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# ***Hygrophila pogonocalyx* (Acanthaceae), new distributional record of a threatened taxa from India: Its ecology and proposal for conservation**

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## **ABSTRACT**

A new species of *Hygrophila*, belonging to the family Acanthaceae is described from Tripura, for the first time in India. The detail taxonomic description, phenology, ecology and global distribution are narrated. Colour photographs are provided to validate the species scientifically. Distinguishing characters are provided to differentiate from closely related species.

**Key words:** New record, *Hygrophila pogonocalyx*, Conservation proposal, India.

## **INTRODUCTION**

Tripura, the North Eastern State of India is situated in between 22° 56' N to 24° 32' N latitude and 90° 09' E to 92° 20' E longitude with 10497.69 sq. km of the total land area in which 60% covers with forests, which falls in the minor ranges of the “Indo Burma hotspots”. Geographically the hilly terrain state represent distinctly five hill ranges running parallel to each other from North South direction, which supports luxurious growth and diversity of vegetation and well known for its own floral and faunal diversity (Sarma & Debnath, 2016). About 86% of the species occurring in the state are widely distributed in India and neighbouring countries, however remaining 14% plant species is prudently restricted in distribution in Tripura (Deb, 1981; 1983). At the time of our systematic investigation in the State on ethno medicinal plants to develop a medicinal plant database of Tripura, we have

collected an interesting species under the genus *Hygrophila* (Acanthaceae), for the first time in India. On critical analysis with the help of appropriate literature and references (e-Flora of China; Pullaiah 2015; Anil Kumar et al. 2005), it has revealed that the species belongs to the genus *Hygrophila* and identified as *Hygrophila pogonocalyx* Hayata. Thorough the enquiry of literatures (Deb 1981; 1983; Clarke, 1885; Karthikeyan et al. 2009; Gamble 1924; Matthew, 1983; Pullaiah 2015; e-Flora of India) showed that this species was previously not recorded from India. Hence, in the present study, the species is reported as a new addition to the angiosperm flora of India along with its ecological status and conservation proposal.

Globally the genus *Hygrophila* represented ca. 100 species (Hai & Huyen, 2012), most of which are aquatic or moisture loving in

nature (Deng et al. 2011) and occur primarily in the tropics (Ramey 2001). Clarke (1885) reported 49 genera, 504 species and 127 varieties of Acanthaceae and eight species under the genus *Hygrophila* from India in the 'Flora of British India.' Karthikeyan et al. (2009) listed 47 genera, 475 species and 118 varieties of Acanthaceae in the "Flowering Plants of India." Gamble (1924) reported four species of *Hygrophila* in the Flora of the Presidency of Madras. Matthew (1983) described four *Hygrophila* species in the Flora of the Tamilnadu Carnatic, while Henry et al. (1987) documented six species in the Flora of Tamilnadu. Pullaiah (2015) listed two *Hygrophila* species viz. *H. polysperma* and *H. spinosa* in the "Flora of Telangana", and *H. polysperma* and *H. salicifolia* were also reported from Tripura (Deb 1981; 1983). The botanical survey of India reported 18 species of *Hygrophila*, in the "e-Flora of India." But, *H. pogonocalyx* was missing in all these reports. Throughout the world *H. pogonocalyx* is distributed in the two geographical regions of China viz. Eastern and Western Taiwan (Teng 1990; Liu et al. 2000). In total fewer than 1,000 individuals were documented in nature by Wang et al. (2000).

## MATERIALS AND METHODS

An intensive survey was done on the distribution, population status and ecology of therapeutic plants in the state for the preparation of medicinal plant database of Tripura. During our field survey (September 2015 – August 2016) the species was recorded; collected and herbarium sheets were prepared using standard taxonomical methods (Rao and Sharma 1990) and deposited in the Department of Forestry and Biodiversity, Tripura University with a proper voucher specimen number. The fresh plant specimens have been identified using regional flora (Deb, 1981; 1983) and other published research works, relevant online e-flora (e-Flora of China), Flora of Telangana (Pullaiah, 2015) etc. The identification was confirmed by the Botanical Survey of India, Eastern regional Centre, Shillong,-793003. A detailed taxonomical description and colour photographs of this species are provided here to facilitate its easy identification and differentiation from other *Hygrophila* species.

