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TEMPORAL VARIATION IN POLLINATORS' VISITATION OF *Lantana camara* IN A TROPICAL URBAN LANDSCAPE: DOES BUTTERFLY ABUNDANCE AND RICHNESS DRIVE THE FRUIT SET?

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Abstract

Cézar K., Franklin E., Pinto C.E.: Temporal variation in pollinators' visitation of *Lantana camara* in a tropical urban landscape: Does butterfly abundance and richness drive the fruit set? Ekológia (Bratislava), Vol. 41, No. 1, p. 46–56, 2022.

Pollinator richness, abundance and visitation frequency may be affected by the abundance of floral resources and abiotic factors, influencing plant reproductive success. We analysed whether the diversity, abundance and frequency of butterfly visitation on *Lantana camara* vary across the year in a tropical urban landscape and whether this variation in butterfly community influences plant's reproductive success. A two-period survey, referred to here as rainier and drier seasons, was carried out in 12 spatially independent plants. Five pollination treatments were applied: single visit, hand cross-pollination, hand self-pollination, spontaneous self-pollination and open pollination (control). A total of 15,749 flowers were used for fruit production analysis. Butterfly richness, abundance and the reproductive success of *L. camara* increased in the drier season. Open pollination was ninefold more reproductively successful during the drier season. Fruit production of hand cross-pollinated plants was threefold higher than open-pollinated plants during the rainier season. No significant difference was found between these treatments in the drier season, attesting the highest abundance of pollination during this period. We provide evidence that changes in the pollinator community affect fruit production. The increase in pollinator diversity allows different visitors to pollinate the plant, increasing fruit set through functional complementarity. This effort establishes baseline data of plant–pollinator interactions for further long-term investigations across different weather seasons. The understanding of *L. camara* and butterflies' synergism will support conservation measures of pollinator populations.

Key words: Lepidoptera, Verbenaceae, plant–pollinator interactions, fruit set, Amazon.

Introduction

Interactions between plants and pollinators are highly dynamic, and the composition of the species involved in this process may change between years (Dupont et al., 2009). These temporal dynamics interfere with the local species' occurrence and their role in communities through effects on development, life cycle and behaviour (Trøjelsgaard, Olesen, 2016). Together with the regulation of endogenous mechanisms, the environmental factors influence the frequency of flowering, the onset of fruiting and seed ripening, mainly affecting the nutritional status (Larcher, 2006), and floral visitor's preference (Price et al., 2005). Even in perennials plants, in which flowering is constant, levels of fruit production may be influenced by precipitation (Strauch, Volk, 2013). For instance, in tropical regions with climatic seasonality, most herbs bloom in the rainiest season (Rathcke, Lacey, 1985). Some plants synchronise the reproduction phase with the period in which more water and nutrients are available (Schaik et al., 1993). However, the peak of resource supply, pollen levels and nectar production also varies according to the season (Aleixo et al., 2017).

The availability of floral resources and abiotic factors such as precipitation and temperature affect pollinator communities (Dupont et al., 2009). Rainfall variations disrupt flight and decrease foraging efficiency (Lawson, Rands, 2019) and, together with temperature, affect the richness, abundance, life cycle, activity and distribution of butterflies (Forest et al., 2010). In the tropics, where the rainfall regime is divided into higher and lower precipitation periods, the abundance of Ithomiinae decreases with increasing rainfall (Araújo, 2006).

Plant populations can experience qualitatively or quantitatively different types of pollinators through time (Petanidou et al., 2008). This variation could potentially modify species' roles in plant–pollinator interaction (Olesen et al., 2008). With this change, links between species are modified, resulting in ecological and evolutionary implications on pollination (Alarcón

