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Population growth and host preference of *Bactrocera dorsalis* (Hendel) (Diptera: Tephritidae) on four common myrtaceous fruits

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Abstract
The oriental fruit fly, *Bactrocera dorsalis* (Hendel), is a major pest of different vegetables and crops worldwide. The stage-specific life table of *B. dorsalis* was constracted on four common Myrtaceae fruits i.e., guava (*Psidium guajava*), rose apple (*Syzigium aqueum*), water apple (*S. samanangense*) and star apple (*Averrhoa carambola*) and their population growth was interpreted in the context of quantitative variation in respective fruits phytoconstituents. Host chemistry differed significantly among the fruits where guava was recorded the highest primary metabolites (PMs) followed by rose apple, star apple, water apple. Whereas, the lowest secondary metabolites (SMs) were recorded in star apple followed by rose apple, guava and the highest was in water apple. All the population parameters in respect to the fruit's phytochemicals recorded the highest growth on guava followed by rose apple, water apple and least on the star apple. Their overall host preference was in the order of guava> rose apple> water apple> star apple. This finding highlighted the vital role of fruit phytochemicals on population growth of *B. dorsalis* and provide a foundation about host suitability or susceptibility-based trap crop selection for sustainable IPM during these fruits' cultivation.

Keywords: Population growth, life table, *Bactrocera dorsalis*, population parameters, host preference, trap crop, IPM

Introduction
Fruits and vegetables are vital for human health, providing essential vitamins (C, A, B6, Thiamin, Niacin E), minerals and fiber (Singh *et al*., 2024) [37]. Their consumption is linked to reducing cancer and cardiac disease risks. Among the variety of fruits some indigenous common fruits of Myrtaceae family include guava (*Psidium guajava*), rose apple (*Syzigium aqueum*), water apple (*S. samanangense*) and star apple (*Averrhoa carambola*). The guava (*Psidium guajava*), also referred to as the "Apple of the tropics" is one of the most significant fruit crops worldwide (Dale and Patel, 2010) [8]. Guava (*P. guajava* L.) is grown in tropical and subtropical regions and tolerates high temperatures, which makes India a favorable place to harvest guavas (Dale and Patel, 2010) [8]. With 45% of the global crop, India is one among the leading growers of guava worldwide (Singh *et al*., 2024) [37]. The most popular guava cultivars in India are white guava and pink guava (Dale and Patel, 2010) [8]. Guava is significant, rich in phosphorus and calcium, making it a valuable addition to a balanced diet (Singh *et al*., 2024) [37]. Rose apple (*S. aqueum*) has crispy fruit flesh with a honey taste (Zuhaimi *et al*., 2024) [47]. This tropical fruit has been widely cultivated and grown throughout the world mainly for the fruits. It is commonly named as rose apples due to the sweet taste of its fruit flesh resembling rose petals. It is sweet and refreshing when eaten and has diversity in appearance (Zuhaimi *et al*., 2024) [47]. Water apple or wax apple (*S. samarangense*) is a native plant of Andaman and Solomon Island cultivated in Asia and the Pacific region (Tarigan *et al*., 2022) [41]. The fruits are primarily consumed fresh, but they are also made into wines, sauces, jams, desserts, liquors, vinegar, and jellies in a small percentage (Khandaker and Boyce, 2016) [24]. The flesh is crisp, juicy, fresh, and fragrant with its sweet taste. Fruit can be harvested at least three times a year. The fruit is commonly eaten after it is ripped and only stored for up to a week in room conditions without preservatives (Al-Obaidi *et al*., 2018) [1]. Star apple (5 corner) or star fruit (*Averrhoa carambola*), is one of the lesser-known fruit in India (Izzati *et al*., 2021) [20]. Fruits are very juicy without fibre and it is light yellow in colour.

The tree (2n=22) is cultivated throughout tropical areas of the world (Dhyani and Mehta, 2023) [11]. It may also be processed into preserved products like Jam, Jellies, Wine and Brandy. It is very beneficial for lowering blood pressure, relief headache, vomiting, coughing and restlessness (Dhyani and Mehta, 2023) [11].

