



Distribution, Population Status and Conservation of *Inga cynometroides* (Bedd.) Bedd.ex Baker; a Critically Endangered Tree Species from Kerala part of Western Ghats, India

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Abstract

The depletion of potential species particularly of RET's has been considered as one of the major causes for the present day biodiversity loss in tropical countries. This paper deals with the Distribution, Population status and Conservation of *Inga cynometroides*; a critically endangered tree species of Kerala Parts of Western Ghats. The population status of *I. cynometroides* was documented through extensive field survey and population studies carried out during 2011–2013. The population sites were geographically marked with global positioning system (GPS) and distribution map prepared using GIS Software. The investigation revealed that the population of *I. cynometroides* is extremely small and species have low dominance and poor ecological success in the study area. A declining population of the species *I. cynometroides* is located from, Kallar in Trivandrum forest division. It is the very first report from other than the type locality after the rediscovery of the species *I. cynometroides* from the type locality, Rosemala, Sendurney WLS of Kollam district, Kerala. As the numbers of mature trees are very limited with poor regeneration, all the populations of the species *I. cynometroides* in the whole study area should be preserved immediately.

Keywords: *Inga cynometroides*, Population status, Distribution, Global positioning system (GPS), Conservation.

Introduction

The United Nations Educational, Scientific and cultural organization (UNESCO) has recognized the Western Ghats as one of the Natural World Heritage sites based on its significant natural habitats¹. Although it covers a mere 5.00 per cent of the country's total land area in the country, it is believed to be more than 27.00 per cent of country's plant species remarkably high level of endemism ranging from 25 to 60 per cent of recorded species in various taxa². Sixty three per cent of Indian ever green tree species are believed to be endemic to that area. In addition to species richness, it is endemism of biodiversity of the regions. The high anthropogenic pressures and associated fragmentation of the landscapes has resulted in loss of habitat and species. An appreciable number of species are well conserved because of their high reproductive efficiency, adaptability to environment or being not affected by human interventions. On the other hand, a number of species does not have a healthy population size; being constrained by intrinsic reproductive barriers affected by natural calamities such as fire, habitat loss or even over- exploitations due to human interventions etc. This initiates various tasks for the conservation biologists to prioritize their activities on the Rare, Endangered and Threatened (RET) species. The internationally accepted designation of Western Ghats as a biodiversity hot spot is related to a substantial number of endangered species in this region³. Occupying the south-western zone of peninsular India, the geographic realm of the Kerala State is more or less

identical with southern Western Ghats. Supported by the mega relief of the Ghats, the monsoonal trade winds and the copious pluvial regime, out of 4465 taxa of flowering plants, it is home for about 4050 species of native plants⁴. Out of this, 497 species are recorded and belong to RET categories and deserves immediate conservation attention.

The species *Inga cynometroides* is a small tree of Mimosaceae family, Endemic to Kerala, growing in evergreen forests area⁵. Beddome collected the specimens in 1870 from Rosemala, Kollam District, Kerala. After the type collection it has not been collected and is placed under indeterminate threat category⁶. Then the species *I. cynometroides* was rediscovered from the type locality after 100 years⁵. Following the revised IUCN Red list categories this species is assigned to the critically endangered category⁷. This paper gives a new record of the species *I. cynometroides* from other than the type locality.

Material and Methods

Field survey and Population study: Intensive field investigations were carried out by research team in the study area, Kerala part of Western Ghats (figure-4) using the data collected from the literature and various herbaria^{5,8-11}. Habit, habitat, altitudinal range, population size, distribution range, and impacts of multiple threats have been studied for two years in the habitat. The populations of *I. cynometroides* was documented through extensive field survey and geographically

marked with global positioning system (GPS) and a distribution map prepared using Arc GIS software. Phenological observations were made on vegetative as well as reproductive events. For studying the phytosociology of the species, quadrates of 33m × 33m size (covering 0.1 ha area) were laid randomly in and around *I. cynometroides* population for recording. The vegetation is sampled according to a plot method in various strata. Each plant was identified in the field itself (either botanical name or local name). Quantitative analysis of vegetation for frequency, density and relative density and Importance value index were performed using NTFP inventory analysis. Diversity indices such as Simpson's index and Shannon's index [H'] were also computed using formulae. The phytosociological parameters worked out for each plot using the formulae given against each¹²⁻¹⁴. Importance Value Index (IVI) of various species was also worked out as the sum of Relative density, Relative frequency and Relative dominance of each of them¹⁵. The quadrat data were then processed for quantitative and qualitative analysis to evaluate structural composition and organization of the community. From the quadrat data obtained from the field work the following primary and secondary analysis were done. Density, Frequency, Abundance, IVI (Importance Value Index), and biodiversity indices were calculated by using formulae. Natural regeneration of *I. cynometroides* was observed and girth at breast height (gbh) was taken for all the stems of the species. To determine the girth class distribution of the species, the natural regenerates of *I. cynometroides* were grouped into three classes for further analysis. The stems <10 cm gbh were classified as saplings, between 10– 20 cm gbh were treated as sub adult and stems between 20-30 cm gbh were classified as mature trees. Population size of seedlings, saplings, trees, and sprout/coppice shoots were ascertained to understand the regeneration status.

