

**TAXONOMIC REVISION OF THE GENUS
OSBECKIA L. (MELASTOMATACEAE) IN INDIA**

*Thesis submitted to
the University of Calicut in partial fulfillment of
the requirements for the degree of*

DOCTOR OF PHILOSOPHY

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CERTIFICATE

This is to certify that the corrections suggested by both the evaluators are incorporated in this thesis entitled "**Taxonomic revision of the genus *Osbeckia* L. (Melastomataceae) in India**" submitted to the University of Calicut by **Mr. Prashob P.**, Research Scholar, Post Graduate & Research Department of Botany, St. Joseph's College Devagiri (Autonomous) Calicut.

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CERTIFICATE

This is to certify that the thesis entitled **Taxonomic revision of the genus *Osbeckia* L. (Melastomataceae) in India**, submitted to the University of Calicut by Mr. Prashob P. in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy in Botany is a bonafide record of research work carried out by him under my guidance and supervision. No part of this work has been presented elsewhere for any degree or diploma previously.

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DECLARATION

I hereby declare that the thesis entitled "**Taxonomic revision of the genus *Osbeckia* L. (Melastomataceae) in India**" submitted by me in partial fulfillment for the award of the degree of Doctor of Philosophy in Botany of the University of Calicut, incorporates the results of the original work done by me in the Department of Botany, St. Joseph's College Devagiri, Calicut. This thesis has not been submitted by me to any other University for the award of any other degree or diploma previously.

Devagiri, Calicut.
08.08.2018

Prashob P.

To
My Parents & Teachers

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Plan of the thesis

The work entitled “Taxonomic revision of the genus *Osbeckia* L. (Melastomataceae) in India” is the result of the extensive field and herbarium studies carried out during the period 2014–2018. The thesis is presented in 9 chapters.

Chapter-1 begins with an introduction which deals with the general characters of the family Melastomataceae and the genus *Osbeckia* L. followed by the relevance of the study and the area of the present study. A review of the relevant literatures is given in chapter-2, wherein earlier taxonomic treatments by various authors, latest reports on Anatomy, Cytology, Palynology, Pollination Biology, Embryology, Molecular Taxonomy, Phytochemistry and Medicinal properties of the genus are briefly discussed. The materials and methods used are presented in chapter-3. In chapter-4, the general morphology of the genus is described.

The systematic treatment is presented in chapter-5. It includes correct nomenclature, typification, citation, relevant synonymy, detailed description, ecology, distribution and notes on the genus. Chapter-5.1 deals with Infrageneric classification. An artificial key to the sections of *Osbeckia* in India is also provided. The sections are treated alphabetically: Section *Amblyanthera* in chapter 5.2, Section *Asterostoma* in chapter 5.3, Section *Ceramicalyx* in chapter 5.4 and Section *Osbeckia* in chapter 5.5. The species are treated alphabetically in each section. For each species correct nomenclature, typification, citation, relevant synonymy, detailed description, chromosome number, flowering and fruiting period, ecology

and habitat are provided. Notes on nomenclature are given wherever found necessary. Only those floras whose voucher materials consulted are incorporated in the citations. The list of specimens examined is given at the end of each species. They are cited by state, district, and place in the alphabetical order followed by the date of collection, the name of the collector and the acronym of the herbaria where it is deposited. Colour photo plates, type photographs and distribution maps are provided for all the species.

Discussion on comparative morphology of the genus is presented in chapter-6 and morphometric analysis of 27 Indian taxa of *Osbeckia* is included in chapter-7. The anatomical studies of stem, leaf and their taxonomic significance are discussed in chapter - 8. The summary of the investigation is presented in chapter-9.

Eight appendices are given at the end *viz.*, the taxa excluded from the study, list of papers published/communicated, list of herbaria consulted, model data sheet of *Osbeckia*, the data matrix for morphometric analysis of Indian species of *Osbeckia*, list of floras consulted, species maintained in the college Botanic garden and the details of herbarium sheets prepared. The bibliography on literature cited and an index to scientific names are also provided.

Melastomataceae, one of the larger families of angiosperms comprises ca. 170 genera and 5400 species in the New World (Renner, 1993; Renner *et al.*, 2007; Conti *et al.*, 1997; Stone, 2006; Melnet, 2007; Goldenberg *et al.*, 2015; Caetano *et al.*, 2018), distributed mainly in tropics and subtropics (Christenhusz & Byng, 2016). Members exhibit a variety of habits from trees, shrubs, woody climbers to herbs and habitats from lowland to montane tropical forests, in savannas as well as in disturbed vegetation (Renner, *l.c.*; Clausen & Renner, 2001). India owns the possession of 166 taxa of the family under 4 tribes and 21 genera (Clarke, 1879).

The family can be distinguished by their acrodromous venation, bisexual, diplostemonous flowers, usually with prolonged and appendaged anther connectives, and by the numerous exalbuminous seeds. In the taxonomic review for the entire family, Cogniaux (1891) recognized three subfamilies *viz.*, Melastomeae, Astronoeae and Memecyleae. The largest among these is Melastomeae comprises 11 tribes. This classification was largely based on Triana (1871), who emphasized characters related to stamens and the number of other floral parts. Triana (*l.c.*) also used biogeography to segregate neotropical groups from palaeotropical ones. Among the various classifications which exist, Cogniaux's system is the most comprehensive for the family and it constituted the basis for many taxonomic or systematic studies on the family.

