

Reproductive biology of *Clerodendrum splendens* (Verbenaceae)

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Abstract

Clerodendrum splendens (Verbenaceae) is an ornamental climbing shrub. Flowering occur during the period between December – April. Flowers are red, small complete pedicellate, pentamerous, zygomorphic, hermaphrodite and hypogynous. Anthesis occur between 06:00 – 06:30hrs followed by anther dehiscence at 07:00 – 09:00hrs. Stigma become receptive at 11:00 – 14:00hrs. There are 2160 ± 380 pollens/flower. There are 4 ovules/flower and pollen – ovule ratio is 540 : 1. Nearly 2% flower show open pollination. There is no fruitset in bagged inflorescence indicating cross pollinating nature. Fruit and seedset percentage is very low. *Xylocopa Eumenes* sp. and *Componotus campertris* (Black ant) are most effective visitors.

Keywords: Geitonogamy, Xenogamy, Anthesis.

INTRODUCTION

Reproduction is the only life processes which ensure the perpetuation of life. For successful cultivation and conservation of plants a detailed knowledge of their reproductive biology is required [8]. *Clerodendrum Splendens*, commonly known as flaming glory bower, bleeding heart vine is an ornamental climbing shrub. It belongs to the family verbenaceae which is spread over 100 genera and 2000 spp. and in India there are about 170 spp. Within this family [11]. It is cultivated in the gardener for its ornamental as well as medicinal value despite its usefulness; less attention has been paid to its floral biology, breeding system and pollination mechanism.

Therefore it is essential for the conservation, improvement and establishment of cultivation to increase the frequency of occurrence of this species. Reproductive biology in relation to conservation, flower attractants and rewards, plant-pollination interaction. Gene flow through pollen & seeds, pollination efficiency is of utmost importance. Reproductive biology of angiosperms has its focus on phenology, pollination biology, pollen-pistil interaction and breeding systems. These are valuable for basic and applied research, having implications to ecological and evolutionary studies as well as agriculture and conservation biology.

Angiosperm tree species tend to be out-crossing and have a lower reproductive efficiency therefore, study of reproductive biology is particularly important in these cases.

Keeping these facts in view, a detailed study of the phenology, floral and pollination biology and also breeding system in *C. Splendens* plants growing in different parts of Agra city has been made.

MATERIALS AND METHODS

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Ten plants each growing at ten different localities of Agra city were marked and observations were recorded. Observation were made on different phenoevents. Floral morphology, floral biology, number of pollen grains/flower and number of ovules/ovary were studied by various methods given by Kearns [6]. Pollen size measured with an ocular micrometer under light microscope following the procedure of McKone and Webb [7]. Pollen viability was checked by *in vitro* pollen germination by hanging drop culture method using Brewbaker and Kwack's [3] medium, FCR (fluorochromatic reaction) test after Heslop-Harrison and Heslop-Harrison [5] and 1% TTC [4].

The mode of pollination was evaluated by bagging the emasculating mature buds and then pollinating them artificially. Different pollinators, their population, types and visitation rates were recorded.

The floral buds were also bagged to understand the mode of pollination. Flowering phenology was studied periodically by counting flowers on marked plants throughout the flowering period.

The morphology of different floral parts was studied by scanning electron microscopy (SEM). For SEM studies, fresh anthers and pistils were fixed in 3% gluteraldehyde. These were dehydrated through aqueous acetone series, dried with CO_2 in a HCP-2. Hitachi critical point dryer. The samples were coating with gold (20nm) in a SCD 020 sputter coating Unit (Poloson Equipment Ltd., Waferd, England) and observed in a Philips EM 50, SEM at all India Institute of Medical science, New Delhi.

