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Manjishtha Bhattacharyya
Research Scholar (DST INSPIRE)
Department of Zoology
Vidyasagar University
Midnapore 721102
West Bengal, India

Susanta Kumar Chakraborty
Professor & Head
Department of Zoology
Vidyasagar University
Midnapore 721102
West Bengal, India

Correspondence:
Manjishtha Bhattacharyya
Research Scholar (DST INSPIRE)
Department of Zoology
Vidyasagar University
Midnapore 721102
West Bengal, India

Luffa cylindrica as a host plant for pollinator bees – a study based in West Midnapore, West Bengal, India.

Manjishtha Bhattacharyya, Susanta Kumar Chakraborty

ABSTRACT
Pollination of flowering trees is a crucial ecosystem service and both wild and reared bees are responsible for the greater part of it. Unfortunately, the bees that pollinate the wild plants are seldom paid any scientific attention.
The present paper, based on a study in lateritic West Midnapore district of West Bengal, attempts to document the bee fauna foraging on common sponge gourd *Luffa cylindrica* as sampled over two flowering periods in the post-monsoon season. Both passive trapping and active netting methods were employed on two plots of wild growing *Luffa* plants. Active netting yielded greater catch than passive trapping. Honeybees (*Apis cerana indica* and *Apis mellifera)* formed the bulk of the specimens sampled. Herbaceous plants like *Luffa* sp. are an important source of pollen and nectar for bees in the post monsoon season in West Midnapore, when flowering in trees is scant. However, being a creeper it is not accorded much protection and is often weeded out, which may negatively affect populations of bees foraging on its flowers.

Keywords: *Luffa cylindrica*, Hymenoptera, Pollinator bees, West Midnapore.

1. Introduction

The significance of pollination as an important ecosystem service is only recently being duly appreciated. A 2009 estimate [1] indicates that the global economic value of pollination service provided by insect pollinators is $217 billion, totalling roughly 9.5% of the value of the world's agricultural food production, and further testifies to the importance of pollination services provided free of cost to man [2]. This involuntary charity displayed towards man, chiefly by the insects, could have gone on uninterrupted as it has in the past since the beginning of civilisation and agriculture had not man, by his reckless and unplanned developmental activities disturbed the balance. The result is that pollination is declining and population of pollinators are steadily dwindling [3].

The effect of decline in pollinators will be felt directly with the escalating prices of food products, as pollination, the crucial agricultural component stops being free and has to be artificially provided.

Although, artificial and assisted pollination are quite prevalent and developed in the first world countries, it is not quite a viable option when a developing country like India is considered. Agriculture, being our mainstay, should see progressive reforms in order to minimize the investment and substantiate the profit. Focus should therefore be on strengthening the free-of-cost pollination services provided by our insects and birds, and not on devising substitute pollination plans. The first step in such a scheme would be to know the status of our pollinators.

Bees are the most abundant and efficient pollinators of almost all flowering ecosystems of the world. A United States Department of Agriculture report estimates that about 75% of the country's agricultural produce can be attributed to pollination by bees [4]. Both reared and wild bees serve as effective pollinators of cultured crops, and are equally important in pollinating the wild plants, on which the sustainability of our ecosystems depend. Managing the survival of bees in nature is therefore an important step in ensuring the continuation of pollination of our cultured crops and wild vegetation, and is therefore the need of the hour.

Such management requires an in depth knowledge of the bee populations native to an ecosystem. Knowledge of alternate food sources of the bees when the target crop is not in bloom is also essential since these alternate food sources support the bees in lean seasons. Often, these alternate food sources are weeds or shrubs which usually are destroyed during planned agriculture and other developments, leading to a loss of bee fauna, unbeknownst to the farmers and policy makers.

The present paper is based on such a study carried out in the district of West Midnapore, West Bengal, India, to document the bee fauna foraging on one such weed species *Luffa cylindrica* during the post monsoon season when the flowering in trees is less abundant. The aim of this study is to understand the importance of these apparently less important plants in supporting the pollinator bees and preserving their diversity.

2. Physiography of Study site

The study was carried out on two wild *Luffa cylindrica* patches growing about 1200 metres apart on barren land earmarked for building and road construction in the village of Amlatoria (Lat. 22° 18' 39.40" N; Long. 87° 19' 49.47" E) in the district of West Midnapore in West Bengal, India, for 10 days from October, 2012 to November, 2012 and 10 days from October, 2013 to November 2013.