Bartling (1830) proposed the tribe Melastomeae to include species having poricidal anthers for the first time. Later it was split based on biogeography, anther structure and nature of pubescence (Triana, 1865; Cogniaux, 1891). Cogniaux (*l.c.*) placed the African and Asian genera in Osbeckieae and the American genera in Tibouchineae. This classification was widely accepted and followed by many authors (Van Tieghem, 1891; Krasser, 1893; Jacques-Félix, 1981, 1995; Vliet *et.al.*, 1981) until Renner (1993) resurrected Melastomeae by merging the earlier two tribes *viz.*, *Osbeckieae* and *Tibouchineae*.

The generic name *Melastoma* L. is of Greek basis and is a neuter noun. The plural of *stoma* is *stomata*, therefore, “Melastomataceae” is the correct family name consequent to the generic name *Melastoma*, not “Melastomaceae” as used by Cogniaux (*l.c.*) and other former authors. Similarly, “Melastomateae” not “Melastomeae” is the correct tribal name matching to the generic name *Melastoma* (Reveal, 2011). Although Renner, (1993), recognized nine tribes under Melastomataceae based on morphology and anatomy, recent studies based on DNA sequence data proposed the establishment of new ones and considerable changes to the delimitation of others (Clausing & Renner, 2001; Fritsch *et al.*, 2004; Michelangeli *et al.*, 2004, 2011, 2013; Goldenberg *et al.*, 2008, 2012, 2015; Amorim *et al.*, 2009; Penneys *et al.*, 2010; Penneys & Judd, 2011, 2013; Rocha *et al.*, 2016).

Despite the diversity, endemism and rarity of the taxon, no revision has been reported in India after Clarke (1879). Being, a family with considerable species richness, the revision of Melastomataceae is a challenging task. Besides the vastness the time constraints that usually

inherent with a Ph.D. programme compelled us to restrict the present revisionary study to the genus *Osbeckia* L. (Melastomataceae) in India.

Osbeckia L. is a major genus of the family Melastomataceae consisting about 50 species worldwide (Mabberley, 2017). The genus is well represented in India with 26 species (Clarke, 1879) of which 20 occur in South India (Gamble, 1919). At present the genus is represented in India with 23 species and 4 varieties (Prashob *et al.*, 2018). Based on the latest phylogenetic study of Veranso-Libalah *et al.* (2017) this genus belongs to the tribe Melastomateae.

Taxonomic revision of *Osbeckia* L. deserves special attention because India owns more than 50% of species worldwide and the genus shows sizeable percentage (63%) of endemism in India. Exempting the treatment of (Clarke, 1879) in 'The flora of British India', the genus is taxonomically ignored in India. Though Hansen (1977) revised the genus for Asia, the work is primarily based on herbarium specimens rather than live specimens or field study. Most of the recent studies are found pertain to cytological or cytotaxonomic aspects of a few species. However, treatments on this genus in various regional floras (Matthew, 1981, 1982, 1983, 1988, 1996, 1999; Manilal & Sivarajan, 1982; Ramachandran & Nair, 1988; Mohanan & Henry, 1994; Sasidharan & Sivarajan, 1996; Pullaiah & Chennaiah, 1997) need to be acknowledged.

Osbeckia is generally distinguished from related genera in having 3–5 or 5–7 acrodromous nerved leaves; isomorphic stamens, anther dehiscence through apical pores; ribbed capsule dehiscing apically by 4 or 5 pores and

numerous curved seeds. The characteristic hairs, bristles and emergences on the hypanthium are often very useful for species level identification.

The present investigation entitled 'Taxonomic revision of the genus *Osbeckia* L. (Melastomataceae) in India' aims at the preparation of a comprehensive taxonomic treatment of the genus in India based on extensive field studies, literature survey, microscopic observations and real and virtual herbarium consultation.

The present study aims at the following objectives

1. Field exploration to assess the present distributional status of all the species, subspecies and varieties of the genus *Osbeckia* L. in India.
2. Establishment of germplasm and preparation of herbarium specimens for future references.
3. Identification of each taxon in consultation with type specimens or other authentic collections and relevant literature.
4. Documentation of ecological and ethnic information of all the species.
5. Preparation of an illustrated taxonomic account of the genus and its infraspecific diversity in India.

Economic Importance

The members of *Osbeckia* form a fascinating group of plants due to their ornamental and medicinal values. The beautiful purple/pink petals and yellow stamens add glory to forest undergrowths. Several species of the

genus are grown as ornamentals. *Osbeckia nayarii*, *O. stellata* var. *stellata*, *O. stellata* var. *crinita*, *O. nepalensis* and *O. reticulata* are examples.