Results and Discussion

Distribution: The species *I. cynometroides* is a small tree of Mimosaceae family, Endemic to Kerala, growing in evergreen forests area⁵ (figure-1, 2 and 3). Beddome collected the specimens in 1870 from Rosemala, Kollam District, Kerala. After the type collection it has not been collected and is placed under indeterminate threat category⁶. Then the species *I. cynometroides* was rediscovered from the type locality after 100 years⁵. Following the revised IUCN red list categories this species is assigned to the critically endangered category⁷. This paper gives a new record of the species *I. cynometroides* from other than the type locality. A declining population of the species *I. cynometroides* is located from, Kallar forest area of Trivandrum forest division Kerala. It is the very first report from other than the type locality after the rediscovery of the species *I. cynometroides* from the type locality, Rosemala, Kollam (Quilon) district, Kerala. Few years back, it was reported that the Population of *I. cynometroides* with up to 100 mature trees confined to an area of less than 1 sq. km⁵. But now the population is diminishing and only less than 50 mature individuals are located from the same area, Rosemala in an altitudinal range of 300 meter. The plants were confined to an area of 1 sq. km in the side of a stream facing great threats of destruction. During the present study, the species *I. cynometroides* is found growing at an elevation range of 250 meter along the wet slopes in evergreen forest of Kallar area of Trivandrum forest division, Kerala, is the first report of this species outside the type locality, and extending its distribution towards the eastern part of Western Ghats. The physical parameters are given in the table 1 and the distribution map is shown in the figure-4.

Table-1
Distribution of *I. cynometroides*: Physical parameters

Species	Location	Latitude	Longitude	Vegetation Type	Altitude
<i>Inga cynometroides</i>	Rosemala	08.911639	77.181417	Evergreen	300 m
	Kallar	08.717383	77.128050	Evergreen	150 m