The study site is a village with scattered mud and brick houses located amidst barren lands used primarily as cattle pasture and recently acquired by the state government for developmental purposes. Agriculture here is limited to some paddy grown in the monsoon. The entire area is distantly surrounded by groves of bamboo, mango and *Azadirachta*. The two latter plants flower only in pre-monsoon season. It can therefore be theorized that the pollinator bees have to depend on some other food sources during the monsoon and post-monsoon seasons to sustain themselves.

Pilot surveys conducted here suggested that the post-monsoon season sees an abundance of wild creepers and shrubs growing in the study area. Most of these plants flower during this period and the entire area is covered with blooms at and near the ground level. Of the plants flowering during the study period, the most abundant were the flowers of *L. cylindrica*, *Solanum sysimbriifolium* and *Commelina* sp. The pollinator bees were, however, found to be foraging mostly on the bright yellow flowers of *Luffa* sp.

Luffa is a creeper of the Cucurbitaceae family predominantly found in tropical and subtropical areas. It is a sturdy herb and can tolerate a wide range of climatic conditions, except heavy rainfall [4] and grows in lateritic West Midnapore, abundantly shortly after the rains for about 2 months till the beginning of winter. Its flowers are big and bright yellow and are a rich source of pollen for the foraging insects, chiefly bees. The importance of *Luffa* as a significant alternative medicinal source is beginning to get attention from the scientific community [5], although it is still widely regarded as a weed and therefore destroyed without much hesitation.

3. Methodology

In the study sites, two roughly rectangular patches of approximately 10 metre x 7 metre dimension were selected for sampling. The *Luffa* plants grew at the ground level and were mostly uninterrupted by other vegetation. Sampling was done for 10 days (from October, 2012 to November, 2012) in sampling season 1 and 10 days (from October, 2013 to November 2013) in sampling season 2 only on bright sunny days with minimal cloud cover, when bees were generally more active.

Both active and passive trapping methods were employed for catching pollinator bees following standard protocol [6]. For passive trapping, UV Blue coloured plastic bowls of diameter 21 cm and depth 07 cm were used. Soap water solution (1:10 Extran: Water) was used in the bowls and these were then placed at approximately 2 metre interval among the plants for 2 hours during the days of trapping, from 8 am in the morning till 10 am, when the bees were noted to be most active. Active netting at the flowers with hand held nets at 30 minutes interval, walking along the length of the patch was done simultaneously with bowl trapping, every 30 minutes, for 2 hours. The sampled bees were stored in 70% alcohol.

The collected specimens were identified by cross referencing with specimens previously identified with the assistance of the Zoological Survey of India, Kolkata.

The total number of *Luffa* flowers growing on each plot at the time of each sampling event was counted and recorded.

The second plot (P2) was appreciably reduced in extent after the sixth sampling event in 2013 by construction agencies employed by the government for construction purposes. Regular sampling was carried on but the generated data was appreciably reduced.

4. Results

A total of 102 bees were sampled in 2012 from Plot 1 (henceforth referred to as P1) of which ≈ 96% (98 individuals) were caught by active netting and ≈ 4% (04 individuals) were sampled using passive trapping (Table 1). 161 individual bees were sampled from plot 2 (henceforth to be referred to as P2) in 2012 out of which ≈ 70% (112 individuals) were actively netted and ≈ 30% (49 individuals) were passively trapped (Table 1).

Table 1: Data from sampling season 1 (Oct-Nov, 2012) from the 2 plots

Sampling events (2012)	**Plot 1**		**Plot 2**		**Number of flowers per plot counted per sampling event**		**Sampling efficiencies of trapping methods**	
	Actively netted	***Passively trapped***	***Actively netted***	***Passively trapped***	***Plot 1***	***Plot 2***	***Plot 1***	***Plot 2***
1	7	0	10	4	38	41	Active netting ≈ 96% Passive trapping ≈ 4%	Active netting ≈ 70% Passive trapping ≈ 30%
2	11	0	12	6	43	41		
3	10	1	9	7	41	37		
4	9	1	11	4	39	39		
5	12	0	12	6	44	39		
6	8	0	10	4	44	39		
7	11	0	13	4	42	41		
8	10	1	12	4	39	43		
9	11	0	12	5	40	43		
10	9	1	11	5	40	38		

In 2013, a total of 122 bees were sampled from P1 of which 117 were actively netted, forming ≈ 96% of the sampled bees, and 05 specimens (≈ 4% of the total sampled bees) were passively trapped from P1 (Table 2). In 2013, a total of 119 bees were sampled from P2, of which ≈ 73% (87 individuals) were actively netted while ≈ 27% (32 individuals) were passively trapped (Table 2).