All the fruit are generally infested by as many as 80 species of insect pests like mealybugs, fruit flies, bark eating caterpillar, capsule borers, hair caterpillar and many sucking pests, out of which fruit fly is the major one causing a heavy loss in the yield (Atwal 1993; Mutamiswa *et al.* 2021) [2, 29]. The damage due to this pest sometimes reaches the extent of crop failure during the rainy season. Delayed harvesting makes it vulnerable to the attack of fruit flies due to their close association with fruits and vegetables (Singh *et al*., 2024) [37]. Fruit flies, belonging to the Tephritidae family, are a vast and diverse group within Diptera, with around 4000 species in 500 genera (Mutamiswa *et al.* 2021) [29]. The oriental fruit fly, *B. dorsalis* (Hendel), (Diptera: Tephritidae) is recognized globally as one of the most economically important tephritids because of its broad host range, rapid dispersal (Danjuma *et al*. 2013). It is a multivoltine pest capable of completing 3-5 generations annually (Ye and Liu 2005; Dongmo *et al*. 2021) [12, 44]. Globally, *B. dorsalis* along with other species cause substantial losses to different agricultural as well as horticultural crops (Megha *et al*. 2023) [26]. They lay eggs on ripe fruits, and upon hatching, larvae feed on pulp, leading to discoloration and premature fruit dropping (Chen *et al*. 2006) [7]. Fruit damaged caused by the fruit flies (*Bactrocera* sp.) result in fruit surface damage and dry areas of the flesh under puncture wounds which may lead to infection by fungi which cause soft rot of the fruit (Dhyani and Mehta, 2023) [11]. Therefore, present study was conducted with the objective to investigate the pattern of population growth in order to comprehend the host preference of *B. dorsalis* and underlying causes for such choice or selection. Moreover, this exploration may serve as a scientific foundation for developing practical sustainable management approaches for fruit flies in the field.

Materials and Methods

Life table and population growth study of *B. dorsalis* on four common Myrtaceous fruits i.e., guava (*Psidium guajava*), rose apple (*Syzigium aqueum*), water apple (*S. samanangense*) and star apple (*Averrhoa carambola*) in relation with fruit phytochemicals were conducted during 2023-2025 for their sustainable management in the field.

Host plants cultivation and fieldwork: Four common Myrtaceous fruits i.e., guava, rose apple water apple and star apple were cultivated in a field situated near Baruipur region of South 24 Parganas [22.1367º N, 88.5565º E], West Bengal, India, in their growing season during 2023-2025. The initial populations of *B. dorsalis* adults were collected from each fruit plant separately by special type of baited traps from the cultivated fields. Within one hour captured flies from the field transfer carefully in laboratory condition (28± 2°C temperature and 70±5% relative humidity with 14:10 [L:D] photoperiod) for rearing. The infected fruits in slices were placed in the rearing cages (40×30×30 cm^3) separately for egg laying. The cultures were maintained until adult emergence as described by Jaleel *et al.* (2019) [21]. A total of 30 plots [5 crops × (3 treated + 3 control) = 30] were established, each measuring 10 m × 10 m, with soil characteristics including 5.3±0.2% organic matter and a pH of 7.7. The experimental setup experienced an average photoperiod of approximately 13:11 (L:D) under ambient temperatures ranging from 30-32 °C. A randomized block design (RBD) was implemented, maintaining a 2-meter spacing between adjacent plots. Crop treatments included the application of a conventional synthetic pesticide, Quinalphos 25 EC, at a rate of 15 g a.i./ha, administered twice, while corresponding control plots received no pesticide application. The experimental fields were naturally infested with *B. dorsalis*, and the infesting populations were collected separately for establishing mass cultures. Fully developed matured fruits were harvested from the untreated control plots of each fruit type for subsequent phytochemical analysis and were also used as a food source for rearing of the flies.

Phytochemical analysis: Fresh fruit samples of guava, rose apple, water apple and star apple were initially washed with distilled water and gently dried using paper towels before being processed for various phytochemical analyses. These analyses included estimations of total carbohydrates (Dubois *et al.* 1956) [13], proteins (Miller 1959) [27], lipids (Folch *et al.* 1957) [14], amino acids (Moore & Stein 1948) [28], nitrogen (Humphries 1956) [19], moisture and ash content (Banerjee & Haque (1984) [3], phenols (Bray & Thorpe 1953) [4], flavonoids (Zhishen *et al.* 1999) [46], tannins and saponins (Trease & Evans 1983) [42], alkaloids (Harborne 1973) [16], phytates (Reddy & Love 1999) [31], and oxalates (Day & Underwood 1986) [10]. All biochemical determinations were performed in triplicate and results expressed in dry weight basis (Roy & Barik 2013; Roy 2020, 2021) [33-34, 36].