Figure-1
Habit of *I. cynometroides*



Figure-2
Flower of *I. cynametroides*



Figure-3
***I. cynametroides*: twig with fruit**

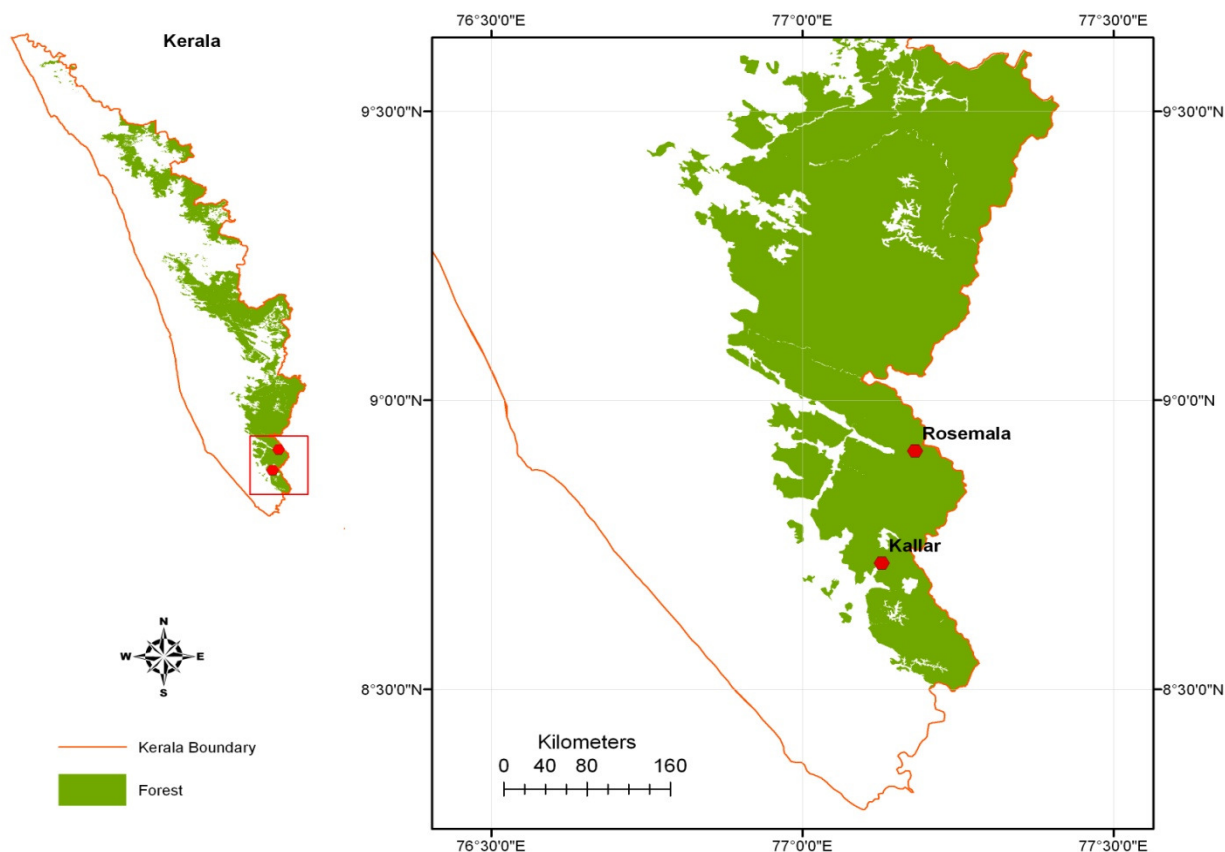


Figure-4
Map showing distribution of *I. cynometroides* in the study area

Population Details: Experimental plots were taken and population analysis has been carried out in a total area of 5445 Sq.mts in and around the natural habitats of *I. cynometroides*. During the study about 244 individuals belonging to 73 species under 32 families were recorded. Among the families, Euphorbiaceae is the largest one which constitutes 10 species, followed by Dipterocarpaceae (5 species), Lauraceae (5 species), Annonaceae (4 species) and Meliaceae (figure-5). IVI values are used to express dominance and ecological success of any species according to its density, frequency and dominance in relation to all other species. The calculated IVI of the species *Inga cynometroides* 0.13/hector indicates that the species have low dominance and poor ecological success in the study area. IVI values indicates that the most successive tree species in the study area are *Bischofia javanica*, *Terminalia bellirica*, *Vateria indica*, *Gluta travancorica* and *Knema attenuate*. Density is found maximum for *Vateria indica* (31.22) followed by *Ixora bractiata* (29.38), *Gluta travancorica* (25.71) and *Knema attenuata* (23.88) (figure- 6). Species diversity indices such as Simpson's Index (0.04) and Shannon's Index (2.98) were calculated which indicates the high diversity in the study area. *Bischofia javanica* was the dominant tree species in the study area, followed by *Terminalia bellirica*, *Vateria indica*, *Gluta travancorica* and *Knema attenuate*.

In the present study, A total number of 66 individual species of *I. cynometroides* were recorded from the whole study area, the Kerala part of Western Ghats of which 38 were mature individuals, 21 were sub adults and 7 were saplings (figure-7). The number of mature individuals was more than sub-adults whereas the number of saplings was very poor. Studies revealed that the flowering and fruiting were regular⁵. But the present study reveals that there is some irregularity is associated with the fruiting and flowering of *I. cynometroides*. Though the fruit seems to be sufficient, other extrinsic and intrinsic constraints to natural regeneration were identified. The major threats found in the natural habitats of *I. cynometroides* are expansion of agricultural activities in forest land and construction of roads and houses in and around forest areas. A rubber plantation is situated near its habitat and people are cutting the trees for various purposes. Such activities may be adversely affecting population of seedlings and saplings in Rosemala forest Area of Shendurney wild life sanctuary, the type locality of the species whereas in Kallar of Trivandrum forest division the plants are growing in roadside near an ecotourism view point, suffering public intrusion.

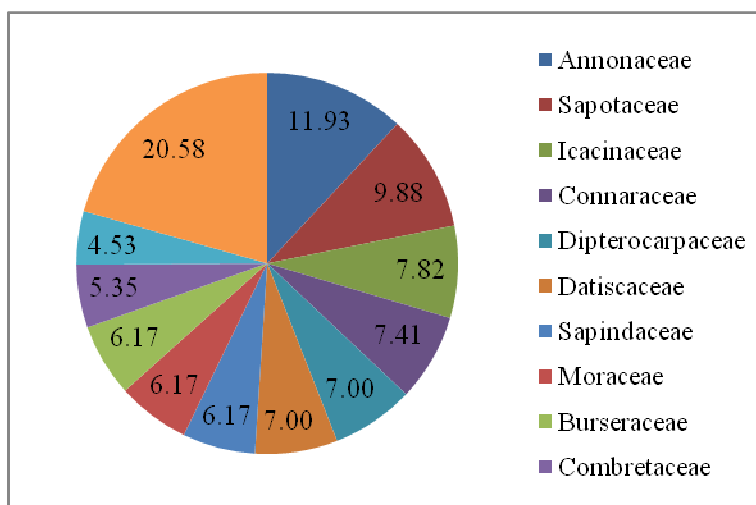


Figure-5

Percentage of individuals from each family in the in the natural habitats of *I. cynometroides*

