

# Phenology of the Genus *Indigofera* L. (Fabaceae-Papilionoideae) of Holalkere and Hosadurga Taluks of Chitradurga District, Karnataka, India

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\***Rachitha C J**

*Department of Botany, Kuvempu University, Shivamogga, Karnataka, India*

**Krishnaswamy K**

*Department of Botany, Sahyadri Science College, Shivamogga, Karnataka, India*

\* *For correspondence (e-mail: rachithacj1992@gmail.com)*

## Abstract

*Importance of phenology has increased in view of global climate change. Reproductive phenology is responsible for success in seed production and thereby perpetuation of a species. Phenological studies were not given much importance, especially in the region of Holalkere and Hosadurga of Chitradurga district of Karnataka state. Hence, attempt was made to study the phenological aspects of the genus *Indigofera* L. of sub family papilionoideae in the study area. The phenophases viz., leafing, flowering and fruiting and leaf fall are observed for 10 recorded species of the genus *Indigofera*. The regular Phenological period of the majority of genus was studied, variation in the phenophases of some small herbs and undershrubs was noticed with respect to its ecology. This investigation gives phenological database of the economically important genus *Indigofera* of the study area. This database can be also utilized, besides this importance, in future, in planning and management of conservational measures in the region.*

**Keywords:** Phenology, *Indigofera*, Papilionoideae, Holalkere, Hosadurga

## Introduction

*Indigofera* in greek means indigo dye which is famous for the natural blue colours obtained from the leaflets and branches of this herb (Soladaye et al. 2010,).

The genus *Indigofera* L. With 750 species is the third largest genus in the sub family Papilionoideae (Nwankwo and Ayodele, 2017,). The species are native mainly to tropical and subtropical regions of the world. The genus is one of the nine genera which are members of the tribe galegae (Soladaye et al. 2010,).

The highest *Indigofera* diversity is found in Africa and Madagascar (550 species), Asia (150 species) and Australia ( 50 species) (Henta furashi et al.2020,). However, In India the genus *Indigofera* is represented by approximately 60 species and 10 varieties, of which 15 species and seven varieties are endemic (Vibha chauban et al.2013,).

Indigofera species are creeping prostrate or erect annual, biennial or perennial herb or semi woody undershrubs and trees or conspicuously branched with bright green or tinged with red colors. The leaves are mostly alternate openly spaced on the stems around 10 cm long and may be roughly or velvety smooth to the touch. The fruit is a pod usually smooth, reddish brown and cylindrical with 2-15 seeds in most species. The variation in the morphological features is significant taxonomic importance of the genus (Nwankwo and Ayodele 2017,)

Phenological parameters are to be focused on the rhythmic features of plant functioning, which are useful in the characterization of the evolutionary strategy of species (Maximina Monasterio and Guillermo Sarmiento 1976,).

Phenology is ultimately responsible for observing periodically recurring phenomena of plant growth and recording the time of their occurrence. Observations made in different areas or over several successive years are compared with each other. Phenology deals not only with mere observation; it also is tasked with determining regularities in the periodic growth sequence and with investigating the dependence of these processes on environmental conditions. Especially for plant phenology, the influence of soil and climate on the periodic appearance of plant life needs to be determined (Fritz Schnelle 1955,).

### Materials and Methods

Holalkere taluk lies in between 13° 51' to 14°15' N latitude and 76° 01' to 76° 28' E longitude covering an area of 1102 km sq with ground elevation of 661 m above MSL. The temperature ranges from 17°C to 19°C (Nov and Dec) and may raise 40°C - 43°C (April and May) average rainfall is recorded from 406-602 mm. Major crops such as jowar maize are grown during kharif season; while ragi and jowar were noticed in rabbi season, ground, vegetables and they were also known to grow some pulses with the help of irrigation in summer season, soil and climatic condition is same in all parts of taluks and is favourable for growing horticultural crops such as mango, banana, sapota, papaya were grown. The soils are observed to be maximum of black and red soils (M.C Munjunath et al. 2017,).

Hosadurga lies in between 13° 30' to 14° 02'N latitude and 76° 03' to 76° 32'E longitude with an aerial extent of 1435.48 sq km, Hosadurga taluk falls under the fringe of Western Ghats, experiencing highest rainfall as that of other taluks of Chitradurga district. The average annual rainfall is recorded as 666 mm during the year 2008, Agriculture in the taluk is rainfed and mainly dependent on timely and adequate rainfall. The vegetation is tropical and temperate with similar kinds of scrubby forest (Basavaraja H.T et al. 2017,)

The major types of forest in this study area are Southern Tropical Dry Deciduous and Southern Tropical Thorn Forests. Saldana has given the name 'Upland thorn and scrub vegetation' to the parts of Chitradurga forest. However, the forests of this division vary from dry mixed deciduous to thorny scrub types (Ganesh 2013,).