### Taxonomic treatments

*Hygrophila pogonocalyx* Hayata, Icon. Pl. Formosan. 9: 81. 1920.

Herbaceous, aquatic, perennial, soft woody plants, base decumbent. Plants grow on moist lands, height about 1-1.5m. Stem erect, branching, quadrangular, hairy, node swollen and reddish colour, lower parts of nodes densely pubescent, length of node about 2-5 cm, pith spongy. Leaf simple, stipulate,

opposite decussate, leaf length 2-5 cm, both side hirsute or scabrous, lanceolate, margin entire, apex acute, reticulate unicostate. Inflorescence in cymose, clusters in leaf axils. Flower bracteolate, bractate, zygomorphic, bisexual, bluish colour. Bracts and bracteoles foliaceous, pubescent, linear to lanceolate, apex acute. Calyx lobes 5, linear-lanceolate, apex acuminate, hairy pubescent, reddish colour, sub equal, gamosepalous, valvate. Petal 5, gamopetalous, bilabiate, lower lip 3 lobed, oblong, upper lip 2 lobed, slightly erect, apex obtuse, hairy, blue colour, valvate. Stamen 4, didynamous, epipetalous, filaments in a pair, length about 5-10mm, anther 2 cells, thecae, basifixed, brown colour. Carpel 2, ovary cylindrical, superior, syncarpous, one chambered, 2 ovules in each chamber, basal placentation, stigma 1, style simple, filiform. Capsule linear-oblong, seeds numerous, discoid, curved retinacula.

**Synonym:** No synonym recorded for this species.

**Flowering and Fruiting phenology:** September to February.

**Ecology:** The plant is growing in moist or wet shady places.

### Global Distribution

The species is globally distributed to the North-Eastern Taiwan and Western Taiwan. Presently it is recorded from Tripura, the North Eastern state of India which falls in Indo-Burma Bio-geographical hotspot region.

### IUCN Status

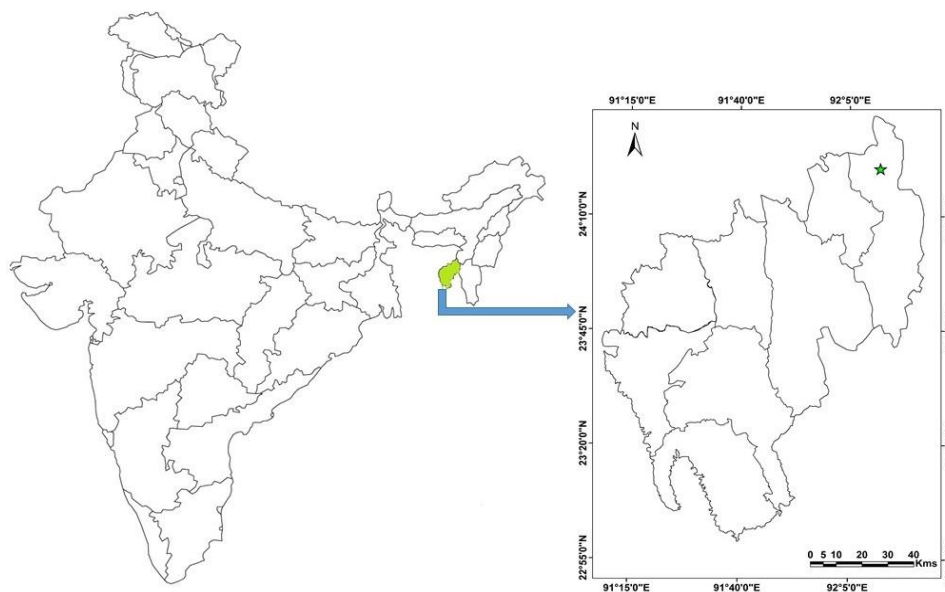
The species *H. pogonocalyx* is an endangered species endemic to Taiwan (Hsieh and Huang 1974). Since 1996, *Hygrophila pogonocalyx* has been recorded in the Red List Categories as the criteria allotted by the International Union for Conservation of Nature and Natural Resources and is considered as a "critically endangered" (IUCN 1997).