Table 2: Data from sampling season 2 (Oct-Nov, 2013) from the 2 plots

Sampling events (2013)	Plot 1		Plot 2		Number of flowers per plot counted per sampling event		Sampling efficiencies of trapping methods	
	Actively netted	*Passively trapped*	*Actively netted*	*Passively trapped*	*Plot 1*	*Plot 2*	*Plot 1*	*Plot 2*
1	10	1	13	5	42	42	Active netting ≈96%	Active netting ≈4%
2	11	1	12	4	43	42		
3	12	0	13	4	42	44		
4	12	1	10	4	42	43		
5	12	1	12	3	41	43		
6	10	0	11	5	41	40	Passive trapping ≈ 73%	Passive trapping ≈ 27%
7	13	0	5	2	41	15		
8	12	1	4	3	39	16		
9	14	0	4	1	40	15		
10	11	0	3	1	39	13		

In both the plots in both the sampling seasons, active netting yielded greater catch than passive trapping (Tables 1 and 2; Figures 1, 2, 3 and 4).

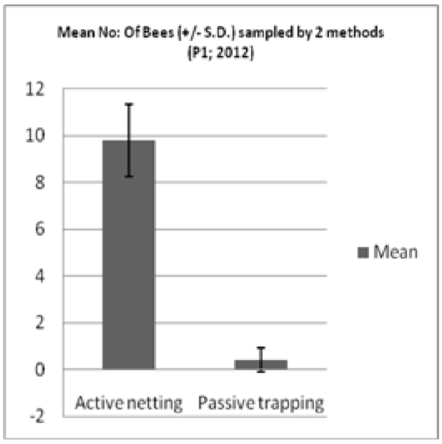

Fig. 1: Active netting yielded more samples than passive trapping (data from P1; 2012)

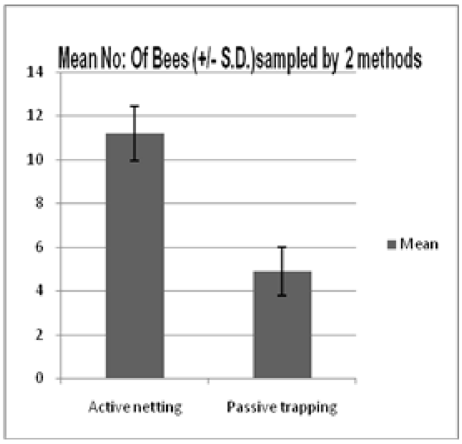

Fig. 2: Active netting yielded more samples than passive trapping (data from P2; 2012)

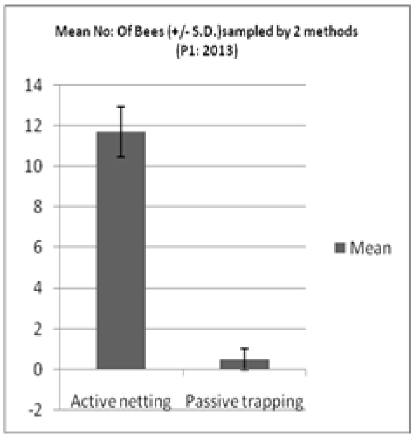

Fig. 3: Active netting yielded more samples than passive trapping (data from P1; 2013)

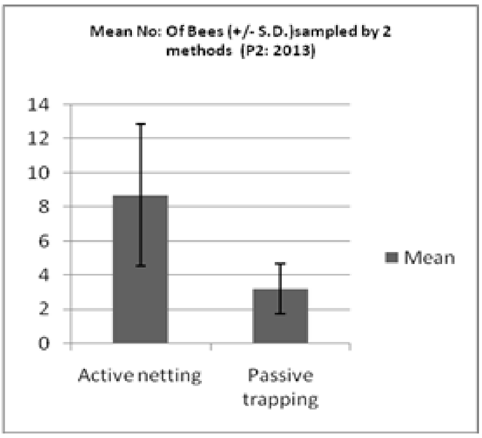

Fig. 4: Active netting yielded more samples than passive trapping (data from P2; 2013)

In 2012, of the total number of bees sampled from P1, using both the active and passive sampling methods, ≈70% of bees were of the genus *Apis* (honeybees) while ≈30% were Non-*Apis* bees (Table 3). Individually, of these 102 bees caught in 2012 from P1, active netting yielded 68% *Apis* bees and 32% non-*Apis* bees, while passive trapping yielded 100% *Apis* bees and no Non-*Apis* in 2012 from P1 (Table 3).