The study area is botanized phenologically in all seasons of a year covering forested areas, aquatic places, wastelands, cultivated fields and different plantations. The particulars of leafing, flowering and fruiting, apart from that leaf fall is also recorded carefully in month wise with respect to different phenophases. The plant specimens have been deciphered using state, regional and district floras. The obtained data is tabulated alphabetically with necessary phenophases. The recent nomenclature has been adapted. The results are analysed and commented critically based on field observation (Patil D.A. 2019,).

### Result and Discussion

The genus *Indigofera* L. avails many benefits to mankind, as name predicts, it is mainly used in the extraction of the blue color dye (*I.tinctoria*) (Sharmin jahan, 2013). Over 60 *Indigofera*

species are reported in traditional medicine (Elise gerometta et al. 2020,), like other legumes the roots of Indigofera shelters bacteria, that fix nitrogen in the soil, because of its beneficiary effects Indigofera was grown in rotation with other crops. It was therefore thought worthwhile to extend phenological studies, especially in this part of chitradurga district of Karnataka state. This investigation provides detailed report about leafing, flowering, and fruiting and leaf fall occurring throughout the year. This region harbours approximately 17% of Indigofera species found in india (60 species).

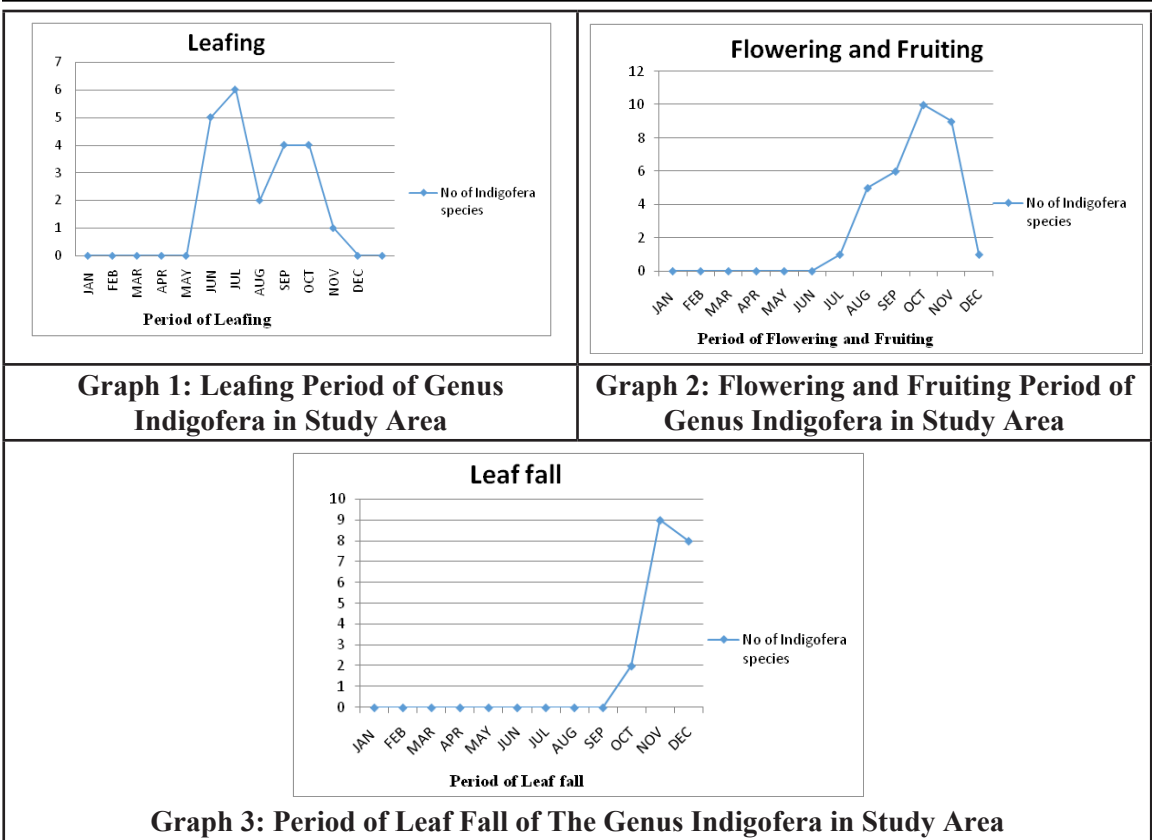
The study area revealed 10 species of the genus Indogofera among them two are undershrub (*I.oblongata*, *I.trita*) and the rest 8 species are herbs. None of the species are cultivated in the study area, but some species are cultivated in other regions (*I.tinctoria*) in over 2000 hectares in the states of Assam, Andhrapradesh, West bangl, Bhihar, Tamilnadu and pondichery.