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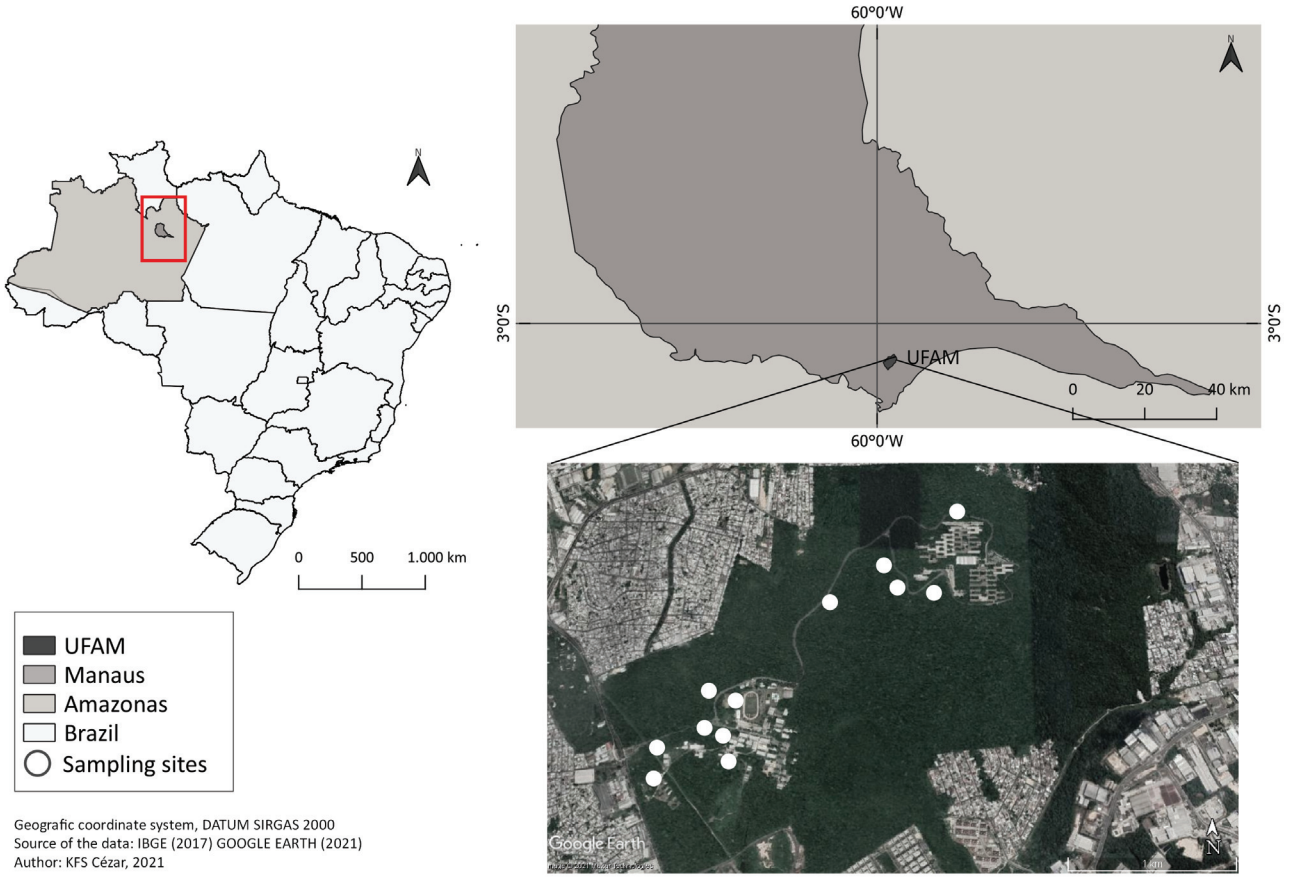

Fig. 1. Distribution of *Lantana camara* in the urban forest fragment of the Federal University of Amazonas- UFAM, located in the Manaus City. The white circles represent the shrubs used in pollination experiments.

et al., 2008). Thus, abundant plants or pollinators will interact with many partner species, whereas relatively rare species will interact with a few species (Alarcón et al., 2008). This species substitution event ensures that interactions are maintained and plants continue to receive visits, but with different visiting frequencies (Olesen et al., 2008).

The development of flowers in fruits and seeds depends on proper pollination (Mulcahy, Mulcahy, 1987). Insufficient or inappropriate deposition of pollen in the stigma, called pollination limitation, can cause a reduction in the reproductive success of plants (Larson, Barrett, 2000) and is usually related to the visitation rate or the abundance of pollinators (Herrera, 2000). Pollen transfer can be improved by increasing the abundance and richness of pollinators. The increase in visitor richness can increase pollinator density (Garibaldi et al., 2016), raising the rate of visitation to flowers (Garibaldi et al., 2011). Hence, the increase of both richness and abundance of pollinators multiplies likelihood of fruit production by the plant (Carnicer et al., 2009). When the abundance and richness of pollinators are lower or absent, and plants need to perform self-pollination, there is a decline in fruit production (Klein et al., 2007).

We tested the temporal variation of plant–pollinator interaction, studying the mutualism formed by *Lantana camara* L. and butterflies in a tropical urban landscape. *L. camara* is a perennial flowering plant, but the resource availability, distribution, growth and reproductive success may be influenced by abiotic factors (Ramaswami, Sukumar, 2013). This shrub blooms throughout the year, and its bright colours and form attract several butterflies (Maharaj, Bourne, 2017). Besides, the butterfly community may differ across the year in the tropical forest (Teston, Silva, 2017). Aiming to provide a baseline for future studies, we 1) analyse if there is variation in the assemblage of nectarivorous butterflies visiting *L. camara* flowers across the year and 2) explore whether the floral visitor assemblage influences the reproductive success of *L. camara*. We hypothesised that the variation of richness, abundance and flower visits of butterflies will affect the reproductive success of *L. camara*.

Material and methods

Plants and butterflies

L. camara is a perennial weed and a popular ornamental garden plant native to Central and South America (Day, Zalucki 2009). It has spread globally and is prevalent in tropical and sub-tropical countries (Ghisalberti, 2000; Berry et al., 2011). It can pre-

vent soil compaction, and its biomass provides soil structural improvement (Sharma et al., 2007), despite being invasive and difficult to control (Kumar et al., 2016). Although it has medicinal properties such as is anti-inflammatory, hepatoprotective and antitumour, it can be toxic to small ruminants (Mukherjee et al., 2015). With diurnal anthesis, this plant blooms from January to December with yellow, orange and pink flowers arranged in spike inflorescences (Barros et al., 2001). Its hermaphroditic flowers are small and tubular, with an average tube length of 9.5 and 0.9 mm in diameter. The androecium is formed of four stamens, with filaments fused to the corolla tube, located in the floral tube's middle region. The gynoecium is formed by a stigma, style and superior ovary. The average distance between the stigma and anthers is 1.5 mm (Barrows, 1976).

