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MAMTA PATRA
SUSHIL K. SHAHI*
ANUPAM DIKSHIT

Biological Product Laboratory,
Botany Department,
University of Allahabad,
Allahabad 211 002, India
*For correspondence.
e-mail: shahiindia@rediffmail.com

Identification, distribution and conservation of *Phyllanthus indofischeri*, another source of Indian gooseberry

Non-timber forest products (NTFP) such as fruits, seeds, roots, etc. are an important source of income for the indigenous people living in and around forests^{1,2}. The pressure on forests for the collection of NTFPs has motivated conservation biologists and forest managers to find ways to harvest NTFPs in a sustainable manner^{3,4}. Identification of plant species is the first and foremost criterion in planning for sustainable utilization of resources, especially if an NTFP comes from two closely related plant species or when the identity of plant species is doubtful. Proper identification of the plant species of commercial importance can shed more light on its distribution, population status in the wild, and its resource generation capability. Lack of knowledge on distribution or population status may make the species vulnerable to extinction due to over-exploitation, especially when the population is small or has restricted distribution. Thus, proper identity of the species, from which the resource of commercial interest is collected, is very important for conservation biologists and forest managers to protect the plant species from overexploitation

and extinction. Proper identity of species also enables traders and consumers to avoid adulteration of products, and aids officials concerned to prevent smuggling or bio-piracy.

Indian gooseberry is widely collected from *Phyllanthus emblica* Linn. (Euphorbiaceae), and *P. indofischeri* Bennet, a species endemic to Peninsular India. Published literature in the fields of medicine, ethnobotany, biology, ecology and natural resource management, have not distinguished *P. indofischeri* from *P. emblica* as another source of fruits as the fruits are known by the same trade name, i.e. 'amla'^{5–9}. However, the indigenous people from the Biligiri Rangaswamy Temple Wildlife Sanctuary (BRT), Mudumalai Wildlife Sanctuary and Thennimalai Reserve Forest, Thiruvannamalai distinguish these two species based on the vegetative characters. *Soligas*, the indigenous people of BRT, have separate local names for these two species. They call *P. indofischeri* as *Ittu nelli* (*Ittu* means large ragi millet ball, a food preparation) or *Bettatha nelli*. *P. emblica* is called *Nai nelli* (fruit is smaller than the other species and is considered to be

inferior). The *Soligas* are aware of the two forest types in which these two species are distributed.

Specimens of these two types of Indian gooseberry trees from BRT forests were compared with the type specimen (K. Rangachari 9000, Kambakkam hills, Chingleput, May 1913) available in Kew Herbarium. It was confirmed that these two Indian gooseberry trees are distinct species named *P. emblica* and *P. indofischeri*. Taxonomic details are provided to distinguish the two species in the field (Figures 1 and 2).

Phyllanthus indofischeri was first collected by C. E. C. Fischer in 1906 from North Coimbatore and was described as *Emblia Fischeri* Gamble¹⁰. However, following Webster¹¹, the concept of the genus *Phyllanthus* was amended and all species under *Emblia* were transferred to *Phyllanthus*. Following the rules of nomenclature, *Emblia fischeri* should have been renamed as *Phyllanthus fischeri*. However, the name *Phyllanthus fischeri* Pax. already existed for an African species of *Phyllanthus*. Therefore, the Indian species was renamed as *Phyllanthus indofischeri* Bennet¹².

SCIENTIFIC CORRESPONDENCE

Table 1. Morphological characters distinguishing *P. emblica* and *P. indofischeri*