**Specimen Examined:** INDIA, North Tripura, Dharmanagar Subdivision, Kameshwar. 24°22'13.53" N Latitude; 92°11'02.52" E Longitude; elevation 31 m. Dipan Sarma. Voucher No. C.S. 92. Dated 12. 11. 2015.

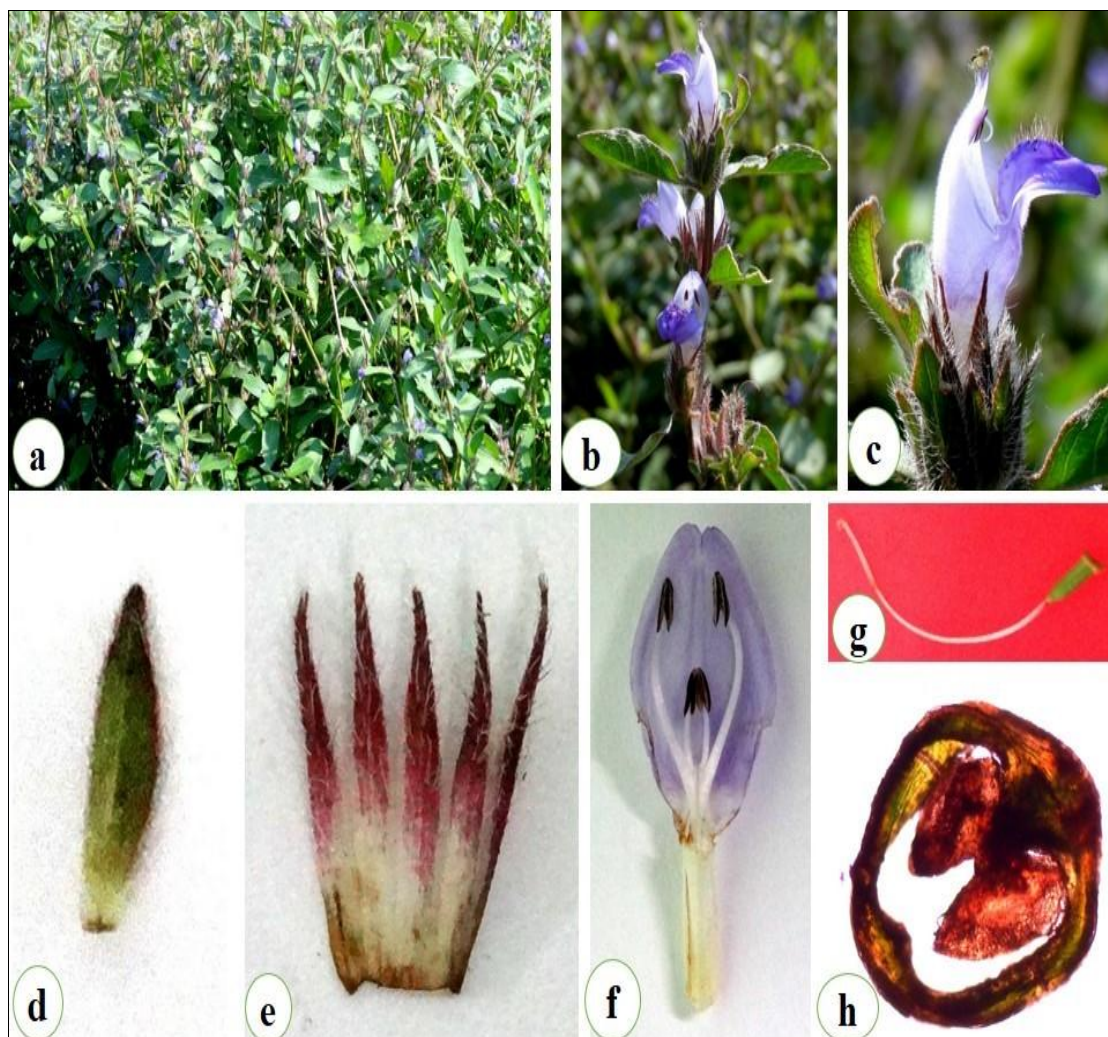
### Identification and authentication

The specimen was confirmed with the help of Botanical Survey of India, Eastern regional Centre, Shillong,-793003, Identification Letter No. BSI/ERC/TECH./PLANT Iden./2016/689; Dated: 09-03-2016.