Butterflies are frequent flower visitors of *L. camara* and act as potential pollinators (Mukherjee et al., 2015). The butterflies sampled in this study were from a single-visit treatment (pollination by butterflies). The specimens were collected and photographed between 6 am and 6 pm, for a total of 8.508 min of sample effort, being 4.254 min for each weather period studied (drier and rainier seasons). Butterflies were collected with an entomological net and photographed with a Canon T3 Rebel camera with a lens of focal length 18–55 mm. Identifying species in the field and laboratory was performed with the naked eye and a hand lens. Butterflies were identified through the collected specimens and photographs. Other resources to aid in identifying species were also used: Garwood et al. (2009), Warren et al. (2016) and comparison with the butterflies deposited at National Institute for Amazonia Research (INPA)'s collections. The systematic arrangement followed the proposal of Lamas (2004). The butterflies are deposited in the INPA's invertebrate collection.

Study area

The study was conducted on the *Campus* of the Federal University of Amazonas (UFAM), located between the east and south zones of Manaus City, Amazonas State, Brazil. The area is traversed by several roads (03°04′34″S; 59°57′30″W) (Fig. 1). The *Campus* is the third largest urban forest fragment in the world, comprising approximately 600 ha of dense ombrophylous 'terra firme' forest, campinarana and planting areas (Biodiversity Research Program, 2014). The landscape is composed of plateaus, sloping areas and bottomlands. Soils are predominantly clay, but some places have sandy soils with shrubby vegetation (Nery et al., 2004).

The climate is classified as 'Afi' under the Köppen system. The rainier period occurs from October/November to May, and the drier period from July to September/October (Marques-Filho et al., 1981). Climatological data were obtained from the online database of Brazil's National Meteorological Institute (National Institute of Meteorology, 2016). We used data from the nearest station, which was 10 km away from the study site. Data collected throughout 10 years (2005–2015) indicated that the mean annual precipitation was 2392.8 mm, the mean annual maximum and minimum temperatures were 32.7 and 24.4 °C, respectively, and the mean annual humidity was 81.1%. In 2015, the annual rainfall was 1735.7 mm, the annual mean maximum and minimum temperatures were 33.6 and 25.7 °C, respectively, and the mean annual humidity was 75.2%.

Sampling design and data collection

With an aim to verify the effect of butterfly community variation on the reproductive success of *Lantana camara*, we carried out the study at two climate distinct periods of the year. The pollination treatments and butterfly collections were carried out for 6 months (April, May, December, June, July and August). Between June and August, the total rainfall, mean maximum and minimum temperatures and the average relative humidity were 133.8 mm, 33.8 and 25.6 °C, and 73.6%, respectively. On the other hand, in April, May and December, the total rainfall, mean maximum and minimum temperatures and the mean relative humidity were 537 mm, 32 and 25.4 °C, and 78%, respectively (refer to table in the supplementary material cited in Appendix I). Hereafter, we will refer to the months in the period between June and August as drier season and the months in the period of April, May and December as rainier season.

A total of 12 *L. camara* individuals, distributed along a road that serves two sectors of the *Campus* (northern and southern), were studied. The individuals' distance was at least 30 m, and the samples were considered independent of each other (Fig. 1).

Pollination treatments

Eleven and 12 individuals of *L. camara* were selected in the rainier and drier seasons, respectively. The same individual shrubs were used in both seasons, and only one died in the rainier season. These individuals were used to evaluate the reproductive success, which corresponded to the number of fruits formed relative to the number of flowers used in each treatment. The 10 bagged inflorescences were distributed in five treatment groups; for each treatment, two inflorescences from the same individual shrubs were used. After the fruit set, new inflorescences were selected to evaluate five treatments:

1. Single-visit treatment: During anthesis, bags were removed from flowers to allow just one flower visit from a butterfly. After a single visit, the flower was marked. Inflorescences were re-bagged until fruits were generated, to prevent contact with other visitors. Using a catching net, the first visitor was caught. Annotations regarding the date, time, data of individual, inflorescence and flowering status were recorded, and a number was given to designate the visitor. Using a catching net, flowers visited by additional animals were discarded. For each inflorescence, the average number of flowers reached 26 (±18) in the drier season and 17 (±19) in the rainier season.
2. Hand cross-pollination treatment: The voile bags were removed during anthesis, and the pollination was done manually with exogenous pollen. Following the method used by Pinto et al. (2008), we used nylon threads to transfer pollen. First, we selected flowers as pollen donors and we inserted the nylon thread to remove the pollen. Then, we inserted this nylon thread with exogenous pollen in a flower tube of a previously bagged flower. The pollinated flowers were marked with a permanent brush,

Table 1. Number of flowering individuals, number of flowers, and the reproductive success of *Lantana camara*, and the abundance and richness of butterflies in rainier and drier seasons

Season	Flowered individuals	Butterfly richness	Butterfly abundance	Number of flowers	Reproductive success
Drier	10	34	60	13,300	0.22
Rainier	8	26	33	2,449	0.17

and the inflorescence was re-bagged until fruit generation. For each inflorescence, the average number of flowers reached 24 (±18) in the drier season and 12 (±19) in the rainier season. Before treatment, we measured the butterfly's proboscis (0.20, 0.25 and 0.30 mm) to ensure that the nylon threads used in the treatment had the same circumference.