Insect mass culture: *B. dorsalis* larvae were initially collected from guava, rose apple, water apple and star apple cultivated in the Baruipur region of South 24 Parganas [22.1367º N, 88.5565º E], West Bengal, India. The larvae from each fruit were incubated separately under laboratory conditions (26 ± 1 °C, 60 ± 5% RH, 12:12 L:D photoperiod) using fresh mature fruits of the respective host in glass jars (20 cm dia. × 30 cm ht.) until pupation. Post-emergence, 10 pairs of newly emerged adult males and females were placed in nylon mesh oviposition cages (25 × 25 × 25 cm) with access to 10% honey solution for feeding and were allowed to oviposit on fresh fruit slices from the corresponding host. The colony was established from F_1 eggs for each crop, and rearing continued under the same conditions for three generations, maintaining three replicates with 20 eggs per jar. F_3 generation females' newly laid eggs (cohort size: n = 60) were collected for life table and population growth studies. Fresh mature fruit slices were provided daily on moistened cotton to prevent desiccation. Larvae were maintained in the same jars until reaching the 5th instar and pupated. Resulting pupae were transferred to smaller jars (6 cm dia. × 10 cm ht.) covered with mesh for adult emergence. In each cycle, 10 newly emerged pairs were again placed on respective fruits in oviposition cages. Mortality, developmental time from egg to adult, and fecundity of freshly emerged females were recorded separately for each fruit type.

Life table study: The survival, developmental duration, and oviposition behaviour of *B. dorsalis* individuals across the four selected fruits i.e., guava, rose apple, water apple and star apple were analysed individually using the stage-specific life table approach. This methodology incorporated several demographic metrics derived from established models and formulae proposed by Carey (1993) [5], Krebs (1994) [25], Price (1998) [30], and Southwood (1978) [38]. Key parameters assessed included the age-specific survival probability (l_x), proportion dying at each age interval (d_x), age-specific mortality rate (q_x), and daily survival probability (s_x) from egg through adult stages. From these core parameters, additional life history statistics were computed, such as the cumulative number of individuals surviving to age x and beyond (T_x), the average number of individuals alive during each age interval (L_x), life expectancy at age x (e_x), gross reproductive rate (GRR or m_x), net reproductive rate (NRR or R_0), mean generation time (T_c), population doubling time (DT), intrinsic rate of increase (r_m), finite rate of population growth (λ), weekly multiplication rate (λ^7), and generational multiplication rate (λ^{Tc}), all in accordance with Carey's (1993) [5] formulations. Furthermore, a range of secondary population indicators were calculated, including potential fecundity (P_f), total fertility rate (F_x), effective population size (N_e), mortality coefficient (MC), population growth rate (PGR), momentum factor for population increase (PMF), projected second-generation population size (PF_2), hypothetical F_2 females (HFF_2), expected F_2 females (EFF_2), general fertility rate (GFR), crude birth rate (CBR), reproductive value (RV), vital index (VI), and trend index (TI). These were estimated using standardized equations as described by Southwood (1978), Carey (1993), and Roy (2020, 2021) [5, 33-34, 38].

Statistical Analysis: Experimental data of different phytoconstituents of the selected four common Myrtaceous fruits i.e., guava, rose apple, water apple and star apple as well as the pest, *B. dorsalis,* population parameters were homogeneous among treatments as confirmed by Levene's homogeneity test. The data were normally distributed, as determined by Shapiro-Wilk tests, and thus they were compared using one-way analysis of variance (ANOVA). Means associated with the data were separated when they had significant (α = 0.05) differences, using Tukey's multiple comparison (HSD) test (Zar, 1999) [45]. All statistical analyses have been performed using Statistical Package for the Social Sciences (SPSS) version 16.0.

Results

Host Phytochemicals: The chemical constituents of the selected four common Myrtaceous fruits i.e., guava, rose apple, water apple and star apple were presented in Table 1. All phytochemicals differed significantly among the fruits ($F_{3,8}$≥10.309, $P\leq 0.004$) (Table1). All the PMS, including carbohydrates, proteins, lipids, amino acids, nitrogen, moisture content were in order of guava> rose apple> star apple >water apple (Table 1). Among the PMs, total carbohydrates and proteins (µg/mg dry weight) were highest in guava (71.860±0.560 and 18.561±0.480) and lowest in water apple (58.247±0.276 and 14.447±0.196), respectively (Table 1). All the SMs including phenols, flavonoids, tannins, saponin, alkaloids, phytate, oxalate were in the order of water apple> guava> rose apple> star apple (Table 1). Among the SMs, total phenols were 22.967±0.226, 18.394±0.510, 18.127±0.490, 17.341±0.518 µg/mg dry weight, respectively in water apple, guava, rose apple and star apple (Table 1). The overall PMs: SMs ratio of the fruits were in the order guava> rose apple> water apple> star apple (Table 1). Guava and rose apple displayed highest nutrient quality relative to the other fruits (water apple and star apple) in terms of nutrient and defensive chemicals for growth of the fruit flies.