Characters	<i>Phyllanthus emblica</i>	<i>P. indofischeri</i>
Forest type/habitat	Woodland savanna (deciduous forest with grasses in the understorey), dry deciduous forest	Scrub forest and stunted low altitude dry deciduous forest
Branch	Branches and branchlets are mostly weak and drooping	Branches and branchlets are stout and erect
Bark pattern	Bark peels into small irregular flakes that resemble the bark of <i>Anogeissus latifolia</i> . Brown in colour. Slash is reddish brown	Bark is mostly smooth. In large-girth trees bark peels into flakes that are square or rectangular in shape. Grey in colour. Slash is reddish brown
Branching	Branchlets are alternate superposed. They all face one plane	Branchlets are alternate and spirally arranged. They do not face one plane
Branchlet and leaf	Length of the branchlets up to 40 cm. More than 100 leaves in the branchlets. Leaf measures about 1.8 cm × 0.5 cm. Linear and apiculate at tip. Greenish glaucous beneath.	Branchlets are stout and rarely exceed 25 cm long. Rarely more than 50 leaves per branchlet. Leaf measures about 2.8 × 1.3 cm. Oblong. Tip is round; the base is cordate or round. Greyish glaucous beneath
Style	Style arms are dichotomously bifid, flat and recurved, greenish, sparsely puberulus. The arms from the tip of the ovary measure 5–7 mm long	Style arms are dichotomously branched but shorter and measure about 2–3 mm long. Arms are flat and greenish
Fruit	Diameter ranges between 1.8 and 2.5 cm. Groove markings along the septa are very shallow	Diameter ranges between 2.5 and 4 cm. Groove markings along the septa are well developed

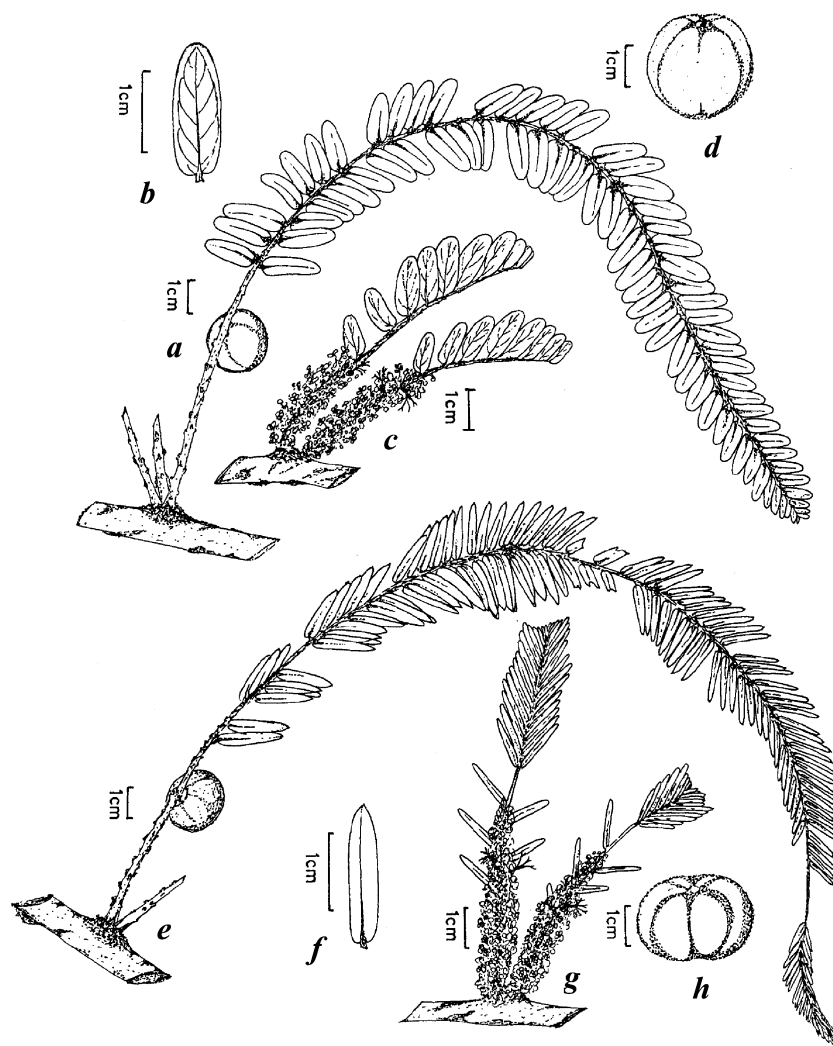


Figure 1. *Phyllanthus indofischeri* (a–d): a, Branchlet with a fruit; b, Leaf; c, Flowering branchlets; d, Fruit; *Phyllanthus emblica* (e–h): e, Branchlet with a fruit; f, Leaf; g, Flowering branchlets; h, Fruit.