3. Hand self-pollination treatment: Bags were removed from inflorescences during anthesis. Manual pollination using nylon threads corresponding to the circumference of proboscis of the visiting butterflies was performed, and pollen from the plant's flower was used. Afterwards, the flowers were marked and the inflorescences were re-bagged. For each inflorescence, the average number of flowers reached 20 (±18) in the drier season and 12 (±19) in the rainier season.
4. Spontaneous self-pollination treatments: The pre-anthesis inflorescences were bagged until they fell or began fruiting. Plants freely able to be pollinated were used as controls (open pollination treatment). The inflorescences were marked with a green tape and exposed to visitation from the beginning of anthesis to fruit generation. For each inflorescence, the average number of flowers reached 11 (±18) in the drier season and 9 (±19) in the rainier season.
5. Open pollination (control): The inflorescences were marked with a green tape and left exposed to visitation throughout anthesis until the generation of fruits. For each inflorescence, the average number of flowers reached 26 (±18) in the drier season and 15 (±19) in the rainier season.

Statistical analysis

A two-way analysis of variance (ANOVA) and a Tukey's post-hoc test were performed to compare the reproductive success of *L. camara*. The reproductive success was the ratio between the fruit set and the number of flowers used in each treatment. Then, the ratio was used as a dependent variable according to the pollination treatment received and the climatic period as an independent variable (Sokal, Rohlf, 1981). Shannon index was used to calculate the diversity of flower-visiting butterflies. Tukey test was used to compare butterflies' diversity between seasons and assess the significance of differences regarding the richness, abundance and frequency of floral visitors among butterfly families and between seasons. Shannon index was calculated in the statistical program Estimate S 9.1.0, and other analyses were performed in R version 3.2.3 (R Development Core Team, 2015).

We used simple linear regression analyses to identify the relationship between 1) butterfly abundance and butterfly richness, 2) the frequency of butterfly visitation and butterfly abundance, 3) the reproductive success of *L. camara* (fruit/flower ration) and butterfly richness, 4) the reproductive success of *L. camara* (fruit/flower ration) and abundance and 5) the reproductive success of *L. camara* (fruit/flower ration) and visitation.

Butterfly richness and abundance were determined by the number of sampled species visiting *L. camara* flowers and individuals of each species, respectively. The frequency of visitation was determined by the number of times each butterfly visited the flower. Fruit production analyses were made based on the number of flowers and not on the number of shrubs. The diversity of butterflies was measured using both richness and abundance.

Table 2. Difference among the five treatments in relation to plant reproductive success in the drier and rainier season (N = 1.056 observations)

Rainier season	Drier season	P value
Self-pollination	Self-pollination	0.999
Hand self-pollination	Hand self-pollination	0.501
Open-pollination	Open-pollination	0.005
Hand cross-pollination	Hand cross-pollination	0.306
Polinattion by butterflies	Polinattion by butterflies	0.969

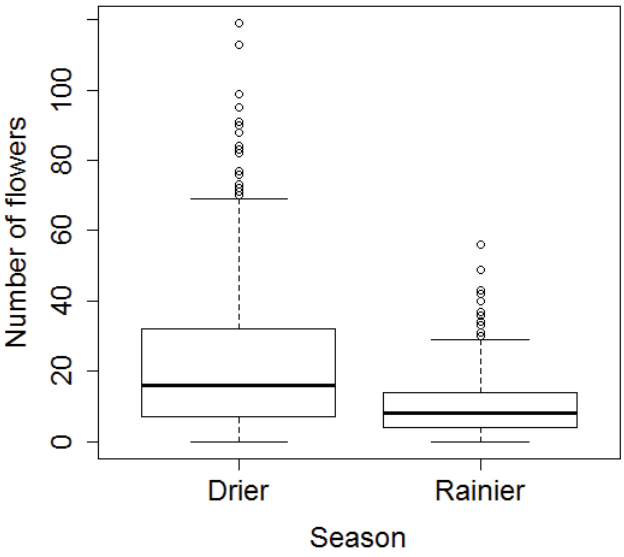

Fig. 2. Flowering of *Lantana camara* in the rainier and drier seasons (N = 15,749 flowers).

