

**REPRODUCTIVE PHENOLOGY OF *HOPEA PARVIFLORA* BEDD.
RELATION TO CLIMATIC FACTORS IN WESTERN GHATS OF
KODAGU, KARNATAKA**

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Abstract: The Western Ghats are the treasure house of plants and animals next only to Himalayan tracts in terms of its diversity of unique species. Plant phenological study has great significance in providing knowledge about plant growth patterns and selective pressure of the environment on flowering and fruiting behaviour. *Hopea parviflora* is the RET species of Western Ghats taken for its reproductive phenological events during 202-2022. The flowering in *Hopea parviflora* started from the last week of January and continued till March and Peak flowering was observed during last week of February. The fruit initiation started from February to April. The mature fruit fall was observed from the end of May till July. Flowering and fruiting of *Hopea parviflora* is influenced by temperature and rainfall of the study area.

Keywords: Western Ghats, Phenology, *Hopea parviflora*, RET species, Temperature, Rain fall.

Introduction

The Western Ghats are the treasure house of plants and animals next only to Himalayan tracts in terms of its diversity of unique species. It is generally described as the art of observing the phase of the life cycle through the year. Phenological observations in a tree species indicates the reproductive behaviour of trees and strengthen the knowledge of the Silvics of the tree species (Arunkumar *et al.*, 2020). *Hopea parviflora* Bedd. belongs to the family Dipterocarpaceae, the trade name is Hopea and the common names are Irubangan, Thambagam, Kamagam and indigenous to the evergreen forests of the Western Ghats from North Canara to Kerala. It is a large, elegant, evergreen tree reaching a height of 30-40 m with a clean cylindrical bole of 20 m and girth of 4-5 m. Bark light brown, mottled with white, smooth in young trees, changes to rusty brown and rough as the tree grows old. Most of the Dipterocarps are only known from limited localities and their high degree of habitat specificity makes them rare. Fragmentation of habitat, land cover change and overexploitation are the major driving factors responsible for the severe decline in their

natural population. To devise strategies for the effective conservation of *Hopea*, information on its distribution, phenology, and ecology is very much essential. The present study was undertaken to investigate the reproductive phenology and its variation in relation to environmental factors.

Material and methods

The study was carried out in the Makutta territorial range of Virajpet division in Kodagu district, Karnataka which lies between latitudes 12° 3' 16" N and longitudes 75° 42' 56.88" E. Based on the species distribution of *Hopea parviflora*, plots of size 20×20 m were laid. Ten plots were laid and trees were marked using tags for reproductive phenological observations. Ten matured trees of *Hopea parviflora* were selected and tagged for the study of reproductive phenological events. The tree crown area of the marked trees was divided into four parts and the observations of various reproductive phenological events were done in the lower branches of the marked trees on all four sides. The observations on different phenophases of the marked trees were taken once in a 15 days interval using a field scope and binoculars. The phenophases like I. Flowering phenology; a) Flower initiation b) Flowering duration c) Peak flowering initiation, d) Peak flowering duration and II. Fruiting phenology; a) Fruit initiation b) Fruiting duration c) Mature fruit fall were recorded. To understand the phenological variation in relation to environmental factors, the data related to rainfall, temperature and relative humidity of the study area during the study period (December 2021 to December 2022) were obtained from the NASA website (<http://power.larc.nasa.gov/data-access...>).

Based on the intensity of flowering and fruiting, the scoring was given on ocular estimation with the following criteria as given by Broadhead *et al.*, (2003) as 0: absent, 1: <30%, 2: 30-60% and 3: 60-100% The correlation between phenological events and rainfall, temperature and relative humidity of the study periods was analysed with Spearman's rank correlation coefficient (r_s) (Nadarajan and Pujari, 2018).

Results

Ten matured trees were marked for reproductive phenological observation in the study area. Out of ten marked trees, trees 1, 2, 3, 5, 8, 9 and 10 show reproductive phenological events and trees 4, 6 and 7 don't show any reproductive phenological events. The flowering in *Hopea parviflora* started from the last week of January and continued till March. Peak flowering was observed during last week of February. The fruit initiation started from February to April. The mature fruit fall was observed from the end of May till July.

