

Record of insect pollinators, their diversity, richness and abundance on *Calotropis procera* (AIT.) R. Br., in the desert of Thar in Rajasthan, India

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Abstract

Pollination is a major phenomenon in flowering plants which determines production efficiency. The present paper is a first attempt to provide collective information on the diversity of Insect fauna, engaged in foraging activity and pollination of *Calotropis procera* (AIT.) R. Br., in the desert of Thar. This xerophytic perennial shrub is widely distributed in the Great Indian Desert and is well known for its variety of medicinal properties. The collected 27 species of Insect pollinators were identified, which belongs to 3 orders (Hymenoptera, Diptera and Hemiptera), 11 families (Apidae, Formicidae, Scoliididae, Colletidae, Megachilidae, Halictidae, Vespidae, Dolichopodidae, Calliphoridae, Muscidae, Lygaeidae) and 14 Tribes (Anthophorini, Apini, Camponotini, Campsomerini, Hylaeinae, Anthidiini, Megachilini, Ropalidiini, Meliponini, Xylocopini, Chrysosomatini, Lucilian, Muscini, Lygaeini). The abundance of insect pollinators has been observed, significantly different in the different time intervals of the day ($P < 0.05$) but t-test analysis [t-stat: -0.3527, P (T≤t: 0.3635)] suggesting, there is no significant difference in the abundance of insect pollinators in the summer and winter season. Simpson index of diversity (1-D) indicating high diversity in the study area with estimated Margalef's richness index (M-summer 3.503 & M-winter 3.555) in both seasons. Value of Shannon index in both the seasons, representing every species in the sample.

Keywords: Diversity, *Calotropis procera*, insects, pollination

1. Introduction

Insect pollination for most of the crops is essential and is regarded as a valuable ecosystem service [11]. The majority of plants for their sexual reproduction need insect pollination which involves the transfer of genetic information through pollen. A wide range of flowering plants required insect pollination which increases their yields significantly [7, 10, 12]. In other words, human for their livelihood and food production relies on this critical ecosystem service of insect pollination [8]. *Calotropis procera* (AIT) R. Br (Asclepiadaceae) locally known as Aak, Akra, Madar, or milk weed is a perennial wild shrub and distributed throughout the Great Indian Desert. It is a native species to North Africa, tropical Africa, South Asia, and Indochina [16]. It is well known for its pharmacological importance for centuries. In the traditional system of medicine, all the parts of this plant including stem, flower, leaf, root, etc. are commonly used. A wide range of pharmacological activities it possesses such as cytotoxic, antidiabetic, antioxidant, analgesic, anti-inflammatory, antiarthritic, anthelmintic, antimicrobial, wound healing, anticovulsant, hepatoprotective, myocardial infarction, and immune responses [3, 13, 14, 15]. In many therapeutic applications, this plant is considered immensely useful for humankind containing amyirin, amyirin esters, calotropin, coroglaucigenin, calactin, uscharidin, corotoxigenin, frugoside, calotropagenin, voruscharine, calotoxin, uscharin. Further for centuries, numerous compounds like cysteine protease, sterols, alkaloids, organic carbonates, flavonoids, cardenolides, and norditerpenic esters made this plant of scientific attraction [17]. Thar desert of Rajasthan is a typical hot and arid ecosystem and is known for its intense xeric conditions. The rainfall is quite low and erratic with ninety

percent of rains occurs during the monsoon season, from July to September. It is followed by a diverse period of cold (November - February) and dry (September - July) weather. Biodiversity is low however endemic flora of great economic importance grows here [2]. The present study recorded insect-bearing pollinaria which visited the flowers of *Calotropis procera*. These insects were classified as pollinators thereby helping in the pollination ecology of the plant [4]. Few similar studies from the Great Thar desert were reported on different vegetations of *Prosopis cineraria* [6] and *Acacia nilotica* [16].