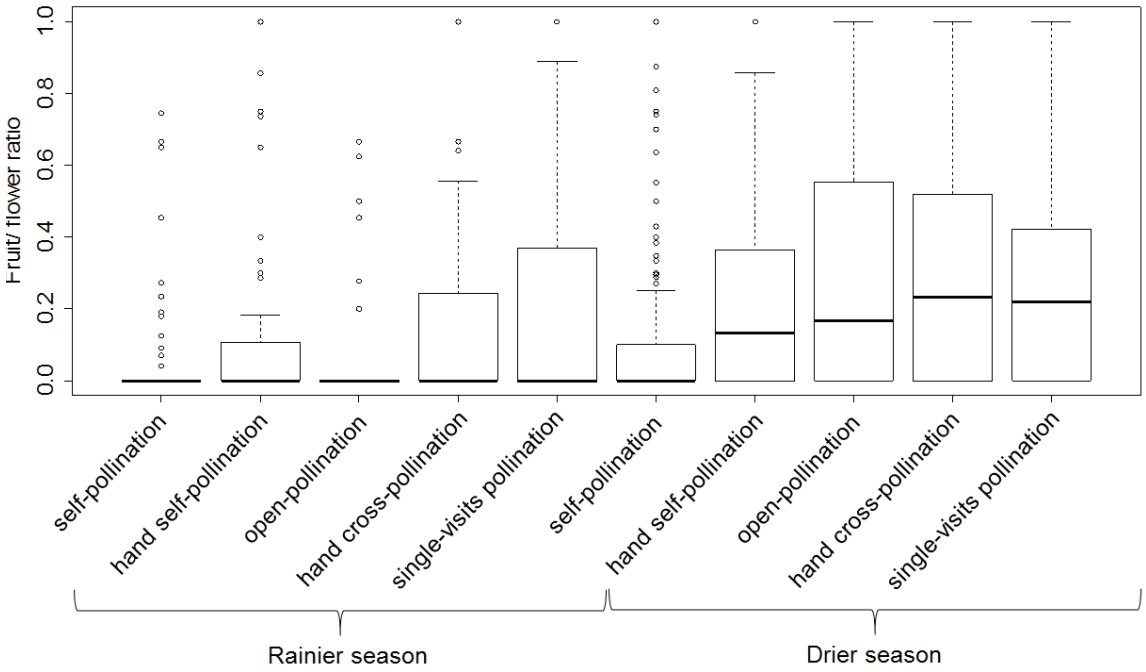

Fig. 3. Box-plot representation of differences between fruit/flower ratios according to pollination treatments applied to the flowers of *Lantana camara* in the rainier and drier seasons (N = 15,760 flowers).

Results

Production of flowers and fruits of L. camara between weather periods

A total of 15,749 flowers were recorded from the 12 *L. camara* shrubs studied during the two seasons (Table 1). The richness and abundance of butterflies differed significantly between seasons (Tukey test, $P \leq 0.05$). Increases in the abundance (45%) and richness (23.5%) of butterflies were observed in the drier season. The same pattern was found regarding the number of open flowers (ANOVA: F = 22.36, d.f. = 5, $P \leq 0.001$; Fig. 2) and the plant reproductive success (Tukey test, $P \leq 0.05$), which were 81.6 and 22.7% higher in the drier period, respectively.

Fruit production analyses were made based on 15,749 flowers produced by the 12 *L. camara* plants. There were differences among the five treatments in relation to the reproductive success; in general, the highest reproductive success of *L. camara* was recorded in the drier season (F = 19.42, d.f. = 1, $P = 0.0001$; Fig. 3). There was no statistical difference when comparing the same treatment between the periods of the year, except for the open pollination (control). In the drier season, nine fold more fruits formed than in the rainier season after open pollination (F = 19.42, d.f. = 1, $P = 0.005$; Table 2). In the rainier season, the reproductive success of hand cross-pollination was threefold higher than in open pollination (F = 19.42, d.f. = 1, $P = 0.05$). On the contrary, this difference was not significant (F = 19.42, d.f. = 1, $P = 1.00$) in the drier season, showing that there was no a shortage of pollination in this period.

Diversity and abundance of butterflies visiting L. camara across the year

Adding up the rainy and dry seasons' data, the group of floral visitors of *L. camara* collected in the urban landscape was composed of 93 individuals, distributed throughout 50 species and six families of Papilionoidea and Hesperioidea. These butterflies performed 436 floral visits (refer to table in the supplementary material cited in Appendix II). Hesperiidae was the richest (32 species) and the most abundant and frequent family visiting *L. camara*. Ten butterfly species (20%) were recorded in both seasons, and the most abundant and most frequent visitors were *Enosis immaculata demon* Evans, 1955, *Anartia jatrophae* (Linnaeus, 1763) and *Ascia monuste* (Linnaeus, 1764). The most abundant and frequent visitors throughout the drier and rainier seasons were *Heraclides thoas* (Linnaeus, 1771) and *Enosis immaculata demon*, respectively. The highest diversity of butterflies (Tukey test: d.f. = 1, $P \leq 0.001$) and the highest frequency of visitation (Tukey test, d.f. = 1, $P \leq 0.0001$) were recorded in the drier season (Fig. 4). Temporal variation in the abundance, richness and frequency influenced the reproductive success of *L. camara*. The reproductive success was positively correlated with the frequency of flower visiting ($r^2 = 0.666$, d.f. = 1, $P \leq 0.0001$), richness ($r^2 = 0.591$, d.f. = 1, $P \leq 0.0001$) and abundance of butterflies ($r^2 = 0.476$, d.f. = 1, $P = 0.001$; Fig. 5).

Discussion

In the studied urban landscape, we tested the hypothesis that the interaction between *L. camara* and its flower-visiting but-

terflies varies across the year. We also have shown that changes in the pollinator community affect fruit production. The fruit set change was positively associated with the significantly increased frequency of flower visits, abundance and butterflies' richness in the drier season. Consequently, the reproductive success of *L. camara* was fivefold higher in the drier season than in the wetter one. Note that the fruit set obtained in open pollination treatment (control) was threefold higher in the drier season. Further, the fruit set averages of the open pollination and hand cross-pollination treatment were discrepant in the rainier season (0.04 and 0.15, respectively), but similar in the drier one (0.32 and 0.33, respectively). Although the average reproductive success of manual cross-pollination and open pollination varied between seasons, there was no significant difference in the results of manual cross-pollination (see Table 2).

