



## Bird pollination in Pagoda Lilly, *Clerodendron Paniculatum*

### KEYWORDS

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**ABSTRACT** The family Lamiaceae is well known for floral peculiarities and pollination syndromes. Here we are describing about another floral syndromes of Lamiaceae. The *Clerodendron Paniculatum* is commonly known as pagoda lilly. The plant is well known for its beautiful flower and it is also used for many medicative purposes. Detailed studies were carried out on the flowering phenology and pollination studies. The flowering phenology observed as June- October. The sunbird *Nectarinia zeylonica* one of the regular visitor of the plant and flower produce nectar for visitors. The long narrow tubed corolla highly suited for narrow beaked sunbird. The correlation between beak length (17-18mm) and corolla tube (18-19mm) is pointed out here. The potential pollinator was identified as sunbird *N. zeylonica*. The interesting feature of our study is that, absence of bee visitation. In the breeding analysis shows that plant is a fully cross pollinated species. The self pollination (Autogamy) was carried out around 20 flowers and self pollination resulted in 0% fruit set. Open pollination in natural conditions resulted in 73% fruit set. Flower bud bagged by removing stamens and stigma resulted no fruit set (Apomixis). Manual pollinations using pollen from other flowers of the same plant resulted in 60% fruit set. Manual cross pollinations using pollen from flowers of different plant resulted in 65% fruit set.

### Introduction

Inflorescence architecture contributes an additional dimension to the diversity within the bird pollination syndrome. This set of traits – the bird pollination syndrome – has arisen independently in multiple plant lineages (Faegri and Van der Pijl, 1979). The adaptations of organisms, in particular those of plants and their animal pollinators, are well known. Some of the clearest examples are displayed by flowers adapted to specialist nectar feeding birds. These are typically robust, reddish in colour, have large volumes of dilute nectar and lack scent (Van der Pijl, 1961). Birds insert the entire bill into tubular type flowers and the pollen is most often deposited on the head feathers (Goldblatt and Manning, 2006). Plants adapted for pollination by each of these functional groups of birds have floral tubes of appropriate length (Snow and Snow, 1972; Kress, 1985; Westerkamp, 1990).

The plant is being used in therapeutics, specifically in Indian, Chinese, Thai, Korean, Japanese systems of medicine for the treatment of various life threatening diseases such as HIV, syphilis, typhoid, cancer, jaundice and hypertension. The powder/paste form and the various extracts of root, stem and leaves are reported to be used as medicine for the treatment of asthma, pyreticosis, cataract, malaria, and diseases of blood, skin and lung (Praveen. M., et.al, 2012).

### Materials and Methods

Flower phenology and Flowering phenology were observed. Each flower and foraging mode carefully studied. Flower length measured and bird beak length of *Nectarinia zeylonica* already reported by Salim Ali & Dilson Ripley (1974). Laboratory tests were done according to Shivanna & Rangasamy (1992). Pollen viability studied by using tetrazolium test. The stigma receptivity test is done by preparing agar plate and flower is fixed in to it. The pollen grains from another flower carefully transfer to already fixed stigma and observe the pollen growth under microscope. Breeding experiments were carried out for understanding the mode of pollination.

### Results

The flowering of *C. paniculatum* observed as June-October. The flower is very attractive red –orange colour. The inflorescence type panicle closely packed. The flower is long narrow tubed corolla and four anthers present at the long filament.

The stigma is byfid.

The Anthesis time of the flower is 10-10.30am. The anther dehiscence mode is through longitudinal slits The flower contains four anthers. The pollen grains spherical and size  $54.41 \pm 7.99$ . The pollen grains were viable at 11.00-16.30hrs and stigma receptive between 14.30-18.30 hrs.

**Table. 1 Pollen Viability**

Sl. No	Time	<i>C.paniculatom</i>
1	10.00	40.00 ± 5.38
2	11.00	68.19 ± 7.20
3	12.00	78.32 ± 9.50
4	13.00	82.59 ± 11.35
5	14.00	71.45 ± 9.32
6	15.00	62.16 ± 6.78
7	16.00	57.42 ± 3.31
8	17.00	35.02 ± 7.49
9	18.00	12.59 ± 12.66

**Table. 2. Flower morphology**

Flowering period	June-October
Inflorescence	Panicle
Flower type	Regular, Bisexual
Corolla	Narrow tubed
Corolla tube length	18-19mm
Colour	Orange-red
Nectar	Present
Anthesis time	10-10.30
Anther dehiscence	Longitudinal slits
Number of anthers per flower	4
Stigma type	Byfid stigma
Fruit	Drupe

### Pollen Viability

Pollen viability was tested by using tetrazolium solution. The maximum pollen viability observed around 13.00hrs (82% of

pollen viable at 13.00hrs (Plate 1).