Of the total of 161 bees sampled in 2012, from P2, ≈ 73% of *Apis* bees and ≈27% Non-*Apis* bees were sampled (Table 3). Individually, in 2012, active netting yielded 71% of *Apis* bees and 29% of Non-*Apis* bees from P2 (Table 3) and passive trapping yielded 78% *Apis* bees and 22% Non-*Apis* bees from P2 (Table 3).

Table 3: Proportion of *Apis* and Non-*Apis* bees sampled during the season 2012 using 2 different techniques

Sampling method	**Sampling event**	**Plot 1**		**Percentage of bee types sampled from P1**		**Plot 2**		**Percentage of bee types sampled from P2**	
		***Apis* bee**	***Non-Apis* bee**	***Apis* bee**	***Non-Apis* bee**	***Apis* bee**	***Non-Apis* bee**	***Apis* bee**	***Non-Apis* bee**
Active netting (2012)	1	5	2	≈70% (active netting + passive trapping)	≈30% (active netting + passive trapping)	7	3	≈73% (active netting + passive trapping)	≈27% (active netting + passive trapping)
	2	8	3			9	3		
	3	8	2			7	2		
	4	6	3			7	4		
	5	9	3			10	2		
	6	5	3			7	3		
	7	7	4			9	4		
	8	6	4			7	5		
	9	8	3			10	2		
	10	5	4			7	4		
Passive trapping (2012)	1	0	0			4	0		
	2	0	0			4	2		
	3	1	0			6	1		
	4	1	0			3	1		
	5	0	0			4	2		
	6	0	0			3	1		
	7	0	0			4	0		
	8	1	0			3	1		
	9	0	0			4	1		
	10	1	0			3	2		
Percentage of bee types sampled by active netting (P1) →		68% *Apis*	32% *Non-Apis*			71% *Apis*	29% *Non-Apis*	← *Percentage of bee types sampled by active netting (P2)*	
Percentage of bee types sampled by passive trapping (P1) →		100% *Apis*	0 *Non-Apis*			78% *Apis*	22% *Non-Apis*	← *Percentage of bee types sampled by passive trapping (P2)*	

In 2013, ≈ 77% of bees sampled from P1 using both active netting and passive trapping were *Apis* bees and ≈ 23% of bees sampled were Non-*Apis* bees (Table 4). Active netting sampled ≈ 77% *Apis* bees and ≈ 23% Non-*Apis* bees from P1 in 2013 (Table 4). Bees sampled by passive trapping from P1 in 2013 consisted of ≈ 80% *Apis* bees and ≈ 20% Non-*Apis* bees (Table 4).

In 2013, ≈ 73% of bees sampled from P2 using both active netting and passive trapping were *Apis* bees and ≈ 27% of bees sampled were Non-*Apis* bees (Table 4). In 2013, active netting from P2 caught ≈75% *Apis* bees and ≈ 25% Non-*Apis* bees (Table 4) while passive trapping in 2013 from P2 caught 69% of *Apis* & 31% of Non-*Apis* bees (Table 4).

Table 4: Proportion of *Apis* and Non-*Apis* bees sampled during the season 2013 using 2 different techniques

Sampling method	Sampling event	Plot 1		Percentage of bee types sampled from P1		Plot 2		Percentage of bee types sampled from P2	
		***Apis* bee**	***Non-Apis* bee**	***Apis* bee**	***Non-Apis* bee**	***Apis* bee**	***Non-Apis* bee**	***Apis* bee**	***Non-Apis* bee**
Active netting (2013)	1	7	3	≈ 77% (active netting + passive trapping)	≈ 23% (active netting + passive trapping)	9	4	≈73% (active netting + passive trapping)	≈27% (active netting + passive trapping)
	2	8	3			9	3		
	3	10	2			8	5		
	4	9	3			7	3		
	5	9	3			10	2		
	6	7	3			8	3		
	7	11	2			4	1		
	8	11	2			3	1		
	9	11	3			4	0		
	10	8	3			3	0		
Passive trapping (2013)	1	1	0			3	2		
	2	1	0			2	2		
	3	0	0			3	1		
	4	1	0			4	0		
	5	0	1			2	1		
	6	0	0			3	2		
	7	0	0			1	1		
	8	1	0			2	1		
	9	0	0			1	0		
	10	0	0			1	0		
Percentage of bee types sampled by active netting (P1) →		***77% Apis***	***23% Non-Apis***			***75% Apis***	***25% Non-Apis***	← ***Percentage of bee types sampled by active netting (P2)***	
Percentage of bee types sampled by passive trapping (P1) →		***80% Apis***	***20% Non-Apis***			***69% Apis***	***31% Non-Apis***	← ***Percentage of bee types sampled by passive trapping (P2)***	