A striking increase in the number of flowers in the drier period accounted for 82% of the total recorded. Higher number of flowers enhanced *L. camara*'s attractiveness to butterflies, increasing the quantity and quality of seeds and fruits produced (see Sun et al., 2017). This positive relation that we detected between *L. camara* and butterflies parallels Mukherjee et al.'s (2015) findings in a tropical urban landscape. The change in the number of flowers can affect pollinators through food availability, which interferes with activity, rate of visits, population density and species composition (Steffan-Dewenter, Schiele, 2008) and may cause damage to the reproductive success of plants (Hegland, Totland, 2005). Earlier studies have indicated that the populations of plants and insects may vary between years due to the influence of temperature and precipitation (Ollerton et al., 2007; Garibaldi et al., 2013). The physical effects of rainfall negatively affect the plants and disrupt the foraging efficiency and sensory signals of pollinators (Lawson, Rands, 2019). It has also been shown that the temporal variation of abundance and richness of mutualistic partners affect the pollination networks (Ollerton et al., 2007; Olesen et al., 2008; Dupont et al., 2009).

We found that higher richness of butterflies was correlated with an increase in fruit set. A higher amount of butterfly species increased the diversity traits of pollinators, which may have benefited fruit production. Each butterfly species' contribution may be small, but their collective role enhances fruiting and the functional effects of the interactions are synergistic (Blüthgen, Klein, 2011). The higher diversity and abundance of pollinator species reduces the pollination deficit. For example, our results showed a threefold difference in the fruit set between the control and manual cross-pollination in the rainier season. However, no significant difference was detected in the drier season, attesting the higher pollinator abundance during this period.

Consequently, fruit production is increased when more pollinators visit and carry pollen to plants with more regularity (Boff et al., 2018; Cohen et al., 2021). In crops whose pollinator assembly is diverse and abundant, including honey bees and wild bees, the pollen limitation is low, leading to better yields (Winfree, Kremen, 2009; Cusser et al., 2016). Although different species visit and pollinate the same species of plants, they do not work equally. For instance, the number of pollen grains adhered to hawkmoth proboscis can vary widely among species

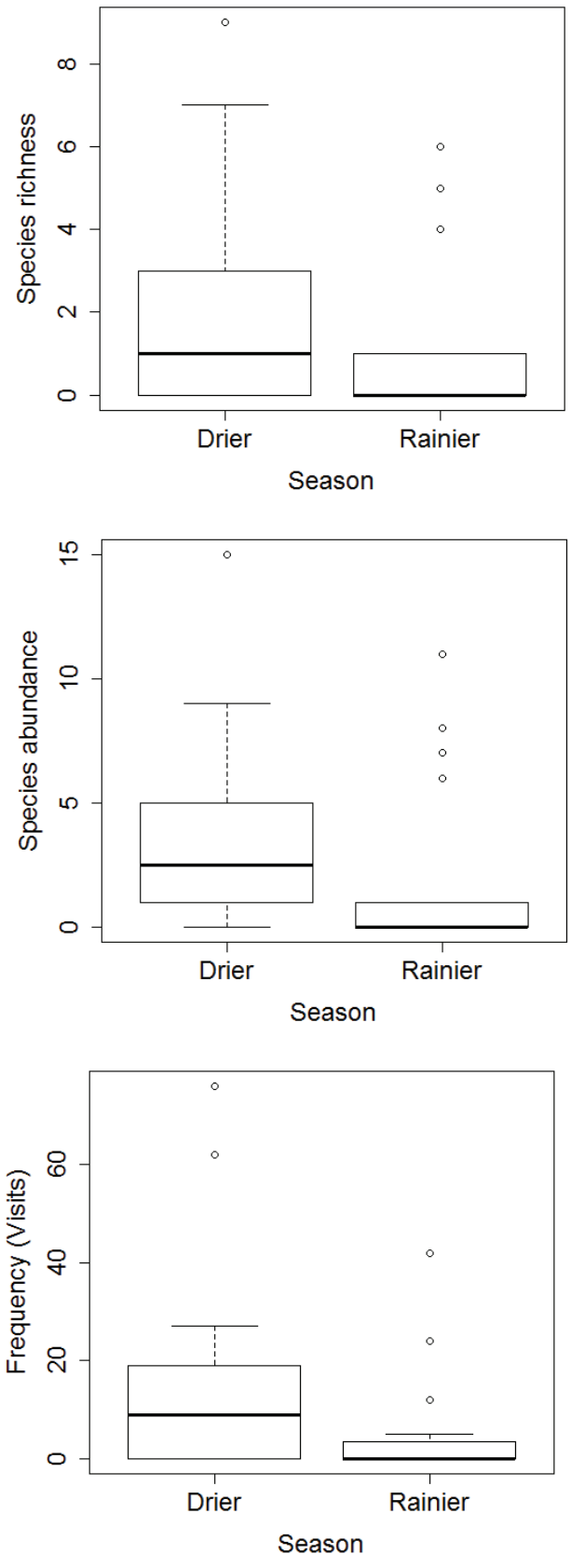

Fig. 4. The richness, abundance and frequency of floral visitors of *Lantana camara* in the rainier and drier seasons.