The observation recorded in Table 1 indicates certain salient features about phenophases of the genus Indigofera in the Holalkere and Hosadurga thaluks of Chitradurga district of Karnataka state. Each species of Indigofera has subjected to study the different phenophases such as leafing flowering, fruiting and leaf fall. Thus phenology in both vegetative and reproduction. The peak period of leafing in the genus Indigofera is found to be in the month of June to July (4 species) followed by September to October (3 species), one species each in August to September and October to November.

**Table 1: Phenology of the Genus Indigofera of Holalkere and Hosadurga thaluks of Chitradurga district**

Sl. No	Plant name	Habit	Leafing	Flowering & fruiting	Leaf falling
1	<i>Indigofera astragalina</i> DC.	Herb	Jun-July	Aug-nov	Nov-dec
2	<i>Indigofera cordifolia</i> Roth	Herb	Aug-Sep	Oct-nov	Nov-dec
3	<i>Indigofera colutea</i> (Burm.f.) Merr.	Herb	Jun-July	Aug-nov	Oct-nov
4	<i>Indigofera glandulosa</i> Wendl.	Herb	Sep-oct	Oct -nov	Nov-dec
5	<i>Indigofera linifolia</i> (L.f.) Retz.	Herb	Sep-oct	Oct-nov	Nov-dec
6	<i>Indigofera linnaei</i> Ali	Herb	June-july	July-dec	Dec-Jan
7	<i>Indigofera oblongata</i> Forssk.	undershrub	June-aug	Aug-nov	Nov-dec
8	<i>Indigofera prostrata</i> Willd.	Herb	Oct-nov	Oct-nov	Nov-dec
9	<i>Indigofera tinctoria</i> Mill.	Herb	June-July	Aug-nov	Nov-dec
10	<i>Indigofera trita</i> L.f.	undershrub	Sep-oct	Sep-oct	Oct-nov

Reproductive phenophases is an important phase in the life cycle of a plant, since it directly concerned with the maintainance of species itself .flowering and fruiting phase is typically found in angiosperm. Both flowering and fruiting can be occurred hand in hand or it is compartmented. The genus Indigofera L. starts flowering in the month of July and extends upto December. As shown in the Graph 2, the peak period of flowering and fruiting can be seen in the month of August to November and October to November (4 species) followed by July to December and September to October (1 species), hence, most of the species of genus Indigofera flowers in the month of October, so, October month is suitable time to study the reproductive phenophases and other floral aspects of Indigofera species.



After the reproductive phase, the plants starts to reach senescent phase, it is marked by the initiation of leaf fall, in majority of Indigofera species leaf fall occurs from the month of November to December. In some plants leaf fall occurs in the month of October to November and December to January, represented in the graph 3. In brief the phenological activity from leafing to reproductive phenophase to leaf fall is consistent and uniform in majority of species. Some species have short duration of phenophases ex: *I.trita*, flowering and fruiting both can be seen hand in hand in the month of September and at the end of October it starts leaf fall, some species Ex: *I.linnaei* flowers early in the month of July and shows flowers upto December. As phenology is directly connected with ecology, environment and economy of the region it became necessary to maintain separate phenological database.

### Conclusion

Phenology of leafing, flowering, fruiting and leaf fall is concentrated in the study area. As the area is very dry, Indigofera species can be seen only after raining season, generally seeds starts germinating after raining, hence, leafing can be seen in the month of July, flowering and fruiting occurred in the month of august extends upto December. But the peak period of flowering and fruiting is October to November as all the 10 recorded plants are flowered and bears fruit. From the study we can clearly understand the phenological behaviour of the Genus Indigofera L. it helps for the further study and documentation of phenological behaviour of the indigofera species in the study area, it also helps to understand the environmental perturbations on phenology with respect to its environmental factors.

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