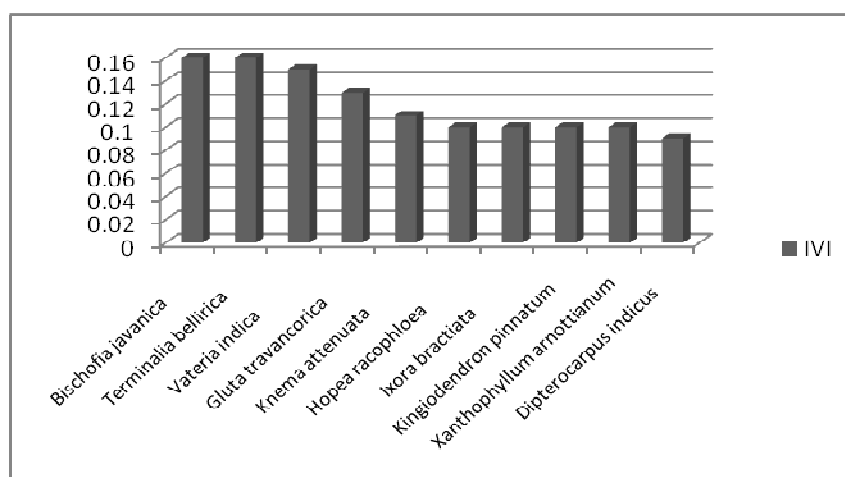


Figure-6

Dominant species in the natural habitats of *I. cynometroides*

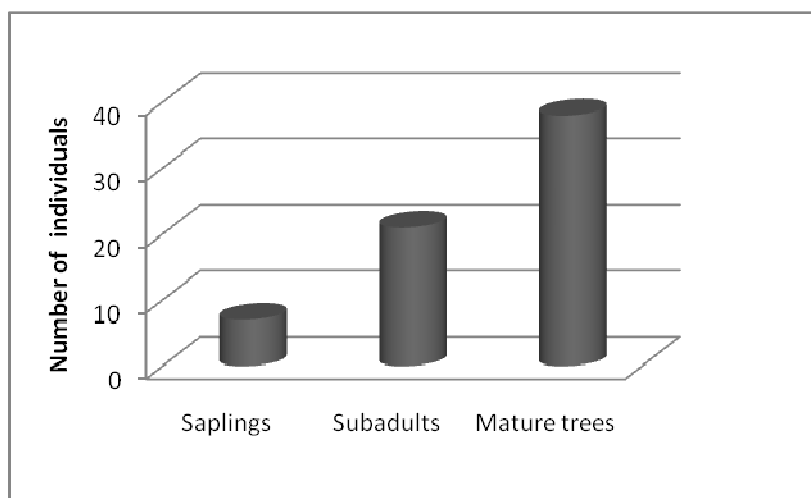


Figure-7

Population structure of *I. cynometroides* in the study area

Conclusion

The investigation revealed that the population of *I. cynometroides* is extremely small and species have low dominance and poor ecological success in the study area. The total number of reproducing individuals is less than 50 confined to an area of less than 1 sq. Km, and is facing great threat of destruction. Therefore, the species can be placed under "critically endangered" category⁵. Hence, active protection measures and continuous monitoring of the existing populations should be given top priority. As the numbers of mature trees are very limited, immediate concerted efforts are required to conserve all the existing populations. Thus, a short-term conservation goal should be adopted to ensure that the vigor of a population is maintained or restored in the face of inbreeding through appropriate manipulation of the remaining genetic variations. According to the demographic characteristics of this species, it is found that the seedling and sapling populations insufficient to maintain the natural regeneration stock. Population restoration by supplementary regeneration could be an adaptive strategy to combat the declining populations by introducing nursery-grown seedlings or vegetatively propagated seedlings to compensate the lack of natural regeneration. Since major threats to *I. cynometroides* are habitat degradation and overharvesting of mature trees, awareness among local people, preservation of existing reproducing individuals, and sustainable harvest of mature trees may be effective in successful preservation of the species. Government agencies such as State Forest Department, NGOs, and other conservation agencies can play a vital role in the conservation of this species by distributing and planting the nursery grown seedling of *I. cynometroides*. Plantation of seedlings along traditional agricultural land or in wayside plantations is also recommended. Identification of unique sites, locating the habitats of selected species with Global Positioning System (GPS), mapping of plants with their density status, etc. can be used for conservation purpose the species.

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