Population dynamics: The population dynamics and life stage survivorship of *B. dorsalis* on four common Myrtaceous fruits i.e., guava, rose apple, water apple and star apple represented in (Table 2-3). The stage-wise life table analysis of *B. dorsalis* reared on four Myrtaceous fruits revealed statistically significant host-dependent variations across developmental stages, with few exceptions (Table 2). All the population parameters on the selected fruits were almost in significant differences ($F_{3,8}$≥6.342, $P\leq 0.016$) with few exceptions (Table 2). Survival (l_x) was consistently highest in guava at all developmental stages followed by rose apple, water apple, star apple (Table 1). However, survival declined progressively in subsequent stages, particularly in star apple, which recorded the lowest l_x values at adult (0.597±0.019) stage (Table 2). The highest q_x was observed in the egg stage on star apple (0.218±0.020) and significantly greater than the other fruits (Table 2). Similarly, q_x values in larval stages increased across all the fruits, with statistically significant differences, while in adult q_x values was highest than any stage (Table 2). The average number of individuals alive (L_x) was similarly affected, being significantly higher in guava followed by rose apple, water apple and star apple across all stages like the l_x values. Correspondingly, total longevity (T_x) and life expectancy (e_x) declined with each successive stage, with values again highest in guava followed by rose apple, water apple and star apple across all stages like the l_x values with significant differences ($F_{3,8}$≥9.125, $P\leq 0.005$) except pupa and adult e_x values (Table 2). The adult stage showed a constant e_x of 1.120 across all fruits without significant differences ($F_{3,8}$=3.2009, P=0.084). The l_x, L_x, T_x and e_x values were gradually decreased throughout the developmental stages and can be arranged in the order of guava> rose apple> water apple> star apple (Table 2). Whereas, the q_x and k_x values were decreased randomly on each fruit and were in reverse order of l_x (Table 2). Comprehensive reproductive metrics also revealed significant inter-host variation ($P < 0.05$) with few exceptions (Table 3). Guava facilitated the highest potential fecundity (P_f) 279.333±7.688 eggs/female, fertility (F_x) 9772.396±91.765 eggs/generation and net reproductive rate (R_0) 97.724±0.918 (Table 2). The intrinsic rate of increase (r_m), finite rate of increase (λ) and realized F_2 females were significantly superior in guava, followed by rose apple, water apple and star apple consistently ranked lowest across all parameters (Table 3). Population parameters like, P_f, F_x, R_0, λ, λ^7, λ^{Tc}, N_e, GS, PGR, CBR, RV, TI, etc. were in the order of guava> rose apple> water apple> star apple (Table 3). Among all the population DT was shortest in guava (22.768±0.056 days) and longest in star apple (27.805±0.524 days), which reverse of P_f and GM further highlighting the suppressive effect on population expansion. The PMF was in the order of guava> rose apple> water apple> star apple like the P_f whereas, values of DT, GM, MC and VI were in reverse order (Table 3). Thus, guava supported the highest survival (l_x = 0.727), fecundity (P_f = 297.333 eggs/female), and net reproductive rate (R_0 = 97.724), whereas star apple exhibited the lowest values of the respective population parameters (Table 2-3). The survivorship analysis across life stages (Table 2) demonstrated that *B. dorsalis* exhibited a Type III survivorship curve, characterized by high early-stage mortality and increased survival among later-stage individual like other insects.