Description of *Phyllanthus indofischeri*: Monoecious trees, up to 12 m tall; bark smooth in younger trees, fissured with square or rectangular flakes in older trees, grey; branches terete, glabrous, tubercled with persistent scars of previous year branchlets; branchlets 3–5 per tubercle, deciduous, acropetal, subtended by minute scales, deciduous; Scales puberulous, 1.5–2.2 mm long, Floriferous part of branchlets thick with prominent floral and bract scars restricted to lower portion of branchlets; Young branchlets 5–9 cm long, with floriferous portion up to 3.5 cm long. Stipules scaly, 1–1.5 mm long, triangular, fimbriate to lacinate along margin, acuminate, pinkish. Leaves alternate, sub-sessile, oblong, 1–2.8 × 0.5–1.3 cm, cordate to obtuse at base, entire, acute, coriaceous, glabrous, glaucous beneath; lateral nerves 5–7 pairs, looping along margin, obscure above, prominent beneath. Flowers fascicled, in leafless portion of branchlets; bracts triangular, acuminate at apex, lacinate to fimbriate along margins. Male flowers pedicellate, many, restricted to lower portion of floriferous branchlets. Pedicels filiform, 2–3 mm long. Perianth-lobes 6, imbricate, oblong to obovate, 1.5–2 mm long, papery, lacinate along margins, obtuse at apex, glabrous, pale green, with a globose gland at base; Stamens 3, yellow; filaments united into a column, 1–2 mm long; anthers 1–2 mm long, dehiscing vertically. Female flowers sessile, usually 1–3, surrounded by numerous male flowers, restricted to upper portion of floriferous branchlets, pro-

togynous. Perianth-lobes 6, oblong, 2.5–3 × 1.5–2 mm, sub-fleshy, entire along margins, obtuse at apex, green. Disc fleshy, 6-angled, enclosing three-fourth of ovary, irregularly lobed. Ovary globoid, ca 1 mm across; stylar column short; stylar arms 3, each 6–8 mm long, flat, curved, bifid at apex, glandular puberulous above, glabrous beneath. Fruits drupaceous, globose, 2.5–4 cm across, pale green; seeds 6, grey.

The distribution of *P. indofischeri* was determined based on herbarium collections (Kew, FRLHT, and ATREE) and literature^{13–16}. *P. indofischeri* is endemic to Deccan Plateau and certain drier forest pockets of southern India (Figure 3). The other species, *P. emblica*, is a widely distributed species and found all through the Indian subcontinent, Sri Lanka (mostly under cultivation), China, and other Southeast Asian countries.

P. emblica and *P. indofischeri* are not found co-occurring in the same forest. *P. emblica* is found in dry deciduous forests and *P. indofischeri* in scrub forests. Only in the ecotones, where both the forest types merge, small populations of *P. emblica* and *P. indofischeri* are found together. The spatial segregation of these two species along forest type gradient is observed in BRT Wildlife Sanctuary, Thenmalai Reserve Forest, and Mudhumalai Wildlife Sanctuary. The influence of forest type on the distribution of these two *Phyllanthus* species can be explained by the 'replacement taxa concept'¹⁷ that one species of the same genus replaces the other along the altitudinal gradients where the forest types also changes. Pascal¹⁸ explains this distributional pattern of closely related species of the same genus with the concept of vicariance. He had found such spatial segregation among the species of the genus *Diospyros* and *Garcinia* across altitudinal gradients and dry and evergreen forest formations in the Western Ghats and pointed out that the vicariance is associated with endemism.

According to fruit harvesters, the marble green colour with less dark spots due to fungal attack makes the fruits of *P. indofischeri* more valuable than the fruits of *P. emblica*. Preferred colour of *P. indofischeri* can make it more vulnerable to exploitation than *P. emblica*. Also, market demand for Indian gooseberry fruits is forcing collectors to harvest *P. indofischeri*. Fruit collectors, lured by money, cut the trees or their major



Figure 2. a, *Phyllanthus emblica* Linn.; b, *Phyllanthus indofischeri* Bennet.