Medicinal properties are reported to many species. For example: drug derived from *O. chinensis* is used as a remedy for a variety of ailments including diabetes mellitus (Syiem & Khup, 2006). The crude extract of *O. aspera*, is traditionally used to treat liver diseases (Renee & Grayer, 2008). Similarly, *O. octandra* is used against jaundice and liver disorders (Thabrew *et. al.*, 1995). Both *O. octandra* and *O. aspera* are used in Sri Lanka for the alleviation of jaundice associated with liver disease (Attygalle, 1917; Jayaweera, 1982).

Study Area

The present study spreads over the entire political boundary of India which lies between 8° 4' and 37° 6' North latitudes and between 68° 7' and 97° 25' East longitudes. It comprises 29 states and 7 union territories. Being the largest peninsula of Asia, it measures 3219 km from north to south and about 2977 km east to west. The natural boundaries are the Great wall of Himalayas in the



north, the Thar desert of Rajasthan in the north west, Indian Ocean in the south, Bay of Bengal (wherein lie Andaman Nicobar islands) in the eastern side of Peninsula, Arabian Sea (wherein lie Lakshadweep islands) in the south western side of Peninsula and the mountain ranges in the east separating Myanmar from India. The countries that touch India's border from the west to east are Pakistan, Afghanistan, Nepal, Bhutan, China, Tibet, Bangladesh and Myanmar (Murthy *et al.*, 1996).

Biogeography

India can be divided into three major physiographic zones: 1. the Peninsula, a triangular plateau encircled by the Vindhyan ranges in the north. The Western Ghats (Sahyadri) and the Eastern Ghats are the major ranges in the Peninsula lying along the western coast and eastern coast correspondingly. 2. the Extra-Peninsula, constitutes the Himalayas and other mountains in the northern extremity, consists of the Hindukush, the Karakoram and the Himalayas. 3. the North Indian Plains, located between the Peninsula and Extra-Peninsula, comprises extensive plains of Assam, West Bengal, Bihar, Uttar Pradesh and Punjab (Murthy *et al.*, *l.c.*).

Soil

Soils in India are classified into eight categories: 1. Lateritic soil, 2. Black cotton soil, 3. Red soils, 4. Alluvial soils, 5. Alkaline soils and saline soils, 6. Peaty and other organic soils, 7. Desert soil or arid soil, 8. Scanty soils of mountains and hills (Venu *et al.*, 1996). The lateritic soils are generally reddish or yellowish-red and turn black on exposure to sun. They are well developed on hill tops and have higher content of humus. The black

soils are mostly dark grey to black and formed by the decomposition of trap rocks. The red soils are mainly found in the peninsular regions and are low in humus and other organic nutrients. Alluvial soils are the largest and the most important soil group of India derived from the silt laid by numerous tributaries of the Indus, the Ganges and the Brahmaputra systems. The alkali and saline soils have a higher percentage of salts while the peaty soils, characterised by excessive organic matter accumulated in poorly decomposed conditions. The desert soils found on arid and semi-arid zones are salty and contain good amount of alkali. The mountain soils which are loose and young or immature are found distributed from north-west to eastern part of the country (Murthy *et al.*, 1996).

Forest

Forests in India encompass 67.83 million hectares of land, which represents 20.64% of the nation's geographical territory. Different types of forests are found in the Indian sub-continent, varying from the arid zone forests to Himalayan temperate forests. Primarily, there are six major types of forests, namely, moist tropical, dry tropical, montane sub tropical, montane temperate, sub alpine and alpine. These are further divided into 16 major types of forests. The eastern part of India consists of moist, deciduous and wet evergreen forests; western part comprises mainly of thorn and dry deciduous forests; northern and central area consists of mostly dry and moist deciduous forests and southern parts include characteristics of both western and central zones (Murthy *et al.*, l.c.).

Rivers

Rivers of India fall into two major groups. 1. The Extra-Peninsular rivers or Himalayan Rivers comprise 19 major rivers of which, the Indus, the Ganges and the Brahmaputra are the largest. Among the 19 rivers, 6 belong to the Indus system, 9 belong to the Ganges system and 4 belong to the Brahmaputra system. 2. The Peninsular rivers: These rivers are entirely fed by monsoon and often more or less dry in summer. They fall into two groups. a. the coastal rivers: these are relatively small streams, drain the western side of the Western Ghats, pass through the narrow plains and flow in to the Arabian sea. There are over 600 on the west coast from Gujarat in the north to Kanyakumari in the south. The inland rivers include the west flowing Narmada and Tapti and the east flowing Mahanadi, Godavari, Krishna and Kauvery (Murthy *et al.*, 1996).

Climate

Climate is one of the basic components in the natural environment. The Himalayan ranges act as a great climatic divide. They obstruct the south west monsoon winds to shed their moisture as heavy rainfall along the submountain areas north of the Indo Gangetic plains and as snowfall on the further north. It also obstructs the direct entry of extreme continental winds from Tibet Plateau into India, so that up to 30° north, the plains experience warmer climate in winter whereas, other parts of the world at the same latitude experience cold winters. The Peninsular India is flanked by the Bay of Bengal on the east, Arabian Sea on the west and the Indian Ocean on the south. The Peninsula is also flanked by Western Ghats along the west coast

and Eastern Ghats along the east coast. These two mountain ranges play a significant role in ensuring rains on their windward slopes (Murthy *et al.*, 1996).