2. Material and Methods

Observation and collection were made to find out the diversity of Insect pollinators on this plant at five different adjoining districts of Rajasthan (Jodhpur, Jaisalmer, Barmer, Jalore, and Bikaner) from March 2015 to March 2020. Insect pollinators were collected by stratified random sampling method in summer and winter season, by using standard 38 cm sweep nets (SN). The experimental collection sites were regularly visited and Samples were collected by using a hand sweeping net from 6 am to 6 pm on every field visit day. Samples were preserved in the killing bottles with ethyl acetate and brought into the laboratory for spreading the insects, identification, and photography. Diversity of insect pollinators has been estimated by calculating Simpson index, Simpson index of diversity, Shannon index and Margalef's index. The abundance of insect pollinators in the three-time periods (morning, noon and afternoon) has been analyzed by single-factor ANOVA by using MS Excel-2019. Comparative study of abundance of insect pollinators in summer and winter seasons of Thar Desert was carried out by analyzing

students t-test by MS Excel-2019.

Shannon-Weiner entropy (H) = $-\sum_{i=1}^s P_i' \ln P_i'$

Simpson Index (D) = $\sum_{i=1}^s P_i^2$

Simpson Index of Diversity = 1-D

Richness Index of species by Margalef = $S-1/\ln N$

n= Number of insects species

N=Total number of insects in sample

Pi' = (n/N), ln=natural log

S= Total number of species

3. Result

A total of 27 different species of insect foragers were identified, belonging to 3 orders Hymenoptera, Diptera and Hemiptera. Insect pollinators have been reported from 11 different families (Apidae, Formicidae, Scolidae, Colletidae, Megachilidae, Halictidae, Vespidae, Dolichopodidae, Calliphoridae, Muscidae, Lygaeidae) and 14 Tribes (Anthophorini, Apini, Camponotini, Campsomerini, Hylaeinae, Anthidiini, Megachilini, Ropalidiini, Meliponini, Xylocopini, Chrysosomatini, Luciliini, Muscini, Lygaeini) (Table 1). Hymenoptera has been observed as the most abundant order while Apidae as the most abundant family in both summer and winter season (Fig. 1). It has been found that *Trigona iridipennis* showed maximum abundance (18.85 / m²/ 5 minutes) and *Chrysosoma spp* (1.44 / m²/ 5 minutes) as the least abundant visitor in the summer while it has been also reported that *Apis florea* was the most abundant (14.70 /m²/ 5 minutes) pollinator in the winter season and *Lucilia sericata* (1.51/ m²/ 5 minutes) as the least one. In the summer season, peak foraging activity was reported in the noon around 10 a.m.-2

p.m. while least abundance was noted in the evening. In the winter season, peak foraging also has been observed in the noon around 10 a.m.-2 p.m. but least abundance was reported in the morning (Table 2). All the insect visitors showed a significant difference in the abundance as per the time of the day (morning, noon and afternoon). ANOVA analysis estimated less P-value as compared to the level of significance (α 0.05) in the summer and winter season both. F-crit value has been estimated less than F-value, suggesting the Null Hypothesis cannot be accepted (Table 3). A total of 19 insect visitors were reported in the summer season and 18 insect visitors were observed in the winter season. Student t-test has been conducted to examine the significant difference in abundance of insect pollinators from summer and winter season (Table 4). It has been estimated that there is no significant difference in the abundance (Fig. 2) but insect pollinators showed variation in insect species. Diversity of insect pollinators has been estimated by calculating Simpson index (D) and Shannon index (H). In the summer season, the value of the Simpson index and Simpson index of diversity (1-D) have been estimated 0.069 and 0.93 respectively, showing a high abundance in the study area (Table 5). Value of Simpson index (D) and Simpson index of diversity (1-D) has been calculated 0.073 and 0.92 respectively in the winter season also showing high diversity of insect pollinators (Table 6). Species richness was estimated by calculating Margalef's index that was found 3.503 and 3.555 respectively in the summer and winter seasons. Some of the major insect pollinators have been shown in Fig. 3.

