

Pollination biology of *Rhynchosstylis retusa* (L.) Blume – An epiphytic ornamental orchid

Pratibha Magotra, Shivali Verma and Namrata Sharma*

Department of Botany, University of Jammu, Jammu 180 006, India

(Received 4 February, 2023; Accepted 22 March, 2023)

ABSTRACT

Pollination in Orchidaceae is known to have co evolved with its pollinators and many orchids in the absence of their pollinators fail to set fruits, leading to the decline in number in the wild. In the present investigation, pollination biology of *Rhynchosstylis retusa* (L.) Blume was studied. Flowers of *R. retusa* as expected are entomophilous. These are visited by several insects including bees, butterflies and beetles, however, only *Xylocopa* sp. was found to be the potential pollinator of the species. Fruit set on manual pollination was quite higher than on open pollination. However, no fruit set was observed in bagged flowers. The species is thus self-compatible but, requires its specific pollinator for successful reproduction.

Key words : *Rhynchosstylis retusa*, *Xylocopa*, Reproductive output, Manual pollinations

Introduction

Family orchidaceae, known for the beauty of its constituent members is one of the largest families of flowering plants consisting of 20,000 to 25,000 species (Yu and Goh, 2001; Dressler,2005 and Cribb *et al.*,2003). Members of the family inhabit all continents except Antarctica, however, their greatest diversity is found in tropical and sub tropical regions (Pridgeon *et al.*,1999 and Jalal,2012). Orchids differ from other plants by the complex structure of their flowers and their species specific pollination mechanisms. Here we represent pollination biology of *Rhynchosstylis retusa* (L.) Blume – an epiphytic orchid inhabiting various trees like *Mangifera indica* L., *Ficus religiosa* L., *Ficus benghalensis* L., *Morus nigra* L. etc (Adhikari *et al.*,2012). Plants of *R. retusa* are commonly known as Fox tail orchids owing to the shape of their inflorescences which resemble the shape of tail of fox.

Materials and Methods

For the present study, plants of the species inhabiting old and lichenated branches of mango trees in Kathua district of Jammu and Kashmir UT were tagged (Fig.1a,b).

Observations on plant and floral morphology were carried out in the field. Plants were studied for their morphological aspects like number of leaves, leaf length, number of inflorescences per plant, number of flowers per inflorescence and length of inflorescence. Floral morphological details like number and dimensions of sepals, petals, lip and spur were studied under Nikon SMZ800 stereomicroscope.

In their wild habitat, plants were observed at regular intervals for various phenological events like time of anthesis and sigma receptivity. During this period of full bloom, these were regularly monitored for types of visitors, frequency of the visits and behaviour of insect visitors on the flowers.

Percentage fruit set was recorded on open pollination, manual self pollination and on bagging by using the formula :

$$\% \text{age fruit set} = \frac{\text{Fruit count/inflorescence}}{\text{Flower count of the same inflorescence}} \times 100$$

Results and Discussion

Plant and Floral Morphology

Plants of *R. retusa* are epiphytic, consisting of short monopodial stem, 6-15 long and fleshy leaves. The plants produce 1-6 racemes of average length 56.7 cm consisting of 40-75 pink and violet colored densely arranged flowers (Fig. 1c). Floral structure of *R. retusa* bears semblance with that of the typical complex structure of orchids. Flowers averaging 0.8-3 cm are bilaterally symmetrical consisting of three sepals and three petals, all alike in color and shape except one modified petal called as lip/labellum,

which is larger in size and differs in shape. Beneath the lip is located, a spur containing nectar. The reproductive structure called column bears fused male and female counterparts i.e. pollinarium and gynostemium respectively (Fig 1e).

The pollinarium is apically positioned on the column and consists of three parts i.e.

- i) A pair of pollinia
- ii) A stipe
- iii) Sticky viscidium

The sub apically positioned gynostemium consists of

- i) Stigmatic cavity
- ii) An elongated ovary

The pollinaria are covered by anther cap positioned above the rostellum i.e. the roof separating the male and female reproductive structures.

Pollination Biology and Mechanism

Plants were monitored regularly for the period start-



Fig. 1. (a) Plants of *R. retusa* growing on the branches of Mango tree (b) Lichens associated with the roots of *R. retusa* (c) Inflorescences (d) Sequence of growth from bud to flower (e) Mature flower

Table 1. Table showing the morphometric details of the plants of *Rhynchostylis retusa*

S. No.	Character	Average	Range
1	No. of leaves	10.5±0.287	6-15
2	Length of leaf (cm)	18.58±0.50	12.2-26.8
3	Number of inflorescence per plant	5±0.081	1-6
4	Number of flowers per inflorescence	53±0.93	40-65
5	Number of sepals per flower	3	-
6	Length of sepal (cm)	0.54±.004	0.5-0.6
7	Number of petals per flower	2+1 (lip)	-
8	Length of petal (cm)	0.615±0.005	0.5-0.7
9	Length of lip/labellum (cm)	1.145±0.004	1.1-1.2

ing from the initiation of buds till the commencement of fruit formation. Buds protuberance initiates during early april. Early during the may, the buds start differentiating into flowers. Anthesis in the flowers starts with the opening of sepals first followed by two petals and it terminates with the opening of lip. This happens in a span of 8-10 hrs. No particular timing of anthesis was found in the flowers i.e. the flowers open at any time of the day Flowers in an inflorescence take 10-12 days to open up. Sticky viscous secretions are excreted in the stigmatic cavity when the stigma becomes receptive.