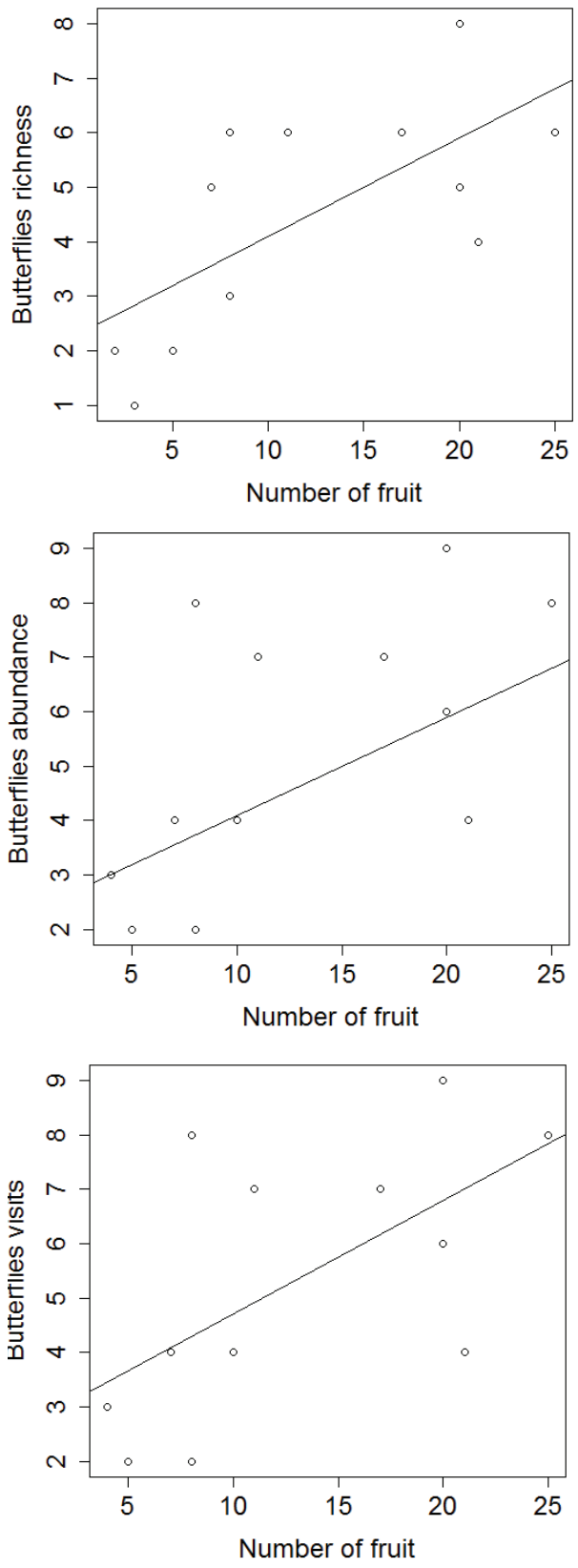

Fig. 5. Relationship between abundance, richness, and visitation of butterflies and the reproductive success of *Lantana camara* (N = 12 shrubs). Regressions between: butterfly richness and the number of fruits, abundance of butterflies and the number of fruits, and flower-visitor abundance and the number of fruits.

(Darrault, Schlindwein, 2002). Honey bees and wild bees may efficiently transfer pollen, but the latter provides better-quality pollination (Garibaldi et al., 2013). Bee diversity may improve reproductive success in plant communities depending on species-specific characteristics that drive functional complementarity (Fründ et al., 2013; Garibaldi et al., 2013).

In summary, we documented that the community of flower-visiting butterflies, and the number of flowers produced by *L. camara* varied between the periods studied during the drier and rainier seasons. In the drier season, the highest abundance and diversity of butterflies coincided with more effective reproductive success of *L. camara*. The 1-year-short-term period is a limitation of our results, and future observations must be extended for more years to understand pollinators' and plant communities' alterations in the time, length and abundance of flowering among years and how these communities are influenced by the interannual variations of climate. However, this study contributes baseline data for future long-term investigations of the synergism between *L. camara* and butterfly in the tropical urban landscape. We demonstrated that plants like *L. camara* help to preserve butterflies' assemblages in the urban landscape. As climate change impacts biodiversity and pollinator abundance declines, studies like ours can contribute to the understanding of how mutual relations between butterflies and *L. camara* can be sensitive to small changes and help predict future impacts of environmental perturbations on these interactions.

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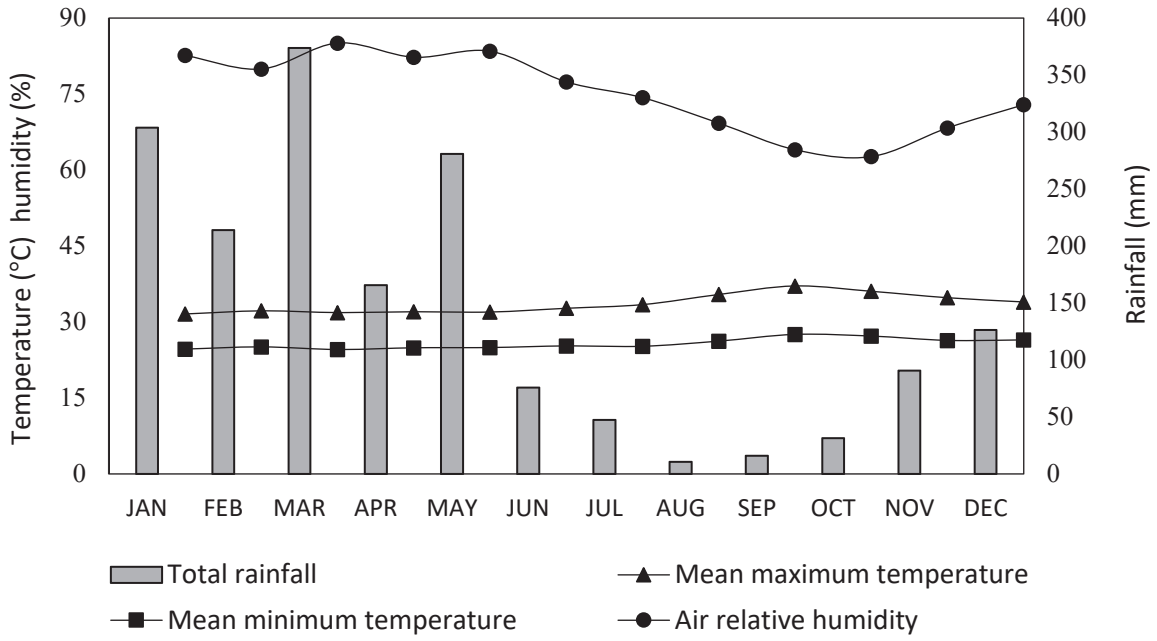
APPENDIX I. Annual variation in monthly rainfall, mean temperatures and relative humidity in 2015.