Table 1: Record of Insect pollinators on *Calotropis procera* (AIT.) R. BR

Sr. No.	Name of Insect Pollinator	Division/Group	Foraging purpose
1	<i>Amegilla cingulata</i> Fabricius (1775)	Order: Hymenoptera, Family: Apidae, Subfamily: Apinae, Tribe: Anthophorini	Nectar + pollen
2	<i>Amegilla fallax</i> Smith (1879)	Order: Hymenoptera, Family: Apidae, Subfamily: Apinae, Tribe: Anthophorini	Nectar + pollen
3	<i>Amegilla zonata</i> Linnaeus (1758)	Order: Hymenoptera, Family: Apidae, Subfamily: Apinae, Tribe: Anthophorini	Nectar + pollen
4	<i>Apis dorsata</i> Fabricius (1793)	Order: Hymenoptera, Family: Apidae, Subfamily: Apinae, Tribe: Apini	Nectar + pollen
5	<i>Apis florea</i> Fabricius (1787)	Order: Hymenoptera, Family: Apidae, Subfamily: Apinae, Tribe: Apini	Nectar + pollen
6	<i>Camponotus</i> spp.	Order: Hymenoptera, Family: Formicidae Subfamily: Formicinae, Tribe: Camponotini	Nectar
7	<i>Campsomeriella annulata</i> Fabricius (1793)	Order: Hymenoptera, Family: Formicidae Subfamily: Scoliinae, Tribe: Campsomerini	Nectar + pollen
8	<i>Campsomeriella collaris</i> Fabricius (1775)	Order: Hymenoptera, Family: Scoliidae Subfamily: Scoliinae, Tribe: Campsomerini	Nectar + pollen
9	<i>Hyleus</i> spp.	Order: Hymenoptera, Family: Colletidae, Subfamily: Hylaeinae	Nectar
10	<i>Icterantheidium saltatore</i> Nurse	Order: Hymenoptera, Family: Megachilidae, Subfamily: Megachilinae, Tribe: Anthidiini	Nectar + pollen
11	<i>Icterantheidium sinapinum</i> Cockerell (1911)	Order: Hymenoptera, Family: Megachilidae, Subfamily: Megachilinae, Tribe: Anthidiini	Nectar + pollen
12	<i>Nomia curvipes</i> Fabricius (1793)	Order: Hymenoptera, Family: Halictidae, Subfamily: Nomiinae,	Nectar + pollen
13	<i>Nomia elliotii</i> Smith (1875)	Order: Hymenoptera, Family: Halictidae, Subfamily: Nomiinae	Nectar + pollen
14	<i>Pseudoheriades nevatus</i> Gupta & Sharma	Order: Hymenoptera, Family: Megachilidae, Subfamily: Megachilinae, Tribe: Megachilini	Nectar
15	<i>Ropalidia marginata</i> Fabricius (1793)	Order: Hymenoptera, Family: Vespidae Subfamily Polistinae, Tribe: Ropalidiini	Nectar
16	<i>Trigona iridipennis</i> Smith (1854)	Order: Hymenoptera, Family: Apidae, Subfamily: Apinae, Tribe: Meliponini	Nectar
17	<i>Xylocopa aestuans</i> (Linnaeus) (1758)	Order: Hymenoptera, Family: Apidae, Subfamily: Xylocopinae, Tribe: Xylocopini	Nectar + pollen
18	<i>Xylocopa amethystina</i> (Fabricius) (1793)	Order: Hymenoptera, Family: Apidae, Subfamily: Xylocopinae, Tribe: Xylocopini	Nectar + pollen
19	<i>Xylocopa auripennis</i> Lepeltier (1841)	Order: Hymenoptera, Family: Apidae, Subfamily: Xylocopinae, Tribe: Xylocopini	Nectar + pollen
20	<i>Xylocopa basalis</i> Smith (1854)	Order: Hymenoptera, Family: Apidae, Subfamily: Xylocopinae, Tribe: Xylocopini	Nectar + pollen

