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NECTAR PROPERTIES AND FLOWERING PHENOLOGY OF *IXORA COCCINEA L.*: AN ECOLOGICAL STUDY OF FLORAL DYNAMICS"

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Abstract- The present study investigates the nectar properties with phenology and dynamics of *Ixora coccinea* in its natural habitat. *Ixora coccinea*'s ornamental appeal and ecological significance as a consistent source of nectar and pollen for visiting pollinators over a lengthy period of time are highlighted by its protracted flowering period, which lasts more than seven months. Fluctuation in volume and concentration of nectar were marked. The species strategy of attracting both early and late daytime pollinators is highlighted by its extended nectar supply. Systematic field observations were carried out to record key phenological events, including onset, peak, and termination of flowering, along with anthesis, anther dehiscence, and nectar secretion timing. Nectar volume, concentration, and total sugar amount were quantified using standard microcapillary and refractometric methods.

Key Words- Nectar, volume, concentration, phenology etc

Introduction-

Throughout India, Ixora coccinea Linn. (Rubiaceae), also referred to as red ixora and jungle of geranium, is an evergreen plant. Plants provide a variety of incentives to entice pollinators. However, for many pollinators, floral nectar serves as the principal plant reward, making it a potential primary selection target (Percival, 1961). The biotic pollination agents are rewarded with floral nectar and pollen (Reddy, T. B. and et al 1992). The most typical floral reward given to mutualistic partners by animal-pollinated plants is nectar. (Simpson, B. B. 1983). The majority of the solutes in floral nectar are sugars, primarily sucrose, fructose, and glucose, in different amounts depending on the species. (Baker and Baker, 1983). Throughout a flower's life, nectar is released in specific rhythms that enable the dynamics of nectar production to be ascertained for a species. Understanding the dynamics of nectar production is essential to comprehending the relationship between plants and animals.

In this paper flowering phenology, dynamics, volume of nectar, concentration of nectar and amount of nectar were analysed.

Material and method-

Study area and material- The present study was carried out in Akot, dist. Akola from Maharashtra. Akola district has a predominantly tropical climate with rainy and dry seasons. *Ixora coccinea L.*, an ornamental plant which belongs to Rubiaceae was selected for the nectar analysis.

Phenology and dynamics-

Observations were made at regular intervals throughout the flowering season. During peak flowering, plants were monitored daily or every alternate day, while in less dynamic phases observations were made weekly. Onset of flowering , peak of flowering and end of flowering were observed for phenology and anthesis, anther dehiscence, nectar secretion time and nectar secretion span were recorded.

Volume and concentration with sugar amount- Every two hours, from 07.00 to 17. 00 hours, the volume of nectar for every species was measured and recorded. In accordance with Dafni et al., the concentration of nectar sugar was determined using a handheld sugar refractometer (Erma, Japan). **(Dafni, A. 1992).** The total sugar amount was calculated using following formula- Total sugar amount = Volume of Nectar / Concentration of Nectar × 100

Observation and Results-

Flowering Phenology and dynamics-

Flowering phenology of *Ixora coccinea* displayed a distinct seasonal pattern. The species floral activity began on April 10th, when the beginnings of flowering was observed. During the peak period, which ran from June 1 to September 27 (Table No.2), a profusion and continuous flowering phase was seen. During this time, the plant produced large clusters of vivid red flowers and made a substantial contribution to the habitat's floral show. After the peak season, the flowering intensity gradually decreased, and on November 22, the end of flowering was seen.

In *Ixora coccinea L.*, the anthesis began early, between 5:00 and 6:00 am, and the floral portions immediately opened fully. Recorded between 6:00 and 7:00 am was another dehiscence. Between 7:00 and 8:30 am, nectar secretion was noticed, and from 8:00 am to 19:00 pm (Table No.3), the nectar secretion span was observed.

Nectar Volume

In Ixora coccinea, nectar volumes varied from 1.2 µl to 1.02 µl in one year and 1.46 µl to 1.48 µl in the next year at intervals of two hours, namely 08.00, 10.00, 12.00, 14.00, and 16.00 hrs. The average for the first year was 1.624 µl with a standard deviation of 0.199 ±, while the average for the second year was 1.504 µl (Table No.1) with a standard deviation of 0.055 ±.

Nectar Concentration

Ixora coccinea nectar concentrations were measured at 2 hour intervals (e.g., 08.00, 10.00, 12.00, 14.00, and 16.00 hrs) in first and second year, and ranged from 29.4 µl to 38.2 µl and 31.2 µl to 33.2 µl, respectively (Graph A). The average for the first year was 34.28 µl with a standard deviation of 3.879 ±, while the average for the second year was 30.56 µl with a higher standard deviation of 1.888. (Table No.1)