APPENDIX II. Table of Diversity, abundance and number of visits of butterflies visiting *Lantana camara* in the rainy and drier seasons.

		Rainier season		Drier season	
	Families and species	**Abundance**	**Visits**	**Abundance**	**Visits**
	Hesperiidae				
1	*Achlyodes mithridates thraso* (Hübner, [1807])	1	3	--	--
2	*Anastrus petius* (Möschler, 1877)	1	3	--	--
3	*Anastrus tolimus robigus* (Plötz, 1884)	--	--	1	5
4	*Anthoptus epictetus* (Fabricius, 1793)	--	--	4	7
5	*Anthoptus* sp.1	--	--	1	1
6	*Anthoptus* sp.2	--	--	1	11
7	*Arita arita* (Schaus, 1902)	1	3	1	7
8	*Autochton zarex* (Hübner, 1818)	1	2	1	4
9	*Callimormus saturnus* (Herrich-Schäffer, 1869)	--	--	1	2
10	*Camptopleura auxo* (Möschler, 1879)	1	3	--	--
11	*Chioides catillus albius* Evans, 1952	1	1	1	1
12	*Enosis immaculata demon* Evans, 1955	2	9	6	50
13	*Flaccilla aecas* (Stoll, 1781)	--	--	1	3
14	*Heliopetes arsalte* (Linnaeus, 1758)	--	--	1	3
15	*Paracarystus hypargyra* (Herrich-Schäffer, 1869)	--	--	2	13
16	*Phanus vitreus* (Stoll, 1781)	--	--	2	11
17	*Pythonides grandis assecla* Mabille, 1883	1	3	--	--
18	*Pythonides jovianus jovianus* (Stoll, 1782)	--	--	1	3
19	*Pompeius pompeius* (Latreille, [1824])	2	6	1	3
20	*Quadrus cerialis* (Stoll, 1782)	1	4	--	--
21	*Udranomia kikkawai* (Weeks, 1906)	1	2	--	--
22	*Urbanus dorantes dorantes* (Stoll, 1790)	2	2	--	--
23	*Urbanus esmeraldus* (A. Butler, 1877)	1	1	--	--
24	*Urbanus proteus* (Linnaeus, 1758)	1	3	--	--
25	*Urbanus simplicius* (Stoll, 1790)	3	3	--	--
26	*Urbanus tanna* Evans, 1952	--	--	3	18
27	*Urbanus teleus* (Hübner, 1821)	1	3	--	--
28	*Urbanus velinus* (Plötz, 1880)	1	2	1	3
29	*Vehilius inca* (Scudder, 1872)	1	4	1	3
30	*Vehilius stictomenes* (A. Butler, 1877)	1	6	1	5
31	*Vettius fantasos* (Cramer, 1780)			1	5
	Lycaenidae				
32	*Rekoa marius* (Lucas, 1857)	1	1	--	--
33	*Strymon bazochii bazochii* (Godart, [1824])	--	--	1	5
34	*Teritas mavors* Hübner, 1818	1	1	--	--
	Nymphalidae				
35	*Anartia jatrophae* (Linnaeus, 1763)	1	3	3	10
36	*Dryas iulia* (Fabricius, 1775)	1	8	--	--
37	*Euptoieta hegesia* (Cramer, 1779)	1	3	2	4
38	*Heliconius antiochus* (Linnaeus, 1767)	--	--	1	1
39	*Heliconius sara* (Fabricius, 1793)	--	--	2	6
40	*Junonia evarete* (Cramer, 1779)	--	--	2	2
41	*Philaethria dido* (Linnaeus, 1763)	1	1	--	--
	Papilionidae				
42	*Heraclides thoas* (Linnaeus, 1771)	--	--	4	36
	Pieridae				
43	*Aphrissa statira statira* (Cramer, 1777)	--	--	2	3
44	*Ascia monuste* (Linnaeus, 1764)	2	7	3	7
45	*Phoebis argante* (Fabricius, 1775)	--	--	2	5
46	*Phoebis philea philea* (Linnaeus, 1763)	--	--	1	5
47	*Rhabdodryas trite trite* (Linnaeus, 1758)	--	--	2	6
48	*Rhabdodryas trite watsoni* (F. Brown, 1929)	--	--	1	1
	Riodinidae				
49	*Nymphidium lisimon* (Stoll, 1790)	--	--	2	2
50	*Synargis calyce* (Felder & Felder, 1862)	1	5	--	--
		33	92	60	251