21	<i>Xylocopa fenestrata</i> (Fabricius) (1798)	Order: Hymenoptera, Family: Apidae, Subfamily: Xylocopinae, Tribe: Xylocopini	Nectar + pollen
22	<i>Xylocopa nasalis</i> Westwood (1838)	Order: Hymenoptera, Family: Apidae, Subfamily: Xylocopinae, Tribe: Xylocopini	Nectar + pollen
23	<i>Xylocopa pubescens</i> Spinola (1838)	Order: Hymenoptera, Family: Apidae, Subfamily: Xylocopinae, Tribe: Xylocopini	Nectar + pollen
24	<i>Chrysosoma</i> spp.	Order: Diptera, Family: Dolichopodidae, Subfamily: Chrysosomatini, Tribe: Chrysosomatini	Nectar
25	<i>Lucilia sericata</i> (Meigen) (1826)	Order: Diptera, Family: Calliphoridae Subfamily: Luciliinae, Tribe: Luciliini	Nectar
26	<i>Musca domestica</i> Linnaeus (1758)	Order: Diptera, Family: Muscidae, Subfamily: Muscinae, Tribe: Muscini	Nectar
27	<i>Lygaeus</i> spp.	Order: Hemiptera, Family: Lygaeidae Subfamily: Lygaeinae, Tribe: Lygaeini	Nectar

Table 2: Abundance of Insect species on *Calotropis procera* (Insects/m²/5 minutes)

Sr. No.	Bee species	Summer season				Winter season			
		6 a.m.-10 a.m.	10 a.m.-2 p.m.	2 p.m.-6 p.m.	Mean	6 a.m.-10a.m.	10 a.m.-2 p.m.	2 p.m.-6 p.m.	Mean
1	<i>Amegilla fallax</i>	13.20	13.91	9.31	12.14	00	00	00	00
2	<i>Amegilla zonata</i>	00	00	00	00	5.70	10.39	7.59	7.89
3	<i>Amegilla cingulata</i>	00	00	00	00	5.19	8.41	6.73	6.78
4	<i>Apis dorsata</i>	16.79	18.70	13.27	16.25	9.39	17.66	14.34	13.80
5	<i>Apis florea</i>	17.31	21.6	14.90	17.94	10.06	18.38	15.67	14.70
6	<i>Hyleus</i> spp.	6.09	9.80	3.69	6.53	00	00	00	00
7	<i>Icterantheidium saltatore</i>	13.73	15.01	10.19	12.98	00	00	00	00
8	<i>Icterantheidium sinapinum</i>	13.64	14.76	9.56	12.65	00	00	00	00
9	<i>Nomia curvipes</i>	2.91	3.20	1.76	2.62	00	00	00	00
10	<i>Nomia elliotii</i>	4.75	5.60	2.67	4.34	00	00	00	00
11	<i>Pseudoheriades nevatus</i>	3.15	4.96	2.11	3.41	00	00	00	00
12	<i>Trigona iridipennis</i>	18.5	22.4	15.65	18.85	4.83	15.00	6.24	8.69
13	<i>Xylocopa auripennis</i>	9.67	11.63	7.28	9.53	00	00	00	00
14	<i>Xylocopa nasalis</i>	10.13	12.40	8.17	10.23	2.77	7.41	4.92	5.03
15	<i>Xylocopa amethystine</i>	7.86	10.16	4.15	7.39	3.72	9.84	5.38	6.31
16	<i>Xylocopa fenestrata</i>	8.29	10.81	5.37	8.16	2.94	9.48	5.05	5.82
17	<i>Xylocopa basalis</i>	9.19	11.33	6.44	8.99	0.70	5.28	2.76	2.91
18	<i>Xylocopa aestuans</i>	00	00	00	00	1.05	6.20	3.14	3.46
19	<i>Xylocopa pubescens</i>	00	00	00	00	3.29	8.63	5.26	5.73
20	<i>Musca domestica</i>	7.23	9.17	5.07	7.16	2.13	5.46	4.33	3.97
21	<i>Ropalidia marginata</i>	2.66	3.84	1.51	2.67	0.54	2.29	1.87	1.57
22	<i>Chrysosoma</i> spp.	1.84	2.36	0.15	1.44	00	00	00	00
23	<i>Campsomeriella annulata</i>	00	00	00	00	5.35	11.44	9.72	8.84
24	<i>Campsomeriella collaris</i>	00	00	00	00	10.82	14.79	12.12	12.58
25	<i>Camponotus</i> spp.	7.60	8.29	5.27	7.12	4.19	6.81	5.45	5.48
26	<i>Lygaeus</i> spp.	00	00	00	00	3.56	4.80	4.10	4.15
27	<i>Lucilia sericata</i>	00	00	00	00	0.43	2.36	1.75	1.51