Discussion

The life cycle flexibility and high reproductive potential of *B. dorsalis* across host and climate conditions underscore the invasive success and pest severity (Chang *et al*. 2015) [6]. Females oviposit 10-30 eggs per clutch beneath the skin of ripening fruits (Dongmo *et al*. 2021) [12]. After hatching, larvae feed on the fruit pulp, causing direct tissue destruction and promoting decay (Chen *et al*. 2006) [7]. Pupation lasts about a week in warm climates (Dongmo *et al*. 2021) [37]. Adult lifespan ranges from several weeks to over a month, influenced by environmental conditions and food availability (Chang *et al*. 2015) [6]. Adults feed on nectar, fruit juices, and protein-rich exudates. Mating is mediated by male pheromone signaling and female host attraction. The comparative life table study of *B. dorsalis* on the selected four common Myrtaceous fruits like, guava, rose apple, water apple and star apple demonstrated significant variation in their performance, which can be largely attributed to the chemical composition of each type of host fruit. The integration of the selected fruits phytochemicals (Table 1) with life table parameters (Table 2-3) highlights a strong correlation between host nutritional quality and insect demographic success. Phytochemical analyses of the four common Myrtaceous fruits like, guava, rose apple, water apple and star apple had revealed that guava and rose apple were with good nutritional quality (PMs) compared to the other two fruits (water apple> star apple) and anti-nutritional factors (SMs) were in different order (water apple> guava> rose apple> star apple). In general PM_S (carbohydrates, proteins, lipids, amino acids etc.) were used for their general growth and reproduction like other animals (Genc & Nation 2004; Kamar *et al*., 2025) [15, 23]. Whereas, consumption of SM_S (phenols, flavonoids, tannins, alkaloids, phytates, etc.) were responsible for reducing their adult longevity, fecundity and retardation of larval growth (Howe and Jander 2008; Roy 2025) [18, 35] due to higher metabolic costs (Xue *et al*. 2010) [43]. Pest ecology and population dynamics are widely useful techniques in their management (Kakde *et al*. 2014) [22]. The P_f, GRR or m_x, NRR or R_0, r_m, λ, T_c and DT are fundamental ecological parameters to predict the pest population growth to evaluate the performance of an insect on different host plants (Southwood & Henderson 2000) [39]. In this finding, we identify guava and rose apple as highly susceptible hosts and other two (water apple> star apple) as moderate and less susceptible, respectively that could be exploited in integrated pest-management (IPM) strategies. Life table data revealed that host plant chemistry directly impacted *B. dorsalis* survivorship and longevity. Habitat manipulation for sustainable IPM will be helpful through host susceptibility based strategic crop clustering with proven push-pull and or trap-cropping frameworks (Holden *et al.* 2012) [17].

The comparative analysis of *B. dorsalis* across the selected four common Myrtaceous fruits like, guava, rose apple, water apple and star apple revealed that guava followed by rose apple support the highest survival, fecundity, and population growth, driven by their rich profiles of PMs relative to defensive SMs. In contrast, star apple exhibited the poorest nutritional profile leading to significantly reduced survival and growth. This suggests an evolutionary strategy focused on both their taste and nutritional utility by the pest. Modern agricultural systems increasingly adopt eco-friendly and sustainable strategies such as Integrated Crop Management (ICM) and Integrated Pest Management (IPM) to support smart farming approaches (Subedi *et al*. 2019; Roy 2025) [35, 40]. Among these, trap cropping stands out as a promising alternative to traditional insecticide-based practices by modifying the crop environment (Rhino *et al*. 2016) [32]. Host-plant quality strongly modulated *B. dorsalis* demography. Higher levels of readily assimilable carbohydrates and proteins in guava correlate with enhanced fecundity and faster population growth followed by rose apple, water apple and star apple, respectively. Conversely, defensive SMs impose antinutritional or toxic constraints, extending development and depressing population growth on the respective hosts. The present age-stage approach further reveals that early-instar mortality is the principal driver of host-mediated population differences. Finally, among the Myrtaceous fruits star apple followed by water apple expressed strong antibiosis against the golden fly build-up which will be another alternative strategy for management of *B. dorsalis* in near future.

Table 1: Phytochemical variation (Mean ± SE of 3 observations) in four Myrtaceae plants like, Guava (*Psidium guajava*), Rose apple (*Syzigium aqueum*), Water apple (*S. samanangense*) and Star apple (*Averrhoa carambola*) observed during their growing season in 2023-2025. All the estimated chemicals significantly differed within the host plants at P<0.05 by Tukey's (HSD) test.

Phytochemicals (ug/mg dry wt)	Guava	Rose apple	Water apple	Star apple	$F_{3,8}$	*P*
Total carbohydrates	71.860±0.560^a	71.593±0.540^a	58.247±0.276^b	70.807±0.568^c	292.928	<0.001
Total proteins	18.561±0.480^a	18.294±0.460^a	14.447±0.196^b	17.508±0.488^c	24.028	<0.001
Total lipids	16.777±0.510^a	16.511±0.490^a	13.047±0.226^b	15.724±0.518^c	19.540	<0.001
Total amino acids	7.056±0.470^a	6.790±0.450^a	8.927±0.186^b	6.003±0.478^c	10.309	0.004
Total nitrogen (%)	7.465±0.480^a	7.199±0.460^a	10.367±0.196^b	6.412±0.488^c	20.103	<0.001
Moisture (%)	82.822±0.670^a	82.555±0.650^a	86.807±0.386^b	81.769±0.678^a	34.237	<0.001
Ash content (%)	14.739±0.520^a	14.473±0.500^a	20.327±0.236^b	13.686±0.528^c	62.383	<0.001
Total phenols	18.394±0.510^a	18.127±0.490^a	22.967±0.226^b	17.341±0.518^c	43.565	<0.001
Total flavonoids	16.954±0.490^a	16.688±0.470^a	21.927±0.206^b	15.901±0.498^c	50.565	<0.001
Tanins	11.251±0.470^a	10.984±0.450^a	19.107±0.186^b	10.198±0.478^c	116.972	<0.001
Saponin	15.542±0.450^a	15.276±0.430^a	22.207±0.166^b	14.489±0.458^c	86.149	<0.001
Alkaloids	13.327±0.500^a	13.061±0.480^a	20.607±0.216^b	12.274±0.508^c	101.462	<0.001
Phytate	8.206±0.460^a	7.939±0.440^a	16.907±0.176^b	7.152±0.468^c	141.739	<0.001
Oxalate	6.462±0.530^a	6.195±0.510^a	15.647±0.246^b	5.408±0.538^c	157.005	<0.001