India's climate is affected by two seasonal winds, the south-west monsoon and north-east monsoon. The south-west monsoon (summer monsoon) blows from the sea to land, whereas the north-east monsoon (winter monsoon) blows from land to sea. Though India is often referred to as a tropical country, half of it is in the tropics and half in the North Temperate Zone. But there is some form of unity in the climatic conditions. This is due to the influence of the Himalayas and the monsoons. The climate may be broadly described as tropical monsoon type. Four seasons found in India are: 1. summer or pre monsoon 2. monsoon 3. post monsoon 4. Winter (Murthy *et al.*, *l.c.*). Temperature, rainfall and humidity are the chief climatic factors.

Temperature

In India, the mean annual temperature exceeds 24°C, except in hilly areas and the extreme North West. The latitude, altitude, humidity, winds *etc.* have influence on the temperature. Hill stations, coastal areas and plateau regions have differing temperature conditions. The hill stations have the lowest temperature averaging between 15.7°C and 16.9°C. In coastal areas, on the west coast has an average temperature of 30.5°C (Mumbai) while on the east coast goes up to 33.4°C (Chennai). In the plateau, Nagpur registers an average of 35.5°C (Murthy *et al.*, *l.c.*)

Rainfall

The south west monsoon and the north east monsoon bring good rains into India. It varies from place to place. There are four broad climatic regions based on rainfall. 1. Areas like the west coast lying at the foothills of the Western Ghats, Assam gets the heaviest rainfall over 200 cm annually. 2. States like Maharashtra, Madhya Pradesh and Bihar along the Vindhyan mountains receive 100–200 cm rainfall. 3. South coastal plains, north western Deccan and the upper Gangetic plain have 50–100 cm rainfall. 4. Rajasthan desert, extending to Kutch, the high Ladak plateau in Kashmir constituting the arid zone receive only nominal rainfall of 15 cm annually. Thus in India about 30% of the country receives 15–80 cm, 40% area gets 80–120 cm, 20% area gets 120–200 cm and only 10% area receives over 200 cm of annual rainfall (Murthy *et al.*, 1996).

According to Thornthwaite (1933), there are 5 humidity zones in India based on total monthly precipitation and total monthly evaporation ratio (P/E ratio). They are pre-humid (P/E ratio > 128), humid (P/E ratio 64–127), sub-humid (P/E ratio 32–63), semiarid (P/E ratio 16–31) and arid zones (P/E ratio < 16). The present account is based on Murthy *et al.* (*l.c.*) and Venu *et al.* (1996).

Distribution and Ecology

The genus *Osbeckia* is distributed from tropical Africa, south and south-east Asia to northern Australia (Hansen, 1977). Most of the Indian species are found in southern Western Ghats region and North eastern Himalayan Mountains. About 56% of Indian taxa are distributed in southern

Western Ghats region and 44% taxa are distributed in north eastern Himalayan mountains.

Among the 27 taxa in India, 17 (62%) are endemic (Table-1). The endemic taxa include *O. abrahamii*, *O. travancorica*, *O. wightiana*, *O. brachystemon*, *O. capitata*, *O. gracilis*, *O. leschenaultiana*, *O. mehrana*, *O. muralis*, *O. nayarii*, *O. nutans*, *O. nepalensis*, *O. parvifolia*, *O. reticulata*, *O. tirunelvelica* and *O. wynaadensis*. In India the highest distribution is reported in South India (14 species) followed by north eastern India (11 species). State wise, Kerala possesses the maximum diversity with 14 species (60%) followed by Tamil Nadu and Meghalaya with 8 species (34%) each.

Majority of *Osbeckia* species in India occur in high altitudes (1000-2700 m) but a few like *O. muralis*, *O. chinensis*, and *O. zeylanica* are present in low lands also. The genus occurs in wide range of habitats. Species such as *O. reticulata*, *O. leschenaultiana* and *O. brachystemon* occur on the margins of shola forests of Eravikulam and Anamudi National Parks. *O. wynaadensis* and *O. nepalensis* thrive best in swampy habitats. While *O. capitata* and *O. nayarii* distributed in grasslands of north east Himalaya; *O. mehrana*, *O. gracilis* and *O. wightiana* distributed in grasslands of southern western Ghats.

Table 1: *Osbeckia* L.- Taxonomic status and distribution

Sl. No.	Name	Status	Area of endemism
1	<i>O. abrahamii</i> G.S.Giri & M.P.Nayar	Endemic	Southern, Western Ghats
2	<i>O. aspera</i> (L.) Blume	Endemic	South India
3	<i>O. travancorica</i> Bedd. ex Gamble	Endemic	Southern, Western Ghats

