moderate peel thickness compared to the other three varieties. These factors may be responsible for the higher performance of *B. dorsalis* on the `Kc` variety because ‘Kc` provides a larger fleshy area for feeding and survival of their maggots. According to Sohail *et al*. (2015), fruit flies prefer to select large host fruits over small ones.

In both choice and no-choice conditions, female flies visited and oviposited in the `Ba` variety following `Kc`. The fruit circumference of `Ba` is lower than `Kc`, and it is one of the most popular mango varieties among Sri Lankans due to its sweet taste (Peris, 2016). Further, the pupal and adult emergence of *B. dorsalis* in the choice condition is also moderate for 'Ba' compared to other tested varieties. Therefore, *B. dorsalis* exhibits a moderate host preference and offspring performance due to its medium-sized fruit.

The `Wld` mango variety showed the lowest numbers of host visits, visit duration, oviposition attempts, and offspring performance of *B. dorsalis*, as well as the highest peel thickness and the lowest fruit weight among the four mango varieties. Their lowest host preference and susceptibility could be explained by their thick fruit peel, which might discourage fruit flies' oviposition behavior.

When compared to 'Ba,' the 'Vc" variety had the smallest fruit circumference and lowest host preference, as well as the lowest susceptibility. This result can be linked to the findings of Sohail et al. (2015), who reported that fruit flies preferentially select larger host fruits over smaller ones for oviposition.

In the no-choice experiment, the number of fruit visits, fruit visit duration, attempts to oviposit, and number of pupae and emerged adult flies of *B. dorsalis* were obviously higher compared to the choice condition. This outcome most likely reflected that females had no choice but to choose their preferred host mango variety, as shown by Rattanapun *et al*. (2009). The number of fruit visits, duration of visits, and *B. dorsalis* oviposition attempts were all strongly associated with the number of pupae and adults that emerged from the host mango fruits. In a non-choice test, a significant positive correlation was observed between the weight of the mangoes and the emergence of pupae and adults.

Fruit circumference had a positive influence, while fruit peel thickness harmed *B. dorsalis* pupae and adult emergence. Furthermore, the physical characteristics of different mango varieties had a significant impact on the oviposition preference, host susceptibility, and offspring performance of *B. dorsalis*.

Conclusions

The preference for oviposition and the emergence of pupae and adults in *B. dorsalis* is greatly influenced by mango varieties and their physical fruit characteristics. The choice, visit, visit duration, and oviposition of female *B. dorsalis*, as well as the emergence of their pupae and adults from host fruits, are all affected by the mango variety. In comparison to the other three mango varieties, 'Karutha kolumban' is more vulnerable to oviposition and offspring performance of female *B. dorsalis*. The number of pupae and emerging adults was positively influenced by the number of fly visits, visit duration, and number of oviposition attempts by the *B. dorsalis* females, as well as the type of mango variety, fruit circumference, and fruit weight. Mango varieties with thick peels influence *the oviposition preference and offspring performance of B. dorsalis*. The study findings will be critical in planning and implementing future management strategies to prevent *B. dorsalis* damage to commercial mango varieties.

Conflicts of Interest: The authors declare that they have no conflicts of interest in undertaking this research.

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ترجیح تخم‌گذاری و حساسیت میزبانی مگس میوه شرقی *Bactrocera dorsalis* Hendel (Diptera: Tephritidae) روی ارقام تجاری انبه

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چکیده: مگس میوه شرقی، *Bactrocera dorsalis* (Hendel)، آفت جدی میوه در جنوب آسیا است؛ با این‌حال، مطالعات درباره رفتار تخم‌گذاری آن روی میوه‌های میزبان‌های مختلف در سریلانکا کافی نیست. از این‌رو، مطالعه حاضر برای تعیین ترجیح تخم‌گذاری و حساسیت میزبانی *B. dorsalis* روی چهار رقم تجاری انبه کاروتا کولومبان(Kc) ، ویلارد(Wld) ، ولای کولومبان (Vc) و بتی‌آمبا (Ba) در شرایط آزمایشگاهی کنترل شده انجام شد. ترجیح و حساسیت نسبی *B. dorsalis* نسبت به چهار رقم انبه از طریق مجموعه‌ای از آزمایش‌های انتخابی و غیرانتخابی بررسی شد. ترجیح تخم‌گذاری ارزیابی شد و حساسیت میزبانی با انکوباسیون میوه‌های آزمایش شده به‌صورت جداگانه تا زمان شفیره شدن و ظهور حشرات کامل مورد بررسی قرار گرفت. نتایج نشان داد که ماده‌های بالغ *B. dorsalis* به‌طور معنی‌دار ترجیح و حساسیت میزبانی متفاوتی بین چهار رقم انبه نشان دادند ($P < 0.05$). تعداد بازدیدهای متمایز از میزبان، مدت زمان بازدید، تلاش‌های تخم‌گذاری و تعداد قابل‌توجه شفیره‌ها و ظهور حشرات کامل برای رقم Kc ثبت شد و پس از آن به‌ترتیب ارقام Ba، Vc و Wld قرار داشتند. رقم Wld کم‌ترین ترجیح را برای تخم‌گذاری داشت. هم‌چنین، تعداد شفیره‌ها و ظهور حشرات کامل برای این رقم کم‌تر بود. رقم انبه و محیط میوه به‌طور معنی‌داری با تعداد بازدیدهای میزبان، مدت زمان بازدید، تلاش‌های تخم‌گذاری و تعداد شفیره‌ها و حشرات کامل هم‌بستگی مثبت داشت، درحالی‌که تأثیر ضخامت پوست میوه بر این عوامل منفی بود. یافته‌های این مطالعه به طراحی اقدامات کنترلی برای *B. dorsalis* به‌منظور جلوگیری از خسارت به ارقام تجاری انبه در سریلانکا کمک می‌کند.

واژگان کلیدی: *Bactrocera dorsalis* ، ارقام تجاری انبه، حساسیت میزبان، رفتار تخم‌گذاری