Note: Different alphabets with in the rows indicate the means (Mean ± SE of 3 observations) are significantly different (P< 0.05, Tukey's HSD) while comparing one type of host plant with the other.

Table 2: Life stages data of *Bactrocera* sp. (Mean ± SE of 4 observations) in four host plants like, Guava (*Psidium guajava*), Roseapple (*Syzigium aqueum*), Water apple (*S. samanangense*) and Star apple (*Averrhoa carambola*) observed. All the estimated population parameters were significantly differed within the host plants at P<0.05 by Tukey's (HSD) test.

Stages	Guava	Rose apple	Water apple	Star apple	$F_{3,8}$	*P*
			l_x			
Egg-0	1.000±0.000^{a}	1.000±0.000^{a}	1.000±0.000^{a}	1.000±0.000^{a}	0.000	1.000
Inst- I -1	0.914±0.022^{a}	0.881±0.020^{b}	0.827±0.013^{c}	0.782±0.020^{d}	9.100	0.006
Inst- II-2	0.868±0.022^{a}	0.836±0.019^{b}	0.783±0.013^{c}	0.738±0.020^{d}	9.255	0.006
Inst- III-3	0.825±0.022^{a}	0.794±0.019^{b}	0.741±0.012^{c}	0.697±0.020^{d}	9.132	0.006
Pup-4	0.773±0.028^{a}	0.732±0.019^{b}	0.681±0.012^{c}	0.637±0.020^{d}	8.416	0.007
Adult-5	0.727±0.025^{a}	0.69±0.018^{b}	0.641±0.012 ^{c}	0.597±0.019^{d}	9.081	0.006
			q_x			
Egg-0	0.086±0.022^{a}	0.119±0.020^{b}	0.173±0.013^{c}	0.218±0.020^{d}	9.100	0.006
Inst- I -1	0.050±0.001^{a}	0.052±0.001^{b}	0.053±0.001^{b}	0.056±0.001^{c}	9.132	0.006
Inst- II-2	0.050±0.001^{a}	0.051±0.001^{a}	0.053±0.001^{b}	0.056±0.001^{c}	6.343	0.017
Inst- III-3	0.064±0.012^{a}	0.078±0.002^{b}	0.081±0.001^{c}	0.086±0.002^{d}	2.260	0.159
Pup-4	0.058±0.018^{a}	0.058±0.001^{a}	0.060±0.001^{c}	0.064±0.001^{c}	0.098	0.959
Adult-5	0.380±0.000^{a}	0.380±0.000^{a}	0.380±0.000^{a}	0.380±0.000^{a}	0.000	1.000
			L_x			
Egg-0	0.957±0.011^{a}	0.941±0.010^{b}	0.913±0.006^{c}	0.891±0.010^{d}	9.100	0.006
Inst- I -1	0.891±0.022^{a}	0.859±0.020^{b}	0.805±0.013^{c}	0.760±0.020^{d}	9.178	0.006
Inst- II-2	0.846±0.022^{a}	0.815±0.019^{b}	0.762±0.012^{c}	0.718±0.020^{d}	9.194	0.006
Inst- III-3	0.799±0.024^{a}	0.763±0.019^{b}	0.711±0.012^{c}	0.667±0.020^{d}	8.867	0.006
Pup-4	0.750±0.025^{a}	0.711±0.018^{b}	0.661±0.012^{c}	0.617±0.019^{d}	9.042	0.006
Adult-5	0.589±0.020^{a}	0.559±0.014^{b}	0.519±0.010^{c}	0.483±0.016^{d}	9.081	0.006
			T_x			
Egg-0	4.832±0.124^{a}	4.647±0.101^{b}	4.372±0.066 ^{c}	4.136±0.105^{d}	9.152	0.005
Inst- I -1	4.101±0.120^{a}	3.920±0.096 ^{b}	3.657±0.063^{c}	3.430±0.101^{d}	9.165	0.006
Inst- II-2	3.210±0.098^{a}	3.062±0.077 ^{b}	2.852±0.050^{c}	2.670± 0.081^{d}	9.153	0.006
Inst- III-3	2.364±0.076^{a}	2.247±0.057 ^{b}	2.090±0.038^{c}	1.952±0.061^{d}	9.125	0.005
Pup-4	1.565±0.052^{a}	1.484±0.038 ^{b}	1.379±0.025^{c}	1.285±0.041^{d}	9.147	0.006
Adult-5	0.815±0.028^{a}	0.773±0.020 ^{b}	0.718±0.013^{c}	0.668±0.021^{d}	9.081	0.006
			e_x			
Egg-0	4.832±0.124^{a}	4.647±0.101^{b}	4.372±0.066^{c}	4.136±0.105^{d}	9.152	0.006
Inst- I -1	4.487±0.023^{a}	4.447±0.013^{b}	4.423±0.008^{c}	4.383±0.015^{d}	7.835	0.009
Inst- II-2	3.697±0.020^{a}	3.662±0.010^{b}	3.644±0.006^{c}	3.615±0.011^{d}	7.229	0.011
Inst- III-3	2.864±0.018^{a}	2.830±0.006 ^{b}	2.819±0.004^{b}	2.800±0.007^{bc}	6.976	0.013
Pup-4	2.026±0.029^{a}	2.027±0.002^{a}	2.024±0.001^{a}	2.017±0.002^{b}	0.098	0.959
Adult-5	1.120±0.000^{a}	1.120±0.000^{a}	1.120±0.000^{a}	1.120±0.000^{a}	3.200	0.084
			k_x			
Egg-0	0.039±0.011^{a}	0.055±0.010 ^{b}	0.083±0.007^{c}	0.107±0.011^{d}	9.195	0.006
Inst- I -1	0.022±0.000^{a}	0.023±0.000^{b}	0.024±0.000^{c}	0.025±0.000^{d}	9.132	0.006
Inst- II-2	0.022±0.000^{a}	0.023±0.001^{b}	0.024±0.000^{bc}	0.025±0.001^{c}	6.342	0.016
Inst- III-3	0.029±0.006^{a}	0.035±0.001^{b}	0.037±0.001^{bc}	0.039±0.001^{c}	2.298	0.154
Pup-4	0.026±0.008^{a}	0.026±0.001^{a}	0.027±0.000^{a}	0.029±0.001^{b}	0.094	0.961
Adult-5	0.208±0.000^{a}	0.208±0.000^{a}	0.208±0.000^{a}	0.208±0.000^{a}	0.190	0.900