Phenological variations in relation to environmental factors

The Spearman's rank correlation coefficients between the flowering phenology of *Hopea parviflora* and weather parameters are given in Table 1. The flowering of *Hopea parviflora* showed a highly significant positive correlation with the maximum temperature ($r_s = 0.533$ at $p < 0.01$) and precipitation ($r_s = 0.699$ at $p < 0.01$). It also exhibits a highly significant negative correlation with the minimum temperature ($r_s = 0.594$ at $p < 0.01$) and relative humidity ($r_s = 0.587$ at $p < 0.01$).

The fruiting of *Hopea parviflora* exhibits a highly significant positive correlation with maximum temperature ($r_s = 0.695$ at $p < 0.01$) and it shows a significant negative correlation with relative humidity and precipitation (Table 2).

Table 1: Spearman's rank correlation (r_s) for the flowering of *Hopea parviflora* and different weather parameters

Parameters	Flowering
Maximum temperature (°C)	0.533**
Minimum temperature (°C)	-0.594**
Relative humidity (%)	-0.587**
Rain fall (mm)	0.699**

*Correlation is significant at the 0.05 level (2 tailed)

** Correlation is significant at the 0.01 level (2 tailed)

Table 2: Spearman's rank correlation (r_s) for the fruiting of *Hopea parviflora* and different weather parameters

Parameters	Fruiting
Maximum temperature(°C)	0.695**
Minimum temperature(°C)	-0.100
Relative humidity(%)	-0.699**
Rain fall(mm)	-0.508*

*Correlation is significant at the 0.05 level (2 tailed)

** Correlation is significant at the 0.01 level (2 tailed)

Discussion

The reproductive phenology of a tree species is paramount in detecting the flower bud initiation, flowering, fruiting and maturation of fruits. In the present study, flower initiation of *Hopea parviflora* was noticed in the last week of January and continued till the last week of March. However, as per the earlier literature, the flower initiation was recorded from the start of January and extended up to March. The shift of flower initiation may be attributed to changes in environmental factors. These observations are in line with studies by Kamarudeen *et al.* (2017) where flower initiation was noticed in January. However, the peak flowering recorded in the last week of February in the present research is also on par with earlier studies. Fruit initiation in *Hopea parviflora* was noticed in the last week of February. However, earlier studies indicated there were more days taken for fruit initiation due to colder temperatures, higher moisture retention and even distribution of rainfall. These results are similar to the studies by Kamarudeen *et al.* (2017).

The Spearman's rank correlation coefficients between the flowering phenology of *Hopea parviflora* and weather parameters. The flowering of *Hopea parviflora* showed a highly significant positive correlation with the maximum temperature ($r_s = 0.533$ at $p < 0.01$) and precipitation ($r_s = 0.699$ at $p < 0.01$). It also exhibits a highly significant negative correlation with the minimum temperature ($r_s = 0.594$ at $p < 0.01$) and relative humidity ($r_s = 0.587$ at $p < 0.01$).

The fruiting of *Hopea parviflora* exhibits a highly significant positive correlation with maximum temperature ($r_s = 0.695$ at $p < 0.01$) and it shows a significant negative correlation with relative humidity and precipitation. These results are in line with Nadarajan and Pujari (2018) opined that the correlation experiments showed that flowering of *Syzygium caryophyllatum* was significantly and positively correlated with temperature ($r_s = 0.500$ for 2012–2013; $r_s = 0.788$ for 2013–2014; $r_s = 0.792$ for 2014–2015). However, there was no significant correlation between flowering and precipitation. Fruiting was positively correlated with precipitation ($r_s = 0.706$ for 2012–2013; $r_s = 0.663$ for 2013–2014; $r_s = 0.887$ for 2014–2015). These results are also similar to the work of Ramasubbu and Kasi (2021) who opined that the Spearman's rank correlation coefficient for the flowering and fruiting of *Eleocarpus gaussonii* was positive and significantly correlated with the temperature and rainfall.

Conclusion

Hopea parviflora is currently endangered species of Western Ghats and indigenous to the Evergreen forests of the Western Ghats from North Canara to Kerala. Results conclude that

flowering in *Hopea parviflora* started from last week of January and continued till March. Peak flowering was observed during last week of February. The fruit initiation started from February to April. The mature fruit fall was observed at the end of May till July. The spearman rank correlation coefficient analysis was indicated that flowering of *Hopea parviflora* was positive and significantly correlated with maximum temperature and negatively correlated with minimum temperature. Relative humidity and precipitation were negatively correlated. The spearman rank correlation coefficient analysis was indicated that fruiting of *Hopea parviflora* was positive and significantly correlated with maximum temperature. Relative humidity and precipitation were negatively correlated.

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