5. Discussion

The abundance of the pollinator bees (both colonial and solitary bees) was appreciable on the flowers of *L. cylindrica*. Active netting accounted for equal to or more than 70% of the catch in both the sites in both the seasons.

Passive trapping was consistently more successful in sampling bees from P2 than P1. This was probably because of the presence of a draw-well at ground level within 50 feet of the first plot (P1). Bees were indeed seen hovering around its rim which was always wet. There was no such water source near the second plot (P2) which allowed easy attraction and subsequent entrapment of the foraging bees in the water traps set up in this plot using UV Blue Bowls. As such, success rate of passive trapping using soap water solution in UV Blue Bowls was higher in P2 than in P1 in 2012.

Apis bees (honeybees) were more abundant than non-*Apis* bees (non-honeybees), in both the plots, in both the sampling seasons. *Apis* bees accounted for more than 65% of the total catch from both plots in both seasons. *Apis cerana indica* was the single most predominant species followed by *Apis mellifera* and *Xylocapa* sp. Observational documentation also attests to this fact. The single solitary species sampled from P1 in 2012 is *Lasioglossum* sp. belonging to the family Halictidae.

6. Conclusion

This study was aimed at highlighting the importance of the creeper *Luffa* in sustaining the pollinator bee population when there are almost negligible food resources in the environment. The study area, as mentioned before, is an almost barren area with very little floral resources in the post monsoon season, during which the study was conducted. The high abundance of honeybees on the flowers of *Luffa* during this short study period indicate that these wild roadside creepers are vital in providing the foraging bees with ample food. In fact, notable observation of *Xylocapa* driving away *Apis cerana indica* from the *Luffa* flowers was made frequently during the study, indicating significant competition for food among the different bee species.

A survey of the village confirmed that there was no hive-boxes set up by any house as an income source. So the honeybees found foraging on the flowers can be assumed to be untamed wild honeybees, which depend on these naturally growing food sources for sustainance. Apart from bees, the plots displayed a great abundance of biodiversity in form of other invertebrates including representatives of Coleoptera, Diptera and Hymenoptera, all foraging on the flowers of *Luffa* plants.

The fruits of the *Luffa* are sometimes eaten by local people and the dried fruit is used as a cleaning sponge. But, because it grows unchecked and spreads quickly, this plant is usually weeded out. The rising importance of the plant in pharmaceutical industry may help check its wanton destruction. That would be beneficial for the foraging bees which seem to rely on it significantly. It is in the interest of the food growers that this apparently pestilential weed be allowed to grow under proper management so that the pollinators of the crops have a back-up food source even after harvest season, before the trees flower.

7. References

1. Gallai N, Salles JM, Settele J, Vaissière BE. Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. Ecological Economics. 2009; 68:810-821.
2. Weblink: http://www.cbc.ca/news/technology. 23 May, 2014.
3. Moisset B, Buchmann S. Bee Basics: An Introduction to Our Native Bees. A USDA Forest Service and Pollinator Partnership Publication 2011; 02.
4. Bal KJ, Hari BKC, Radha KT, Madhusudan G, Bhuwon RS, Madhusudan PU. Descriptors for Sponge Gourd [*Luffa cylindrica* (L.) Roem.] NARC, LIBIRD & IPGRI, 2004.
5. Pratap S, Kumar A, Sharma NK, Jha KK. *Luffa Cylindrica*: An important medicinal plant. Journal of National Products and Plant Resources 2012; 2(1):127-134.
6. Droege S. The Very Handy Manual: How to Catch and Identify Bees and Manage a Collection. A USGS Native Bee Inventory and Monitoring Laboratory Publication 2009; 02:13.