Table 3: ANOVA testing of the abundance of insect pollinators on *Calotropis procera*

ANOVA (Abundance of insect pollinators in summer season) at $\alpha = 0.05$							
Source of variation	SS	Df	MS	F	P-value	F-crit	Conclusion
Between the group	2790.206	26	107.3156	27.3097	1.43E-22	1.701636	H ₀ rejected P < α F crit < F
Within the group	212.1973	54	3.929579				
Total	3002.403	80					
ANOVA (Abundance of insect pollinators in winter season) at $\alpha = 0.05$							
Source of variation	SS	Df	MS	F	P-value	F-crit	Conclusion
Between the group	1560.598	26	60.02301	11.54345	5.15E-14	1.701636	H ₀ rejected P < α F crit < F
Within the group	280.7863	54	5.199747				
Total	1841.385	80					

Table 4: t-test of paired two samples for means

	Summer season	Winter season
Mean	6.311111	4.415556
Variance	35.78157	20.01026
Observations	27	27
Pearson correlation	0.205169	
Hypothesized difference of mean	2.35	
df	26	
t-stat	-0.35275	
P (T≤t) for one -tail	0.36356	
t- critical for one- tail	1.705618	

P (T≤t) for two-tail	0.72712
t-critical for two-tail	2.055529

Table 5: Diversity index of insect pollinators on *Calotropis procera* index in summer