Early in the morning, the flowers effuse a mild sweet odour to attract the foragers. Large number of insects were observed visiting the inflorescences. These include ants, butterflies, bees, *Xylocopa* sp. and few unidentified insects (Figs. 2a&b). During our observations, only *Xylocopa* sp. was found to be the potential pollinator of *R. retusa* (Fig. 2c). Other insects fail to bring about successful pollination due to their small size due to which they do not come in contact with the pollinarium at all.

Xylocopa sp., soon after reaching the inflorescence, starts searching for the nectar which is secreted in the spur at the base of the column. The pollinator inserts its proboscis into the spur to suck out the nectar and in turn either aids in removing the anther cap or adhering the sticky viscidium on

its forehead (Fig. 2d). The pollinator when repeats the same process in another flower is now able to insert the pollinia into the receptive stigmatic cavity, thus bringing about successful pollination. Flowers of orchids apart from their beauty and ornamentations are known for their long shelf life. Similar is the case in *R. retusa*. Flowers of *R. retusa* exhibit longevity until pollinated. The unpollinated flowers remain fresh whereas, after pollination, floral senescence initiates. The lip starts retracting backwards covering the stigma. The stigmatic cavity closes its receptive surface and sepals and petals start shedding. By the end of July, flowering phase is over and fruit set is initiated.

Reproductive Output

On open pollination, 22.6% fruit set was recorded. On bagging the inflorescences, however, no fruit set was recorded. To check the self-incompatibility status of the species, manual self pollination was done and it augmented the fruit set to 50.16%, indicating that *Rhynchosstylis retusa* is self compatible orchid. However, it requires intervention of a pollinator for successful fruit set.

Orchids are well known for their unique floral specializations and different pollination strategies. Reward and deception to their pollinators is a well studied phenomenon in these plants (Schiestl, 2005). Many orchids have adapted precise instrumentations in their floral structure to avoid self pollination and enhance cross pollination, still about 400 species of orchids belonging to most tribes have been found to practice autonomous self pollination (Peter, 2009). However, there are few orchid species which despite being self compatible need external interference to affect the pollination eg, *Liparis kumokiri*, an orchid that blooms in rainy season, shows rain triggered self pollination (Suetsugu, 2019). *R. retusa* is also a member of this group. It is specialized for pollination by *Xylocopa* sp. in the area of study. Proper conservation/propagation of the species requires the presence of its pollinator.

Acknowledgements

Sincere thanks are due to CSIR and NMHS for financial assistance. There is no conflict of interest.

References

Adhikari, Y.P., Fischer, H.S. and Fischer, A. 2012. Host tree



Fig. 2. (a,b) Different insects visiting the Flowers of *R. retusa* (c) *Xylocopa* sp. inserting its proboscis into the spur (d) Pollinaria attached to the forehead of *Xylocopa* sp.

- utilization by epiphytic orchids in different land-use intensities in Kathmandu Valley, Nepal. *Plant Ecol.* 213: 1393–1412.
- Cribb, P.J., Kell, S.P., Dixon, K.W. and Barrett, R.L. 2003. Orchid conservation: a global perspective. Natural History Publications, *Kota Kinabalu*. 1–24.
- Dressler, R.L. 2005. How many orchid species? *Selbyana* 26 155-158.
- Jalal J.S. 2012. Distribution pattern of orchids in Uttarakhand, Western Himalayas, India. *Int. J. Plant Sci.* 3 e5.
- Peter, C. I. 2009. Pollinators, floral deception and evolutionary processes in *Eulophia* (Orchidaceae) and its allies. Dissertation, University of KwaZulu-Natal, Kwa Zulu-Natal, South Africa.
- Pridgeon, A.M., Cribb, P., Chase, M.W. and Rasmissen, F.N. 1999. *Genera orchidacearum*. Oxford University Press, New York vol 1.
- Schiestl, F.P. 2005. On the success of a swindle: pollination by deception in orchids. *Naturwissenschaften.* 92: 255–264.
- Suetsugu, K. 2019. Rain-triggered self-pollination in *Liparis kumokiri*, an orchid that blooms during the rainy season. *Ecology.* 100(7): e02683.
- Yu, H. and Goh, C.J. 2001. Molecular Genetics of Reproductive Biology in Orchids. *Plant Physiol.* vol 127.
-
-