4	<i>O. wightiana</i> (Benth.) Wight & Arn.	Endemic	South India
5	<i>O. brachystemon</i> Naudin	Endemic	South India
6	<i>O. capitata</i> D.Don ex Wight & Arn.	Endemic	North East Himalaya
7	<i>O. chinensis</i> L.	—	Peninsular India and North east Himalaya
8	<i>O. chinensis</i> L. var. <i>pusilla</i> (Zoll.) Triana	—	Andaman Islands
9	<i>O. gracilis</i> Bedd.	Endemic	South India
10	<i>O. leschenaultiana</i> DC.	Endemic	South India
11	<i>O. Mehrana</i> G.S.Giri & M.P.Nayar	Endemic	Western Ghats
12	<i>O. Muralis</i> Naudin	Endemic	South India
13	<i>O. nayari</i> G.S.Giri	Endemic	Meghalaya , Tamil Nadu
14	<i>O. nepalensis</i> Hook.	—	North East Himalaya
15	<i>O. nepalensis</i> var. <i>albiflora</i> Lindl.	—	North East Himalaya
16	<i>O. nutans</i> Wall. ex C.B.Clarke	Endemic	North East Himalaya
17	<i>O. parvifolia</i> Arn.	Endemic	South India
18	<i>O. reticulata</i> Bedd.	Endemic	South India
19	<i>O. saddlepeakensis</i> Prashob, Manudev, Sibichen & Nampy	Endemic	North Andaman
20	<i>O. stellata</i> Buch.-Ham. ex D.Don var. <i>stellata</i>	—	North East Himalaya
21	<i>O. stellata</i> Buch.-Ham. ex D.Don var. <i>hispidissima</i>	—	North East Himalaya
22	<i>O. stellata</i> Buch.-Ham. ex D.Don var. <i>crinita</i>	—	North East Himalaya
23	<i>O. rostrata</i> D.Don	—	North East Himalaya
24	<i>O. tirunelvelica</i> Murugan & Manickam ex Kottaim. & Gnanasek.	Endemic	South India
25	<i>O. virgata</i> D.Don ex Wight & Arn.	—	South India
26	<i>O. wynaadensis</i> C.B.Clarke	Endemic	South India
27	<i>O. zeylanica</i> L.f.	—	South India

I. Taxonomy

Linnaeus (1753) described the genus *Osbeckia* for the specimens brought by Pehr Osbeck from Canton in China to Sweden (Hansen, 1972; Hansen & Fox Maule, 1973). The name '*Osbeckia*' was coined by Linnaeus in honour of Pehr Osbeck (1723-1805) and published in *Species Plantarum*. Linnaeus (*l.c.*) placed *Osbeckia chinensis* as the second genus under Octandria-Monogynia and treated *Kadali maderaspatanum* and *Echinophora maderaspatana* as synonyms of *O. chinensis*. Among these, *Kadali maderaspatanum* is a nomenclatural synonym of *Echinophora maderaspatana*. After the death of his father, Linnaeus *f.* (1781) published *O. zeylanica* in *Supplementum Plantarum* based on the specimens sent by Koenig, and merged *E. maderaspatana* to *O. zeylanica* when he published this species. Hansen (*l.c.*) observed three specimens of *E. maderaspatana* in the Plukenet volumes of the Sloane Herbarium (Plukenet, 1692) in the British Natural History Museum, and verified that they are all *O. zeylanica*. Moreover, he determined that these were the specimens used by Plukenet for the illustration of *E. maderaspatana* and also admitted undoubtedly that *E. maderaspatana* is a synonym of *O. zeylanica*.

Linnaeus in the draft of his *Species Plantarum* (1746), treated *E. maderaspatana* as a synonym of *Rhexia foliis integerrimis fructo hispido calycibus hispidis*. Again in his draft of *Species Plantarum* (1751-52) it is treated as a synonym of the same *Rhexia*, named as *Rhexia indica* in the margin. While publishing the final draft of *Species Plantarum* in June 1752, Linnaeus had the conviction that *R. indica* and *E. maderaspatana* are one and the same and he

treated *E. maderaspatna* as the synonym of *O. chinensis*. But the name *Rhexia indica* has been deleted from the list of synonyms. Hansen (1972) shared his view that though Linnaeus had seen the specimens of both *O. zeylanica* and *E. maderaspatana* the two distinct species, he had retained *E. maderaspatana* as the synonym of *O. chinensis* in his various editions of *Species Plantarum* and *Systema Vegetabile*.

Hansen (*l.c*) states that Lamarck (1792) was the first to recognize the true position of *E. maderaspatana* and he distinguished *O. zeylanica* based on Plukenet's figure and *O. Chinensis* on the basis of Osbeck (1757). Lamarck omitted synonyms and references in his text, and Willdenow (1799) was the first to enter *E. maderaspatana* as a synonym of *O. zeylanica*.

Hooker (1822) in his *Exotic Flora* described the new species, *O. nepalensis* where, he notes that there are only two species of *Osbeckia viz.*, *O. chinensis* and *O. zeylanica* appear to have been known, until Sir James Smith described five additional species in Rees's *Cycliopaedia*. Buchanan-Hamilton (1822) described *O. stellata* in *Botanical Register* and noticed that numerous samples of the species collected by Wallich are found in Lambert's Herbarium. Don (1825) described *O. rostrata* in *Prodromus florum Nepalensis* in addition to the five other species of *Osbeckia* in Nepal. Five more new species of *Osbeckia viz.*, *O. leschenaultiana*, *O. manillana*, *O. repens*, *O. chulesis* and *O. octandra* were published by Candolle (1828) in *Prodromus Systematis Naturalis Regni Vegetabilis*. Blume (1831) published the species *O. aspera* in *Flora*.