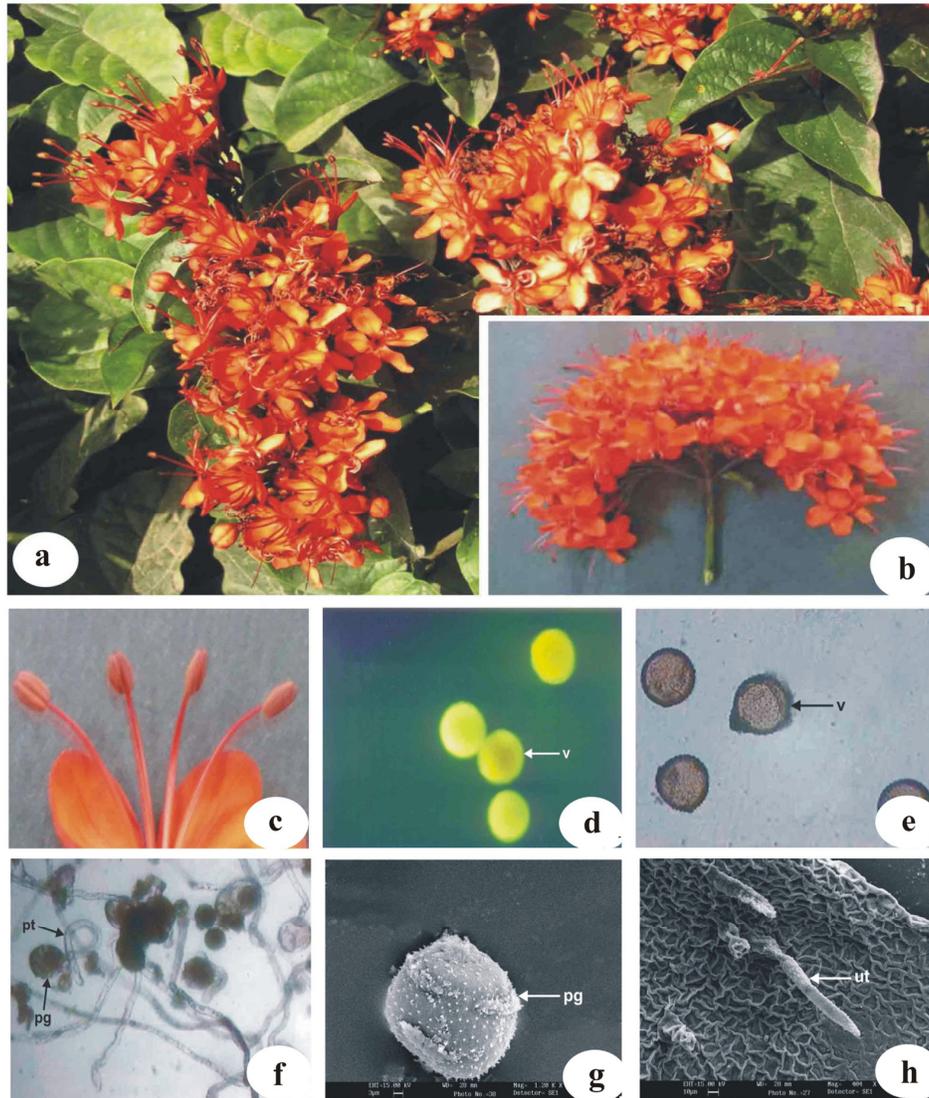
RESULTS AND DISCUSSION

Clerodendrum splendens is an ornamental climbing shrub. The flowering starts in the month of December – April with maximum floral density in February.

The Flowers (average size 3.04 ± 0.42 cm) are red, arranged in a corymbose spike (Fig. a, b). They are small, complete, pedicellate, pentamerous, zygomorphic, hermaphrodite, hypogynous. There are four stamens (2.50 ± 0.12 cm) epipetalous, polyandrous and red in colour (Fig. c). The anthers (0.12 ± 0.06 cm) are dorsifixed, introse and dehisce through longitudinal slits. Pollen grains are spheroidal, echinulate with reticulate exine pattern (Fig. g)

and $15.9 - 55.3 \pm 0.53 \mu\text{m}$ in diameter. Pistil is differentiated into stigma style and ovary, with a bifid, capitate and wet type of stigma. Unicellular non capitate trichomes are seen on the corolla (Fig. h).

Similar observations were observed by Sharma *et al.* (2009) in *Duranta repens*.



(a) *Clerodendrum splendens* plant and inflorescence
 (b) Corymbose spike inflorescence
 (c) Flowers showing epipetalous stamen
 (d) Pollen viability as tested by FCR test
 (e) Viable pollen grains as tested by TTC test
 (f) Pollen fertility as tested by Brewbaker/Kwack's medium
 (G) SEM micrograph showing pollen (Bar = $3 \mu\text{m}$)
 (h) SEM micrograph showing unicellular, non capitate, trichome (ut) trichome on corolla surface (Bar - $10 \mu\text{m}$)

The flowers are protandrous in nature. They open between 06:00–06:30hrs followed by anther dehiscence taking place between 07:30 – 09:00hrs. The stigma becomes receptive between 11:00–14:00hrs. Similar observations have also been observed by Sharma *et al.* [10] in *Cassia tora*, and Bansal & Chauhan [1,2].

The stigma receptivity was remarkably noticed by hyaline secretion on stigmatic surface. The average number of pollen grain/flower is 2160 ± 380 . Pollen-ovule ratio is 540:1.

Pollen viability by FCR test is 86% (Fig. d), 1% TTC test shows 62% viability (Fig. e). Brewbaker and Kwack's medium comes out to be only 58% with $763.65 \pm 34 \mu\text{m}$ long pollen tubes (Fig. f). In

different sucrose concentration 10% and 20% showed 45% ($222 \pm 30 \mu\text{m}$ tube length) and 56% ($621 \pm 37 \mu\text{m}$) respectively. Fruiting starts in March and it ripe & falls till the end of June. It has a drupe type of fruit. Nearly 2% flowers produce fruits by open pollination. The No. of fruits is one or rarely 1 – 2, The seed/fruit is one or rarely 2.

There is No. fruit-set in bagged flowers indicating its cross-pollinated nature. However in controlled pollination there is 3% fruit formation by geitonogamy and 7% by xenogamy. The flowers of *C. splendens* are intensively visited by different insect group since the first hour of morning until the afternoon. So, visitors with long

tongues could collect nectar at the corolla base more easily, and pollen as well, compared to short-tongue insect. The insects visiting the flowers are *Xylocopa Eumenes* sp, *Componotous compestris* (Black ant).

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