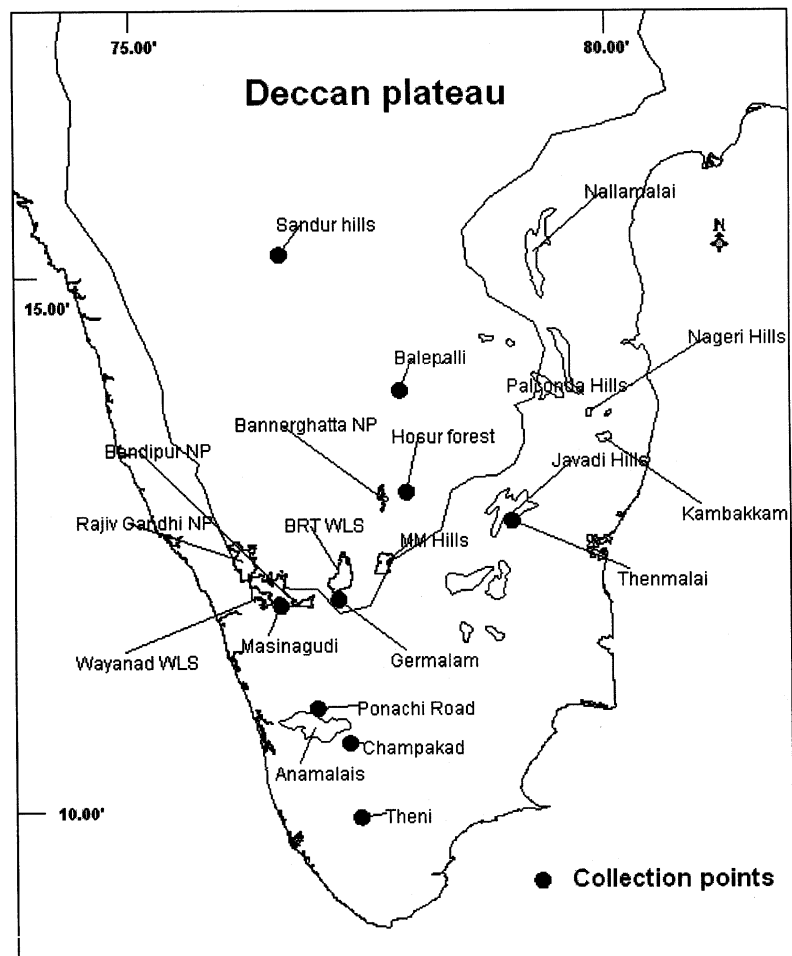


Figure 3. Distribution of *Phyllanthus indofischeri* in peninsular India.

branches to maximize collection. Also, during a religious festival called 'Uthana dwadasi', held at the end of the monsoon season, a large number of people in Karnataka and Andhra Pradesh worship the fruiting branches along with tulsii (*Ocimum sanctum*) believing that the fruiting branches will bring prosperity to their families. On the festival day, large loads of lopped branches of *P. indofischeri* with young fruits are sold in local market.

P. indofischeri is facing threat not only from the excessive fruit collection that impedes its regeneration but also from habitat loss. Scrub and dry deciduous forests in peninsular India have been extensively cleared for agriculture in the past. Presently, the remaining patches of these forests are under threat due to forest fire, grazing, encroachment, conversion to monoculture plantations, and unsustainable collection of fuel wood and NTFPs¹⁹⁻²¹.

Indian gooseberry has been extensively used in indigenous medicinal preparation in India. The fruits are used to make pickle, shampoo and hair-dye. Of late, *Phyllanthus emblica* is being cultivated on a large scale due to increase in demand. In addition, horticultural varieties with good traits have been released for large-scale farming to meet the demand from the international market. Also, *P. indofischeri* has been introduced in cultivation as a horticultural variety under the name 'Krishna' in Tamil Nadu (R. Ganesan, pers. observ.) and 'Champakad large' in Kerala¹⁶. However, large quantities of fruits of both species are still harvested from the wild in different parts of India.

Since *P. indofischeri* is an important NTFP species with restricted distribution in a few forested pockets of the Deccan Plateau in southern India, indiscriminate collection can lead this species to rapid extinction. Educating NTFP collectors about its restricted distribution and its vulnerability to extinction might encourage them to adopt non-destructive collection practices. Efforts have begun in this direction in BRT sanctuary through Participatory Resource Management involving indigenous people, forest department

and a local NGO²². These agencies are trying to reduce the level of tree damage while harvesting, and to improve the regeneration of *P. emblica* and *P. indofischeri*.

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R. GANESAN

Ashoka Trust for Research in Ecology and the Environment (ATREE),
659, 5th A Main, Bellary Road, Hebbal,
Bangalore 560 024, India
e-mail: rganesan@atree.org