Bentham listed a few species in the Numerical list of dried specimens by Wallich (1831) *viz.*, *O. capitata*, *O. crinita*, *O. pulchella* and *O. wightiana*. All are *nomen nudum*. Wight and Arnott (1834) treated 7 species of *Osbeckia* in *Prodromus Florae Peninsulae Indiae Orientalis* and validated the names *O.*

virgata, *O. truncata* and *O. cupularis* published by D. Don. Arnott (1837) published *O. parvifolia* in *Companion to the Botanical Magazine* along with six other species.

Naudin (1850) reported 37 species of *Osbeckia* including 16 new species in *Annales des Sciences Naturelles Botanique*. Among these, 25 species were from India. In the same year (1850), Wight described *O. hispidissima* in *Icones Plantarum Indiae Orientalis*.

Beddome (1864) described 2 South Indian species *viz.*, *O. reticulata* and *O. gracilis* in *Madras Journal of Literature and Science*. The invalid publication of *O. travancorica* by Beddome was later validated by Gamble (1919). He also made special attention to the South Indian species and published three species *viz.* *O. lineolata*, *O. courtallensis* and *O. lawsoni* (Gamble, 1919).

Triana (1871) included 32 species under 4 sections and Clarke (1879) enumerated 26 species under 4 sections and published the species *O. wynaadensis* and validated the name *O. nutans* in Hooker's *Flora of British India*. Cogniaux (1891) enumerated 51 species. His classification is considered as the most comprehensive for the family Melastomataceae and is the basis for many taxonomic studies on the family.

Hansen (1977) published a monograph of the genus wherein, he dealt with 46 taxa, 31 species and 15 varieties in Asia. His work was largely based on the dried specimens housed at various herbaria in the world.

As part of Flora of India Project, Giri (1983), Giri and Nayar (1983, 1984 and 1986) made remarkable contributions to the taxonomy of the genus *Osbeckia* in India. They described 5 species and one variety *viz.* *O. abrahamii*,

O. arunkumarensis, *O. mehrana*, *O. darjeelingensis*, *O. nayarii* and *O. lineolata* Gamble var. *anamalayana*. Manickam and Murugan (2002) described *O. tirunelvelica* from southern Western Ghats. Recently Prashob *et al.* (2018) described *O. saddlepeakensis* from Andaman and Nicobar Islands.

Despite scattered treatments in different local and regional floras and papers by various authors like Prain (1903), Rama Rao (1914), Gamble (1919), Nicolson and Saldanha (1976), Manilal and Sivarajan (1982), Matthew (1982, 1999), Ramachandran and Nair (1988), Henry *et al.* (1989), Mohanan and Henry (1994), Sasidharan and Sivarajan (1996), Pullaiah and Chennaiah (1997), Manickam *et al.* (2003) and Sasidharan (2004), there is no commendable revisionary work on *Osbeckia* in India after *Flora of British India* (Clarke, 1879).

II. Anatomy

Anatomical information on the genus *Osbeckia* is scanty. Feissly (1964) provided anatomical data on indumentum of the calyx tube of a few African genera of the tribe Osbeckieae. The anatomical descriptions of the leaves of the Melastomataceae by Gottschall (1900), Palezieux (1899) and Pflaum (1897) are considered as classical. Solereder (1899 & 1908) and Metcalfe and Chalk (1950) summarized the data available on leaf anatomy. Anatomical study by Mentink and Baas (1992) demonstrated that leaf anatomy of the subfamily Melastomatoideae and most of its individual tribes are very heterogeneous, while that of the subfamilies Astronioideae, Crypteroniaceae and Memecylaceae are relatively homogeneous. Metcalfe and Chalk (*l.c.*) reported that the petiole in cross section shows an arc of xylem completely surrounded by phloem and the same structure is noticed

in accessory vascular bundles also. Howard (1979) emphasized the significance of anatomical structure of the petiole in identifying certain taxa.

The leaf anatomy of Melastomataceae was studied by Baumgratz (1980, 1989-1990), Baumgratz and Ferreira (1980, 1984), Hansen (1980, 1982, 1985a-d), Hansen and Wickens (1981), Jacques-Felix and Leuenberger (1980), Jacques-Felix *et al.* (1978), Judd (1986, 1989), Karatela and Gill (1988), Keating (1984), Maxwell (1980, 1982), Morley (1953, 1976, 1989), Nayar (1974), Renner (1989), Todzia and Almeda (1991), Weber (1982) and Winkler (1964, 1965).

The variations in shape, size and nature of epidermal trichomes are important parameters in the identification of the genera as well as species of Melastomataceae. The occurrence of simple trichome is very rare in Melastomataceae (Metcalf & Chalk, 1950). Wurdack (1986) made an extensive SEM study on hairs of the neotropical taxa of the family and Baas (1981) recorded stomatal types and cell inclusions in leaves. Klucking (1989) explored the pattern of leaf venation in the family. Solereder (1920), Schnell (1966, 1967), Costa (1977), Almeda (1989), Pemberton and Turner (1989), Brouwer and Clifford (1990) and Gregory (1990) investigated domatia. Rao (1957), Rao and Dakshni (1963), Rao and Bhattacharya (1977), Rao and Jacques-Felix (1978) and Rao *et al.* (1980, 1983) studied foliar sclereids in Melastomataceae. A survey of wood anatomy of Melastomataceae has been attempted by Vliet (1981), Vliet *et al.* (1981) and Welle and Koek-Noorman (1981).