Pollen is presented upon elongate filaments, and after a few days these curl downward and the style elongates and becomes receptive. While autogamy is avoided in this manner, geitonogamy can occur. maner, geitonogamy can occur.

#### Floral syndrome

In the flowering peak Sunbird *Nectarinia zeylonica* visits flower frequently. The long narrow bill helps to feed nectar from flower. The corolla mouth permitted only those visitors having long proboscis or narrow bill. The closely packed inflorescence favours the sunbird to cover many flowers in a single visit (Plate 1).

#### Breeding analysis

In the open pollination in natural conditions resulted in 73% fruit set. Apomixis, Flower bud bagged by removing stamens and stigma resulted no fruit set. Autogamy was carried out around 20 flowers. Self pollination resulted in 0% fruit set. Manual pollinations using pollen from other flowers of the same plant resulted in 60% fruit set. Manual cross pollinations using pollen from flowers of different plant resulted in 65% fruit set.

Table.4. Breeding system analysis.

Sl. No.	Breeding system analysis	No. of flowers pollinated	No. of flowers fruit set	Percentage of fruit set
1	Open pollination	40	29	73
2	Apomixis	20	0	0
3	Autogamy	20	0	0
4	Geitonogamy	40	24	60
5	Xenogamy	40	26	65

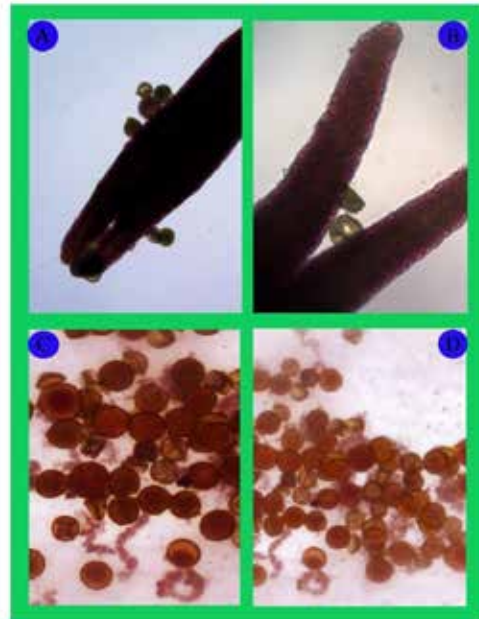


Plate 2. A&B Receptive stigma showing pollen tube growth. C&D Test on pollen viability.

#### Discussion

##### Why bees do not visit *Clerodendron paniculatum*?

The floral architecture has been modified to permit the long narrow proboscis insects or birds with narrow beak. My observation gives the idea that main visitors of *C. paniculatum* is Sun birds *Nectarinia zeylonica* has the beak length of 17-18mm according to Salim Ali & Dilson Ripley (1974). Other visitors were recorded as butterflies of Papilionidae, the butterflies having long proboscis.

##### Energy saving strategy of sun bird *Nectarinia zeylonica*

One of the factors affecting whether or not an animal can be dependable flower visitor is the relationship between the energy demands and the quantity of food it can be harvest from the flowers. Other than thermoregulation, the highest energy costs are those of locomotion. Flight, particularly hovering, is a most expensive mode of locomotion. For insects and birds, the energetic coast of flight has been shown to vary markedly with load and flight speed, but relatively independent on ambient temperature. In sun birds nectar extracting strategy varies with increasing corolla length, which decreases the nectar extraction (Heinrich. B,1975).

The flowers are arranged very closely in an inflorescence, might favour the flower visitor. The flower visitor can forage many flowers at a unit time. The inflorescence were arranged as highly suitable for animal that visits *C. paniculatum*, the inflorescences producing average number of flowers ranging from 180- 200. So sun birds can forage many flowers at unit time. The arrangement of flowers in an inflorescence like flowers packed very closely, it helps the bird visitor to reduce their flight and minimize the energy loss. Our study reveals that *C. paniculatum* is a cross pollinated species and vector playing crucial role in pickup and delivery of pollen. The sun bird *N. zeylonica* was identified as potential pollinator because of long narrow bill is allowing to nsert in to the long corolla tube.



Plate 2. A,B,C&D, *Nectarinia zeylonica* foraging on *C. paniculatum*.

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