Sr. No.	Insect species	Abundance (n)	Pi	Pi ²	ln pi	Pi ln pi
1	<i>Amegilla fallax</i>	12.14	0.07124413	0.00507573	-2.64164283	-0.18820155
2	<i>Apis dorsata</i>	16.25	0.09536385	0.00909426	-2.35005571	-0.22411036
3	<i>Apis florea</i>	17.94	0.10528169	0.01108423	-2.25111576	-0.23700127
4	<i>Hyleus spp.</i>	6.53	0.0383216	0.00146854	-3.26174167	-0.12499515
5	<i>Icteranthidium saltatore</i>	12.98	0.07617371	0.00580243	-2.5747389	-0.19612741
6	<i>Icteranthidium sinapinum</i>	12.65	0.07423709	0.00551115	-2.6004914	-0.19305291
7	<i>Nomia curvipes</i>	2.62	0.01537559	0.00023641	-4.1749743	-0.06419268
8	<i>Nomia elliotii</i>	4.34	0.02546948	0.00064869	-3.67027427	-0.09347999
9	<i>Pseudoheriades nevatus</i>	3.41	0.02001174	0.00040047	-3.91143632	-0.07827464
10	<i>Trigona iridipennis</i>	18.85	0.11062207	0.01223724	-2.2016357	-0.24354949
11	<i>Xylocopa auripennis</i>	9.53	0.05592723	0.00312786	-2.8837039	-0.16127757
12	<i>Xylocopa nasalis</i>	10.23	0.06003521	0.00360423	-2.81282403	-0.16886849
13	<i>Xylocopa amethystine</i>	7.39	0.04336854	0.00188083	-3.13802088	-0.1360914
14	<i>Xylocopa fenestrata</i>	8.16	0.04788732	0.0022932	-3.03890445	-0.145525
15	<i>Xylocopa basalis</i>	8.99	0.05275822	0.00278343	-2.94203577	-0.15521656
16	<i>Musca domestica</i>	7.16	0.04201878	0.00176558	-3.16963863	-0.13318435
17	<i>Ropalidia marginata</i>	2.67	0.01566901	0.00024552	-4.15607014	-0.06512152
18	<i>Chrysosoma spp.</i>	1.44	0.0084507	7.1414E-05	-4.7735055	-0.04033948
19	<i>Camponotus spp.</i>	7.12	0.04178404	0.00174591	-3.17524089	-0.13267438
		S(number of species) = 19		N= (total number of individuals)=170.4		
		Sum of Pi ² = 0.06907712		Sum of Pi ln Pi = - 2.7812842		
		H= Shannon biodiversity index		D (Simpson index)=0.06907712		
		H=- (- 2.7812842)= 2.7812842		1/D= 14.4766		
		Margalef's richness index = S-1/in N		Simpson index of diversity (1-D) = 0.9309		
		Margalef's index= 3.50320				

Table 6: Diversity index of insect pollinators on *Calotropis procera* in winter season

Sr. No.	Insect species	Abundance (n)	Pi	Pi ²	ln pi	Pi ln pi
1	<i>Amegilla zonata</i>	7.89	0.06618017	0.00437982	-2.71537439	-0.17970394
2	<i>Amegilla cingulata</i>	6.78	0.05686965	0.00323416	-2.86699342	-0.16304492
3	<i>Apis dorsata</i>	13.8	0.11575239	0.01339862	-2.15630193	-0.2495971
4	<i>Apis florea</i>	14.7	0.12330146	0.01520325	-2.09312303	-0.25808512
5	<i>Trigona iridipennis</i>	8.69	0.07289045	0.00531302	-2.61879759	-0.19088535
6	<i>Xylocopa nasalis</i>	5.03	0.04219091	0.00178007	-3.16555054	-0.13355745
7	<i>Xylocopa amethystina</i>	6.31	0.05292736	0.00280131	-2.93883485	-0.15554477
8	<i>Xylocopa fenestrata</i>	5.82	0.04881731	0.00238313	-3.01967026	-0.14741219
9	<i>Xylocopa basalis</i>	2.91	0.02440866	0.00059578	-3.71281744	-0.09062488
10	<i>Xylocopa aestuans</i>	3.46	0.02902198	0.00084228	-3.53970194	-0.10272915
11	<i>Xylocopa pubescens</i>	5.73	0.04806241	0.00230999	-3.035255	-0.14588166
12	<i>Musca domestica</i>	3.97	0.03329978	0.00110888	-3.40220443	-0.11329267
13	<i>Ropalidia marginata</i>	1.57	0.01316893	0.00017342	-4.32989491	-0.05702009
14	<i>Campsomeriella annulata</i>	8.84	0.07414863	0.00549802	-2.60168365	-0.19291129
15	<i>Campsomeriella collaris</i>	12.58	0.10551921	0.0111343	-2.24886227	-0.23729817
16	<i>Camponotus spp.</i>	5.48	0.04596544	0.00211282	-3.07986542	-0.14156738
17	<i>Lygaeus spp.</i>	4.15	0.0348096	0.00121171	-3.35786219	-0.11688583
18	<i>Lucilia sericata</i>	1.51	0.01266566	0.00016042	-4.36886087	-0.05533451
		S(number of species) = 18		N= (total number of individuals)=119.22		
		Sum of Pi ² = 0.07364099		Sum of Pi ln Pi = -2.73137645		
		H= Shannon biodiversity index		D (Simpson index)=0.07364099		
		H=- (- 2.73137645)= 2.73137645		1/D= 13.5794		
		Margalef's richness index = S-1/in N		Simpson index of diversity (1-D) = 0.9263		
		Margalef's index= 3.5558				