Claudia *et al.* (2004) studied the petiole and leaf vascularisation of 22 species of Melastomataceae. The study revealed that the venation is acrodromous for all representatives and also certain characters such as the

type of the areola, the relationship between the number of primary and secondary ribs, the type of venation of the last marginal vein and organization of the network of ribs are useful in the delimitation of the tribes and genera studied. The anatomical study of petiole also revealed that certain aspects such as the contour of the lamina, the distribution of vascular bundles and epidermal characteristics, provide information helpful for the delimitation of the genera. Studies of Wurdack (1986), Mentink and Baas (1992), Guimarães and Martins (1997) and Milanez (2007) utilized the diversity of trichomes in identification and differentiation of various genera and species under Melastomataceae. Taxonomic significance of crystals and stomata (Baas, 1981) and sclereids (Rao *et al.*, 1980) are also been reported. It needs special mention that, studies related to anatomical plasticity show that members of Melastomataceae exhibit variation in anatomy in tune with altitudinal variation and environmental conditions (Gardoni *et al.*, 2007; Boeger *et al.*, 2008; Ribeiro *et al.*, 2010).

III. Cytology

Karyomorphology is an important element in evaluating the relationship and deducing phylogeny in angiosperms (Raven, 1975). Changes in chromosome number and morphology may be rapid even within a genus (Stebbins, 1966), and the data derived from the field are potentially useful in plant taxonomy for delimiting species. Thus the diversity of chromosome number and their relative constancy within population and species constitutes an important tool in taxonomic segregation.

Karyological details of the genus *Osbeckia* has been studied by various authors. Meenakumari and Kuriachan (1990) made significant contributions in this regard by investigating 12 Indian species of *Osbeckia*. The results

show that 10 taxa viz., *O. aspera*, *O. travancorica*, *O. wightiana*, *O. brachystemon*, *O. leschenaultiana*, *O. mehrana*, *O. miner*, *O. muralis*, *O. octandra* and *O. reticulata* have the basic chromosome number ($n=10$); *O. virgata* ($n=11$); and *O. wynaadensis* ($n=12$). Almeda (1997) suggested that a detailed cytotaxonomic survey of *Osbeckia stellata* complex is obviously needed because reports on chromosome number of this species varies from $n=10$ (Malla *et al.*, 1975); to $n=19$ (Bir *et al.*, 1980; Gill *et al.*, 1984), or $n=20$ (Sandhu and Mann, 1988). If all of these reports are correct *O. stellata* complex may consist of diploids, tetraploids, and descending aneuploid derivatives of the latter. Similar chromosomal variation has been noticed in *O. nepalensis* Hook. As per Favarger (1962) $n=19$; and $n=20$ according to Mehra (1976) and Mehra & Khosla (1969). Chromosome counts have been reported for 18 other taxa of *Osbeckia*. Fifteen of them have $n=10$ (Favarger, 1952; Mangenot & Mangenot, 1962; Mehra & Khosla, 1969; Mehra, 1976; Solt & Wurdack, 1980; Meenakumari & Kuriachan, 1990). Two other species viz., *O. virgata* D. Don ex. Wight & Arn. and *O. wynaadensis* C.B. Clarke, are aneuploids with $n=11$ and $n=12$, respectively (Meenakumari & Kuriachan, 1990). *Osbeckia parvifolia* Arn. (including *O. rosea* Fyson sensu Hansen, 1977), has populations with $2n=20$ and $2n=40$ (Subramanyam, 1946). The diploid population was reported as *O. parvifolia* whereas, the tetraploid population was reported as *O. rosea*. Based on available chromosome counts it seems that the basic chromosome number of *Osbeckia* is 10 (Almeda, 1997).

IV. Palynology

Pollen grains are of considerable taxonomic significance not only in the differentiation of subfamilies and tribes but also of genera and species of several dicot families (Bailey & Nast, 1943). In melastomataceae pollen

grains are three-celled at the time of anthesis (Cronquist, 1981; Tobe & Raven, 1983). The number of cells in the pollen is referred widely in articles on the embryology of the family Melastomataceae by (Subramanyam, 1942, 1944, 1946, 1948). Subramanyam (1942) reported one-celled pollen in *Leandra cordifolia* and two-celled pollen in *Memecylon heyneanum*. In 1944 Subramanyam reported three-celled pollen in *Sonerila wallichii*, another member of Melastomataceae. Again in 1946 the same situation is reported in *Osbeckia octandra*, *O. zeylanica*, *O. truncata* and *O. rosea*. Three celled condition is also reported in *Melastoma malabathricum* in 1948. Brewbaker (1967) studied the number of cells in the pollen of angiosperms and reported three-celled pollen in *Sonerila*, *Osbeckia*, and *Melastoma*. On the contrary, Tobe and Raven (1984) reported that pollen of Melastomataceae is not three-celled, as reported previously, but two-celled. Two-celled mature pollen is characteristic of the order Myrtales.

