

## STUDIES ON FLORAL BIOLOGY OF *IXORA AGASTHYAMALAYANA* SIVADASAN & MOHANAN - A RARE SOUTHERN WESTERN GHATS ENDEMIC

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### Abstract

*Ixora agasthyamalayana* is a rare and endemic taxon of southern Western Ghats of Kerala. It flowers throughout the year under the climatic conditions of Agasthyamala and the peak during January. The floral biology of this plant was studied. Anthesis occurred between 0600 and 1300hr with its peak at 0700hr. Anther dehiscence was observed between 0700 and 1300hr with a peak at 1000hr. The maximum receptivity of stigma was found on the day of anthesis. Pollen grains were round, light pink in colour and 32.24µm in diameter.

### Keywords

Anthesis, floral biology, *Ixora agasthyamalayana*, pollen grains, stigma receptivity, Western Ghats

### Introduction

*Ixora agasthyamalayana*, a rare and endemic plant belonging to the family Rubiaceae is found in Agasthyamala Hills of southern Western Ghats. It is a shrub, growing in deep evergreen forests and is so far known only from the type locality. Flowering and fruiting are observed almost throughout the year (Sivadasan & Mohanan, 1991). Flowers are pink, sessile or shortly pedicelled in pedunculate corymbs; stamens four, alternating with corolla lobes at throat; style slender, 1.5cm long; ovary 2-celled, ovule one in each, placentation axile. In order to understand the narrow distribution and breeding behaviour of the species, a study on floral biology was undertaken. The knowledge of floral biology is a prerequisite in estimating the overall reproductive potentiality of a species which in turn, controls adaptive changes in the organisms (Simmonds, 1962).

### Materials and Methods

The study was carried out on *Ixora agasthyamalayana* from Agasthyamala Hill ranges between November 2000 and February 2002. Ten healthy plants were selected in the community and observations were made on day-to-day basis on flowering

season, flowering habit, flower development and anthesis. Peak flowering time was noted when maximum number of flowers opened. Fifty flower buds were selected and observation was made between 0500 to 1800hr to study the time of anthesis and anther dehiscence. Pollen ovule ratio was worked out as per the method suggested by Cruden (1977). Pollen fertility was assessed by using 2% acetocarmine and glycerine (1:1) staining technique. To study pollen germination *in vitro*, pollen grains collected from fresh flowers were incubated for eight hours in a drop of Brewbaker's medium containing 1% sucrose. Pollen grains which had produced pollen tubes longer than the diameter of the pollen grains were counted as viable. Stigma receptivity was studied visually with the help of a hand lens and by hand pollination method. For the study of pollen germination on stigma (*in vivo*), the flowers were labelled at the time of anthesis. The pistils were collected from the labelled flowers at different time intervals after anthesis. These pistils were boiled with lactic acid, stained with 10% cotton blue for 10 minutes, mounted on clean slides and examined microscopically.

### Results and Discussion

#### Flowering habit

Under the climatic conditions of Agasthyamala, *Ixora agasthyamalayana* starts flowering in the month of November, continuing throughout the year, and reaches a peak during January. The flower buds take 4-5 days from initiation to full bloom.

#### Time of anthesis and anther dehiscence

Anthesis commenced between 0600 and 1300hr. About 84% of anthesis occurred between 0700 and 1000hr and maximum of 36% was recorded during the first hour of anthesis. There was no anthesis recorded between 1400 and 1700hr. Anther dehiscence was observed after one hour of opening of flowers and maximum of 34% was noticed after four hours. The anther dehiscence longitudinally and expose pollen grains (Table 1). The present observations concur with the study of Sarma *et al.*, (1997) in *Ocimum canum*, where anthesis commenced at 0800hr, reached its peak at 1100hr and declined by 1300hr. The

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**Table 1. Details of anthesis and anther dehiscence in *Ixora agasthyamalayana***

Time (Hrs)	No. of Fls. opened	% of Fls. opened	No. of Fls. with anther dehisced	% of Fls. with anther dehisced
0500-0600	0	0	0	0
0600-0700	8	16	0	0
0700-0800	18	36	5	10
0800-0900	10	20	7	14
0900-1000	6	12	10	20
1000-1100	3	6	17	34
1100-1200	3	6	9	18
1200-1300	2	4	2	4
1300-1400	0	0	0	0
1400-1500	0	0	0	0
1500-1600	0	0	0	0
1600-1700	0	0	0	0
1700-1800	0	0	0	0

dehiscence of anthers also took place between 0700 and 1300hr with a peak at 1000hr.

#### Pollen-ovule ratio

The floral analysis indicates that each flower has four anthers and two ovules. A single anther contained 1200 pollen grains and thus a flower had around 4800 pollen. Hence P-O ratio was worked out as 2400 pollens per ovule (2400:1) which again confirms the pollination by zoophily (Cruden, 1977).

#### Pollen germination

Pollen grains are round and 32.24µm in diameter. The acetocarmine staining technique reveals that 88% of pollen grains are fertile. The maximum *in vitro* pollen germination of 72% was recorded in Brewbaker's medium containing 1% sucrose and attained an average tube length of 340µm.

**Table 2. In vivo pollen germination before and after anthesis in *Ixora agasthyamalayana***

Time	% of pollen germination	Pollen tube length (µm)
6 hrs. before anthesis	0	0
At the time of anthesis	38	180
6 hrs. after anthesis	58	310
12 hrs. after anthesis	52	280
18 hrs. after anthesis	46	260
24 hrs. after anthesis	38	222
30 hrs. after anthesis	32	160
36 hrs. after anthesis	28	146
42 hrs. after anthesis	14	110
48 hrs. after anthesis	8	60

**Table 3. Stigma receptivity and fruit set in *Ixora agasthyamalayana***

Period	No. of flowers pollinated	No. of fruit set	% of fruit set
One day prior to anthesis	50	0	0
On the day of anthesis	50	15	30
One day after anthesis	50	5	10
Two days after anthesis	50	0	0

#### Stigma receptivity

The stigmas remained receptive at the time of flower opening and hence it is protogynous in nature. To confirm the receptivity of stigma, hand pollinated flowers were observed periodically for seed setting. The visual observations indicated that the stigma was wet and shiny on the day of anthesis, retained its status for 48 hours, after which it turned black. This observation was further supported by *in vivo* pollen germination tests. The results indicated that the maximum stigma receptivity was recorded on the day of anthesis and it had lasted for 48 hours giving different percentage of pollen germination on stigma (Table 2). Highest percentage of pollen germination (58%) was recorded after six hours of anthesis which resulted in 30% fruit set. On the contrary, the percentage of pollen germination declined considerably when pollinated after 24 hours of anthesis which resulted in 10% fruit setting and thereafter no fruit set was observed (Table 3). The study agrees the observation of Baruah and Saha (1999) on *Bacopa monnieri*, where maximum stigma receptivity was observed on the day of anthesis with 26% fruit set, followed by the next day with 4% and thereafter no fruit setting was observed.

Receptivity of the stigma is a critical factor for the successful completion of post pollination events. It is usually maximal soon after anthesis and also it varies from species to species depending upon temperature and humidity (Shivanna & Johri, 1989). The present investigation has shown that the stigma was maximally receptive on the day of anthesis which had resulted in moderate fruit setting in natural conditions.

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