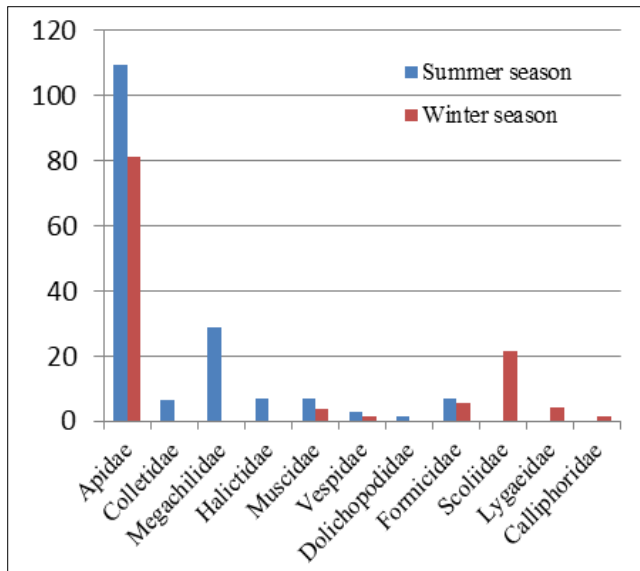


Fig 1: Average abundance of families of Insect pollinators on *Calotropis procera* in different seasons

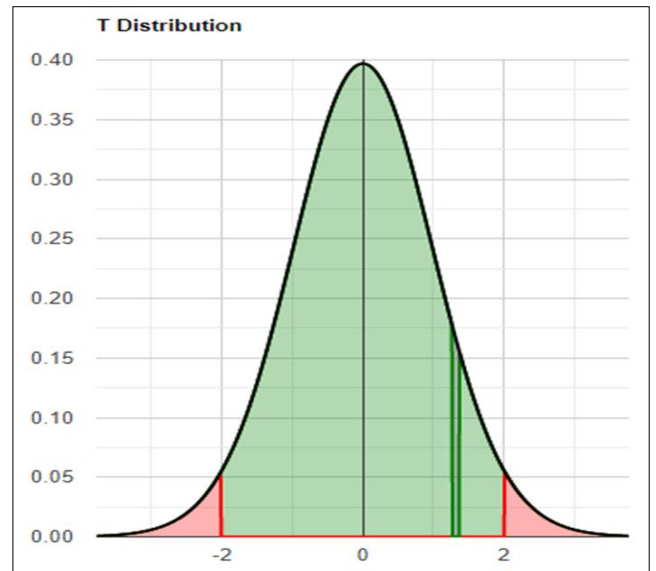


Fig 2: t- Distribution of abundance of insect species in summer and winter season