**\*Note:** The examined species *H. pogonocalyx* Hayata may be threatened and endangered in India, it is found in Tripura, North-East India along with Taiwan (China).



**Fig. 1.** In the map star showing the geographical distribution of the species *Hygrophila pogonocalyx* Hayata for the first time in India from Tripura; North-East India.



**Fig.2.** *Hygrophila pogonocalyx* Hayata: a, Habitat; b, Flowering twig; c, Single flower; d, Bracts; e, Calyx; f, Stamens along with petals; g, Gynoecium and h, T.S. of ovary.

### Taxonomic correlation of some closely related *Hygrophila* sp. available in Tripura:

Procumbent unarmed herbs, aquatic, leaves simple, opposite, entire, inflorescence in short terminal spikes, sepals 5 lobed, stamen 4, 2 fertile, capsule more than 15 seeded..... *H. polysperma*

Erect, armed herbs, semi aquatic, quadrangular stem, nodes reddish, leaves pseudo whorls in 6 with 6 spines, oblong-lanceolate, margin minutely dentate, inflorescence in axillary whorls fascicles cymes, sepals 4 lobed, Stamen 4, all fertile, capsule 4-8 seeded..... *H. spinosa*

Erect herbs, aquatic, inflorescence in axillary whorls, sepals 5 lobed, stamen 4, fertile .....*H. salicifolia*

Erect herbs, base decumbent, semi aquatic, stem quadrangular, leaf papery, hirsute, clustered cymose in axillary leaf axils, Stamen 4, fertile, filaments in a pairs..... *H. pogonocalyx*

### Short review on biological activity

An active compound phenylethanoid glycoside 'acteoside' isolated from *H. pogonocalyx* (Ho et al. 2013) showed anti melanogenic activity in human melanocytes cells, neurocytoprotective activity in PC12 cells (Ho et al. 2013), antioxidant activity (Jiang et al. 2006, Ho et al. 2012), the anti-inflammatory (He et al. 2011), chemopreventive (Hwang et al. 2011), antiallergic (Yamada et al. 2010) and hepatoprotective (Zhao et al. 2009) activities. Another isolated compound, luteolin 7-O-β-D-glucopyranoside reported from this plant showed the protective effect against 6-OHDA induced PC12 cells (Lin et al. 2009, 2012). Rutin separated from this plant exhibited the protective effect against spatial memory loss induced by trimethyltin, toxicant induced hippocampal injury in rats (Koda et al. 2008, 2009) and the neurocytoprotective activity in 6-OHDA-induced NGF-differentiated PC12 cells (Ho et al. 2013). Myricetin present in the plant exhibited antiallergic (Shimosaki et al. 2011), antipsychotic like (Pereira et al. 2011), and anxiolytic (Fernandez et al. 2009) effects.

### Conservation proposal

In recent field investigation, it is noticed that the plant has been destroyed by cattle browsing, habitat transformation for agricultural practices and collection of soil for brick industry, which increase the risk of its survival.

The plant *H. pogonocalyx* is the sources of various essential phytochemicals and shows the many biological activities hence it is consequential to conserve the species for the further investigation. Moreover, the germplasm conservation is needed to researcher for bio-resources including propagation

and nursery techniques for large-scale multiplication of the plant and isolation of phytochemicals for developing new drugs for severe diseases. Therefore, it is very much important to conserve its habitat for its restricted geographical distribution, ecological and bio diversity resources or values. It is a matter to consider the protection of its habitat disturbance and to promote the awareness of local people about its importance.

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