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DETERMINATION OF FLOWER BIOLOGY OF POLLINATOR ATTRACTING UNDEREXPLOITED VEGETABLE, Luffa cylindrica (L.) GROWING IN HOME GARDENS OF JAFFNA

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Abstract

Luffa cylindrica is an edible, underexploited, Cucurbitaceae vegetable crop in Sri Lanka. It has the potential to attract diverse pollinators and to sustain their visits to the home gardens. Conserving the pollinator diversity through the sustained contribution of potential plants that support pollinators in the home gardens were studied. Flower biology of L. cylindrica was investigated by assessing the flowering stages over time, corolla opening with time, maximum nectar production, anthesis, pollen shedding time and stigma receptivity. The rate of flower opening was at peak around 03.45 hr to 04.15 hr. Anthesis was prolonged for 2-2½ hours and stigma receptivity was 3-3½ hours after flower opening fully. The nectar volume appeared to be the highest around 6hr after flower opening. Of the L. cylindrica flower visitors, nine bee species (Amegilla sp, Amegilla cingulata, Apis florea, Apis cerana, Ceratina binghami, Trigona iridipennis, Thyreus ramosellus and Lasioglossum vagans , Xylocopa fenestrata), three butterfly species(Catopsilia pyranthe, Telchinia violae and Appias paulina) and an ant were found. These results confirm the potential of L. cylindrica to be grown as one of the pollinator conserving plant in the home gardens of Jaffna.

Keywords: Luffa cylindrica, home gardens, flower biology, anthesis, pollinator.

Introduction

Luffa cylindrica, known as sponge gourd, is a tropical and subtropical underexploited vegetable belongs to the family Cucurbitaceae. Though it is not commonly grown in home gardens, it has enormous potential to support pollinators by rewarding the pollens. These plants are growing in the wild and due to its multipurpose use people started domesticating it in their household however this crop has not been grown forever. Being a neglected crop growing in most of the households, this vegetable has enormous potential to attract pollinators. In general, plants in the family Cucurbitaceae possess potential to attract pollinators and L. cylindrica is one such noble crop used for salad preparation. This crop tolerates a wide range of climatic and soil conditions during flowering and fruiting period. Isolated cultivation of L. cylindrica is found in home gardens in the dry zone of Sri Lanka. However, the information on the flower biology and flowering phenology of L. cylindrica is scarce. To explore the potential of its support to pollinators, the flower biology and flowering phenology of L. cylindrica needs to be understood.

Materials and Methods

Luffa cylindrica, known as sponge gourd, is a tropical and subtropical underexploited vegetable belongs to the family Cucurbitaceae. Though it is not commonly grown in home gardens, it has enormous potential to support pollinators by rewarding the pollens. These plants are growing in the wild and due to its multipurpose use people started domesticating it in their household however this crop has not been grown forever. Being a neglected crop growing in most of the households, this vegetable has enormous potential to

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Materials and Methods

The study was conducted at Thirunelvely area in Jaffna district located at 9^0 40' 60N, 80^0 1' 0E at an altitude of 8m above the mean sea level, which is in the Northern Province of Sri Lanka, falls in dry zone (DL3). *L. cylindrica* grown in a home garden was used to study time of anthesis; time taken to shedding of pollens; stigma receptivity; maximum nectar volume production; a measure of corolla opening with time; different stages of flower from bloom to cease. During the study number of pollinators visited was also investigated.

Fifty male and female flowers were observed and recorded for these studies. Anthers were observed under the microscope to detect the opening and shedding time of pollens of *L. cylindrica* flower. Stigma was observed under the microscope to find out the receptivity.

Thirty six *Luffa* male flowers were covered by a net (2mm mesh size) separately in a plant before opening to prevent visiting of any pollinator in a day. On the following day after blooming the flower, nectar was collected from a flower with the help of micro-capillary tube in an hour interval from bloom (05:00 hr) to senesce (16:00 hr). The maximum volume of nectar were determined. Each flower stages were recorded with the help of series of photographs. Corolla length was measured with the help of scale from 03:30 hr to 16:00 hr. All the pollinators visited the flowers were recorded and collected between 03:30 hr to 16:00 hr on a day.