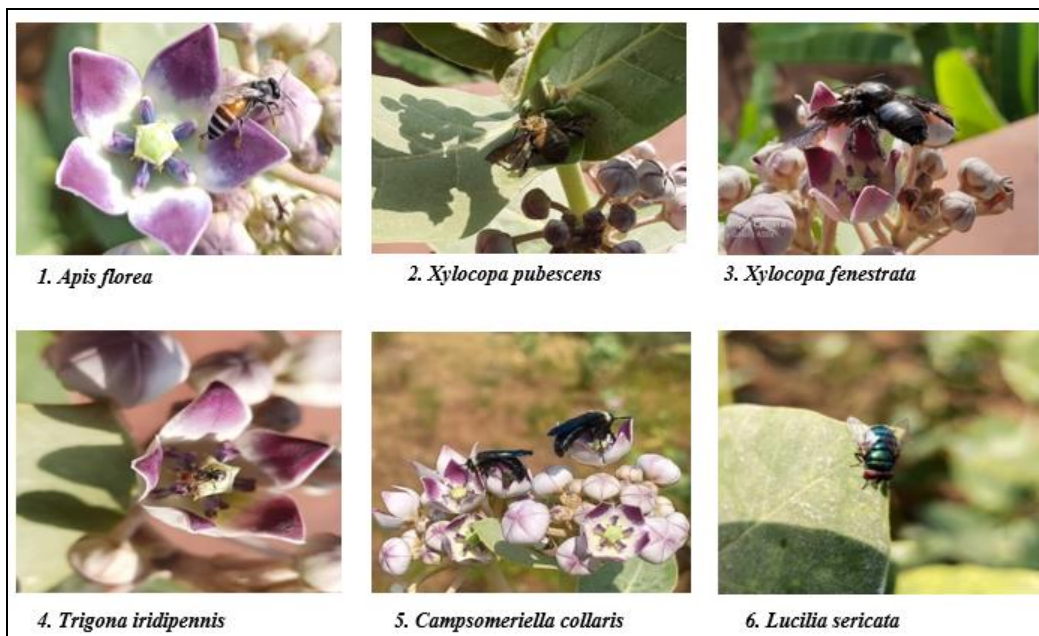


Fig 3: Insect pollinators on *Calotropis procera* in Thar desert, Rajasthan

4. Discussion

It was noticed that *Calotropis procera* was visited by 27 insect pollinators of 03 orders and 14 tribes in the study area, indicating much abundance of insect visitors in the desert of Thar where extreme hotness (up to $\geq 48\text{ }^{\circ}\text{C}$) was recorded in the months of summer and coldness (up to $\leq 4\text{ }^{\circ}\text{C}$) in the winter season. Plant-flower relationship of *Calotropis procera* and insects has been observed necessary for the co-existence of both the flora and fauna in the Thar Desert. Insects fulfil their requirement of nectar and water from the resin of the plant while insects help in pollination service in extreme conditions of the desert. Bees from the Apidae family were found most abundant on the flowers which were also reported in an investigation on *Calotropis procera* [18]. It was observed, *Campsomeriella collaris* as the most abundant Vespidae in the study area. It was also reported much abundant in the previous study in the Rajasthan [8]. Peak foraging activity of insect pollinators was recorded between 10 a.m. and 2 p.m., showing that

temperature rise by sunshine positively affected abundance. The significant difference in abundance of insect pollinators has been recorded in different time intervals of the day of inspection which was authenticated by the statistical analysis ($P < 0.05$). The abundance of insect visitors in the morning of summer and winter was compared, revealing less abundance of insects in the morning of winter as compared to the morning of summer because of high humidity and low temperature in the morning of winter. The value of the Simpson index of diversity 0.9309 indicating that there is more than 93% chance of different insect pollinators when randomly captured in the summer season. The value of Shannon index (H-summer 2.7812 & H-winter 2.7313) also showing significant diversity of insect in both seasons. It was noticed that abundance of insect pollinators in the summer and winter season are not showing significant difference as per t-test analysis but the difference in the insect composition has been observed.

5. Conclusion

It may be concluded that *Calotropis procera* would become a landmark for the protection of 27 species of Insect pollinators recorded from the Great desert of Thar in Rajasthan. During periods of scarcity i.e. when other nectar resources were rare or lacking, then pollinators exclusively depended upon the flower resources of *Calotropis procera*. Therefore, the plant becomes a very useful resource for rich Insect pollinator biodiversity in the desert of Thar, during hours of constraints. Thar Desert has the ample diversity of insect pollinators making it a specific ecosystem. Seasonal variation was observed that affecting the composition of pollinators. Thar Desert showed a great plant-flower relationship in such a diverse climatic condition.

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