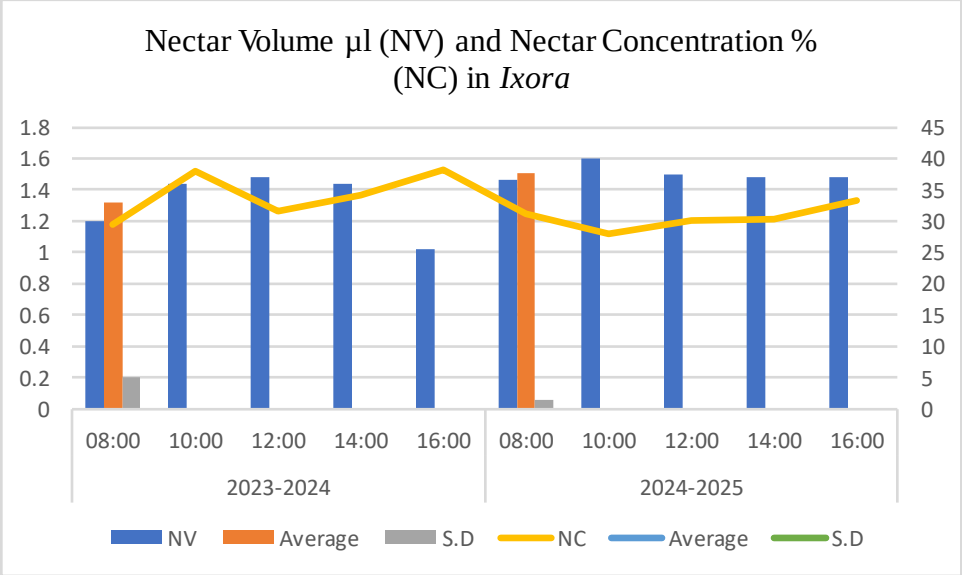
Sugar amount-

Ixora coccinea nectar has a moderately high sugar content. The average sugar level during first year was 44.996 mg, with a range of 35.28 mg to 54.72 mg. The sugar level was marginally higher for the second year, averaging 45.896 mg and ranged from 44.8 mg to 49.136 mg. (Table No.1)

Observation Table-

Year	Time (hrs.)	NV	Average	SD	NC	Average	SD	Amount of Sugar (mg)	Average
Year 1st	08:00	1.2	1.316	0.199198	29.4	34.28	3.879691	35.28	44.996
	10:00	1.44			38			54.72	
	12:00	1.48			31.6			46.768	
	14:00	1.44			34.2			49.248	
	16:00	1.02			38.2			38.964	
Year 2nd	08:00	1.46	1.504	0.055498	31.2	30.56	1.888915	45.552	45.896
	10:00	1.6			28			44.8	
	12:00	1.5			30			45	
	14:00	1.48			30.4			44.992	
	16:00	1.48			33.2			49.136	

Table No. 1: Average nectar volume (µl), nectar concentration (%) and amount of sugar (mg) in *Ixora coccinea L.*



Graph A: Nectar volume and concentration of two years with an average of *Ixora Coccinea L.*

Sr. No.	Name of Plant	Study area	Onset of flowering	Peak of flowering	End of flowering
1	*Ixora coccinea L.*	Ujjwal Nagar, Akot	10th April	1st June to 27th September	22th November

Table No. 2: Flowering phenology of *Ixora coccinea L.*

Sr. No.	Name of Plant	Anthesis	Anther dehiscence	Nectar secretion time	Nectar secretion span
1	*Ixora coccinea L.*	05.00-06.00	06.00-07.00	07.00-08.30	08.00-19.00hrs

Table No. 3: Flowering dynamics of *Ixora coccinea L.*

Discussion-

In *Ixora coccinea*, nectar production is closely synchronized with the flowering rhythm, ensuring that rewards are available during peak pollinator activity. The tubular corolla and clustered inflorescences secrete nectar predominantly during the morning hours, coinciding with anthesis. Nectar secretion initiates shortly after flower opening and continues for several hours, gradually declining by the late afternoon. The pattern of secretion indicates a steady but limited nectar supply per flower, which is typical for species adapted to frequent visitation by small insects.

Analyzing nectar can reveal the taxonomic affinities of the species in consideration as well as how well they have adapted to the pollinators who visit their taxa (Galetto, 2004). It is possible to measure nectar secretion in terms of volume, milligrams of sugar, or both. Using only volume data, several writers have examined the impact of nectar removal and discovered that plants alter their secretion in response to their movements (Zimmerman and Pyke, 1986).

The nectar volume in *Ixora coccinea* remains relatively low per flower, but the abundance of flowers within an inflorescence results in a substantial cumulative reward. Volume is steady while concentration indicates induced variability. The concentration of nectar is generally in the medium to high range, which provides an optimal balance between energy content and accessibility. Such concentrations are effective in attracting both short-tongued and long-tongued insects, particularly bees and butterflies, which are frequent visitors of *Ixora*.

Ixora coccinea's clustered inflorescences increase the cumulative nectar reward and produce resource patches that sustain a variety of pollinator assemblages. Therefore, in addition to being essential for its own reproductive ecology, *Ixora coccinea* nectar also has a wider ecological impact by influencing pollinator behavior, promoting biodiversity, and strengthening the bonds between tropical plant–pollinator networks.

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