Results and Discussion

The corolla width of fully opened male flower and female flower was ranged from 80-84 mm and 78-80 mm diameter, respectively. Fully opened flowers were yellow in colour. Further analysis of flowering phenology with age revealed that the stigma was receptive in two to three hours after flower opening. Rate of flower opening was at its peak around 03.45 hr to 04.15 hr. Anther opening was observed 2-2½ hours after flower opening.

Plate 1: (A) Receptive stigma and (B) anther under 10×3.5 Stereo microscope

The nectar volume and nectar recovery appeared to be highest (2.8 ML) around 11.00 hr. and the lowest nectar volume (0) was measured in 04.00 hr and 17.00 hr. Each flower stages were recorded. Plate 2: Flower stages with time showed that 1 – 9 stages were appeared between 03.00 hr and 09.00 hr. Stage 1 is

called as bud stage. And stage 9 was the fully opened flower. In stages 10, 11 and 12, flower was started to senesce. Finally this flower was ceased at 16.00 hr (Stage 13)

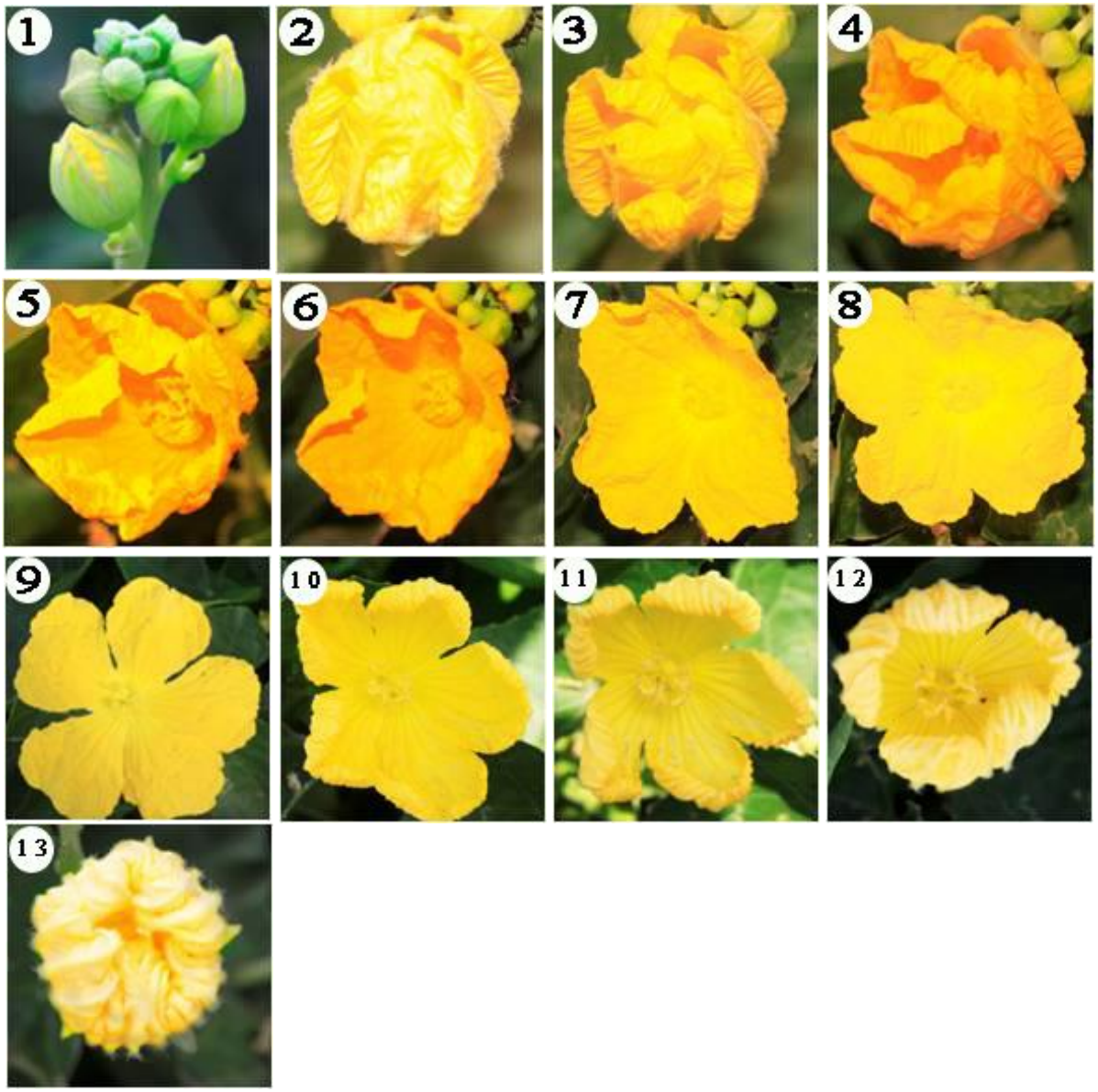

Plate 2: Flowering stages of luffa cylindrica with time

The observation was during 15-25, July 2014 during the hours 03:00 to 16:00 for a total of 140 hours. (Throughout the study hours the day and night average temperature and relative humidity were 98^0F, 79^0F and 79.8 %.) Pollinators belonging to three orders were recorded on the *L. cylindrica* flower. These included ants and bees (Hymenoptera) and butterflies (Lepidoptera). Ants were recorded as the most abundant floral visitors. There were nine bee species, three butterfly species and an ant recorded as floral visitors. Among those bee species, majority of bees belong to the family Apidae (66.67%). Three species of social bees, *Apis dorsata*, *A. cerana*, *A. florea* and *Trigona iridipennis* were visited. Six species of solitary bees were foraging on pollen collecting nectar of *Luffa*