Note: Different alphabets with in the rows indicate the means (Mean ± SE of 3 observations) are significantly different (P< 0.05, Tukey's HSD) while comparing one type of host plant with the other.

Table 3: Population parameters of *Bactrocera* sp. (Mean ± SE of 4 observations) in four host plants like, Guava (*Psidium guajava*), Rose apple (*Syzigium aqueum*), Water apple (*S. samanangense*) and Star apple (*Averrhoa carambola*) observed. All the estimated population parameters were significantly differed within the host plants at P<0.05 by Tukey's (HSD) test.

Population parameters of *Bactrocera*	Guava	Rose apple	Water apple	Star apple	$F_{3,8}$	*P*
Potential fecundity (P_f)	297.333±7.688^{a}	232.000±13.051^{b}	212.000±10.583^{b}	156.333±12.414^{c}	27.347	0.095
Total fertility rate (F_x)	9772.396±91.765^{a}	7229.747±303.798^{b}	6137.895±195.228^{c}	4209.944±283.676^{d}	98.258	<0.001
Gross reproductive rate (GRR or m_x)	134.573±3.480^{a}	105.003±5.907^{b}	95.951±4.790^{c}	70.756±5.619^{d}	27.347	0.095
Net reproductive rate (NRR or R_0)	97.724±0.918^{a}	72.297±3.038^{b}	61.379±1.952^{b}	42.099±2.837^{c}	98.258	<0.001
Generation time (T_c)	150.510±0.676^{a}	150.225±0.740 ^{a}	151.471±1.292^{a}	149.744±1.408^{a}	0.455	0.721
Doubling time (DT)	22.768±0.056^{a}	24.341±0.306^{b}	25.512±0.349^{b}	27.805±0.524^{c}	36.455	<0.001
Intrinsic rate of increase (r_m)	0.030±0.000^{a}	0.028±0.000^{b}	0.027±0. 000^{b}	0.025±0.000^{c}	42.948	<0.001
Euler's corrected r (r_c)	0.101±0.003^{a}	0.100±0.003^{a}	0.103±0.003^{b}	0.101±0.004^{a}	0.174	0.911
Finite rate of increase (λ)	1.031±0.000^{a}	1.029±0.000^{ab}	1.028±0.000^{b}	1.025±0.000^{c}	43.036	<0.001
Weekly multiplication rate (λ_7)	1.238±0.001^{a}	1.221±0.003^{ab}	1.210±0.003^{b}	1.191±0.004^{c}	43.561	<0.001
Increase rate per generation (λ_{Tc})	97.724±0.918^{a}	72.297±3.038^{b}	61.379±1.952^{c}	42.099±2.837^{d}	98.258	<0.001
Effective Population size (N_e)	35.558±1.207^{a}	33.722±0.869^{ab}	31.325±0.585^{b}	29.160±0.937 ^{c}	9.081	0.006
Generation mortality (GM)	0.346±0.015^{a}	0.369±0.011^{b}	0.401±0.008^{c}	0.432±0.014^{d}	9.233	0.006
Mortality coefficient (MC)	0.111±0.007^{a}	0.136±0.010^{b}	0.138±0.009^{b}	0.175±0.017^{c}	5.589	0.023