flower at home gardens. *Amegilla sp, Amegilla cingulata, Ceratina binghami, Thyreus ramosellus and Lasioglossum vagans, Xylocopa fenestrata* were identified under solitary bees.

Conclusion

From the observations of various flower stages, the maximum corolla width of male and female flowers was ranged from 80-84 mm and 78-80 mm diameter, respectively. The timing of anthesis was at the peak between 2-2½ hours after male flower opening and stigma was receptive in 2-2½ hours after female flower opening. Maximum nectar volume was 2.8 ML around 6hr after opening of flower. Nine bee species, three butterfly species and an ant were recorded as pollinators. Though *Luffa* is considered as an underutilized plant, it can be grown in the home gardens to preserve and protect the pollinators in the ecosystem.

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Appendix

Table 1: Corolla opening with time (Distance between two ends of petals) of Luffa flower

Time	Diameter (cm)	Diameter (cm)	Diameter (cm)
3.30	0.0	0.0	0.0
3.40	0.1	0.2	0.2
3.50	0.3	0.4	0.4
4.00	0.6	0.7	0.7
4.10	0.8	0.9	0.9
4.20	1.0	1.3	1.2
4.30	1.6	1.8	1.7
4.40	1.9	2.1	2.0
4.50	2.5	2.8	2.7
5.00	2.8	3.0	2.9
5.10	4.1	4.5	4.3
5.20	5.0	5.1	5.1
5.30	5.8	6.0	5.9
5.40	6.4	6.6	6.5
5.50	6.9	7.0	7.0
6.00	7.0	7.1	7.1
7.00	8.0	8.2	8.1
8.00	8.0	8.2	8.1
9.00	8.1	8.4	8.3
10.00	8.0	8.2	8.1
11.00	6.1	6.2	6.2
12.00	4.9	5.2	5.1
13.00	4.5	4.9	4.7
14.00	4.0	4.4	4.2
15.00	1.5	2.0	1.8
16.00	1.0	1.0	1.0

Table 2: Nectar total volume of Luffa flower

Time	Day 1	Day 2	Day 3
4.00	0	0	0
5.00	2	2	3
6.00	8	7	8
7.00	13	12	10
8.00	17	22	19
9.00	21	25	23
10.00	24	26	26
11.00	25	27	31
12.00	24	23	28
13.00	14	13	19
14.00	11	12	15
15.00	11	11	11
16.00	4	8	6
17.00	0	0	0