Generation survival (GS)	0.796 ± 0.010^{a}	0.783 ± 0.004^{ab}	0.775 ± 0.003^{b}	0.762 ± 0.005^{c}	5.514	0.024
Population growth rate (PGR)	1.373 ± 0.043^{a}	1.218 ± 0.026^{b}	1.079 ± 0.006^{c}	0.923 ± 0.041^{d}	34.933	<0.001
Population momentum factor of increase (PMF)	17.534 ± 0.533^{a}	15.615 ± 0.636^{b}	15.331 ± 0.561^{c}	13.390 ± 0.704^{d}	7.680	0.010
Population size in 2nd generation (PF_2)	789.192 ± 3.673^{a}	666.773 ± 15.870^{b}	608.326 ± 11.023^{c}	494.118 ± 18.505^{d}	82.746	<0.001
Hypothetical F_2 females (HFF_2)	9551.656 ± 178.571^{a}	5245.382 ± 433.256^{b}	3774.998 ± 239.810^{c}	1788.458 ± 231.134^{d}	131.344	<0.001
Realised F_2 females (RFF_2)	576.110 ± 2.681^{a}	486.744 ± 11.585^{b}	444.078 ± 8.047^{c}	360.706 ± 13.508^{d}	82.746	<0.001
General fertility rate (GFR)	9.068 ± 0.555^{a}	7.455 ± 0.580^{b}	7.328 ± 0.506^{b}	5.818 ± 0.597^{c}	5.614	0.023
Crude birth rate (CBR)	3.614 ± 0.190^{a}	2.931 ± 0.219^{b}	2.866 ± 0.193^{b}	2.252 ± 0.224^{c}	7.256	0.011
Reproductive value (RV)	269.146 ± 6.960^{a}	210.006 ± 11.814^{b}	191.902 ± 9.580^{c}	141.513 ± 11.237^{d}	27.347	<0.001
Vital Index (VI)	0.152 ± 0.009^{a}	0.186 ± 0.013^{b}	0.189 ± 0.012^{b}	0.240 ± 0.023^{c}	5.589	0.023
Trend index (TI)	117.392 ± 4.773^{a}	93.383 ± 6.284^{b}	90.089 ± 5.632^{b}	69.099 ± 6.316^{c}	11.689	0.003

Note: Different alphabets with in the rows indicate the means (Mean ± SE of 3 observations) are significantly different ($P< 0.05$, Tukey's HSD) while comparing one type of host plant with the other.

Conclusion

Based on the integrated evaluation of survival metrics and population growth parameters, the selected four common Myrtaceous fruits like, guava, rose apple, water apple and star apple varied significantly in their suitability for *B. dorsalis*. Among them, guava emerged as the most favorable host, supporting the highest survival, longevity, fecundity, reproductive value, and population growth. The host suitability for *B. dorsalis* was in the order of guava> rose apple> water apple> star apple. This study underscores the critical role of host plant chemistry in population dynamics of *B. dorsalis.* Given these findings, guava can be recommended as a highly suitable trap crop in IPM programs to attract and concentrate *B. dorsalis* as well as other *Bactrocera* spp. Integrating life table and host plant chemistry provides a strategic basis for designing ecologically sustainable IPM solutions in near future.

Statements and Declarations

Competing Interests: The authors declare that there is no competing interest other than publication of this paper.

Author's contributions: BS, NC, NK and NR designed the whole study including sample collection, chemical analysis, index calculation, data analysis and drafts the manuscript with the help of institutional support.

Disclosure: The author declares that there is no conflict of interest other than publication of this paper.

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