V. Pollination Biology

Melastomataceae is characterized by buzz pollination. Buchmann (1983) and Renner (1989) opined two aspects of the buzz pollination syndrome that have received little empirical consideration in this family. First, the anthers in the family are typically bright yellow in colour, which mimics abundant pollen even when they are empty. This has been interpreted as a deceptive adaptation because insects must visit the flowers to determine whether they are rewarding (Vogel, 1978; Buchmann, *l.c.*). Second, Melastomatacean flowers commonly undergo a colour change after anthesis (Renner, 1989; Weiss, 1995). Floral colour change in flowering plants has been hypothesized to increase the efficiency of pollinator foraging and pollen transfer (Gori, 1983, 1989) and the maintenance of flowers that

have undergone a color change is thought to increase floral display size and thus visitation rates (Cruzan *et.al.*, 1988; Gori, 1989; Weiss, 1991)

VI. Embryology

Guha and Maheshwari (1964) and Bhojwani and Bhatnagar (1978, 1999) emphasized that embryological characters are useful in delimiting plant groups. The characters such as the anther, quadripartition of the microspore mother cell, development and organisation of the pollen grain, development and structure of the ovule, origin and extent of the sporogenous tissue in the ovule, megasporogenesis and development of the embryo sac, form and organisation of the mature embryo sac, fertilization, endosperm, embryo and seed-coat are of immense significance in taxonomy.

Literature is scanty with regard to the embryological features of Melastomataceae, *Osbeckia* in particular. Melastomataceae is characterized by the bitegmic ovules and zig-zag micropylar pore. Subramanyam (1942) discovered Onagrad type of embryo development is in *O. cupularis*, *O. hispidissima* and *O. wightiana* and nucellar polyembryony in *O. hispidissima*. The micropylar megaspore of the tetrad develops into four nucleate embryo sac in *O. rosea* (Subramanyam, 1946).

VII. Molecular Taxonomy

The most modern approach in Systematics is the analysis of molecular and morphological data of the taxa under study (Bremer & Struwe, 1992). Despite several modifications that have been proposed in recent phylogenetic analysis by Renner (1993), Clausen & Renner (2001), Fritsch *et al.* (2004) and Michelangeli *et al.* (2004), Cogniaux's (1891)

classification remains as the most comprehensive and constituted the basis for many taxonomic or systematic study conducted later.

Clausing and Renner (2001) made remarkable contribution to the molecular phylogenetics of Melastomataceae and character evolution. They analyzed parsimony and maximum likelihood (ML) of cpDNA sequences from the *rbcL* and *ndhF* genes and the *rpl16* intron, generated for eight outgroups and 54 species of Melastomataceae. The sample represents 42 members of the family's currently recognized 150 genera, the 13 traditional tribes, and the three subfamilies *viz.*, Astronioideae, Melastomatoideae, and Memecyloideae. Parsimony and ML yield congruent topologies that place Memecylaceae as sister to Melastomataceae. *Pternandra*, a Southeast Asian genus with 15 species, of which five were sampled, is the first branching Melastomataceae. This placement has low bootstrap support (72%), but agrees with morphological treatments that placed *Pternandra* in Melastomataceae because of its acrodromal leaf venation, usually ranked as a tribe or subfamily.

Recently Michelangeli *et al.* (2013) studied the phylogenetic relationships and distribution of New World Melastomeae. In total, 236 species, including outgroups (Miconieae and Merianieae) and representatives of the Microlicieae and Rhexieae, were sequenced for (nrITS), and *accD-psaI* and *psbK-psbL*. In this study Melastomataceae is not found as monophyletic but as a group of mostly herbs and small trees with mostly tetramerous flowers, nested between Rhexieae and Microlicieae. Therefore, new World Melastomeae is not resolved as monophyletic, but it is an assemblage of Old World genera like *Melastoma*, *Osbeckia*, *Tristemma* and allied genera nested in the tribe.

VIII. Phytochemistry

The genus *Osbeckia* consists of many species with interesting phytochemical properties. They have been widely used in traditional medicine and also as constituents in bitters and similar concoctions. *Osbeckia chinensis* contains flavonoids such as kaempferol, rutin, quercetin and ellagic acid; tannins like punicalcorcin and casuarin having good antioxidant potential (Su *et al.*, 1987, 1988; Thabrew *et al.*, 1995, 1998), hepatoprotective properties (Grayer *et al.*, 2008), immunomodulatory (Nicholl *et al.*, 2001), hypoglycemic and anti-hyperglycemic properties (Syiem & Khup, 2006). *Osbeckia parvifolia*, a species widely distributed in South India is used to treat inflammation (Anonymous, 1952; Krishnan *et al.*, 1985; Nadkarni, 1994; Rashtravardhana, 2006).

Murugan and Parimelazhagan (2013) studied the free radical scavenging and anti-inflammatory activities of *Osbeckia parvifolia* by Soxhlet and fractionation extraction. The study revealed that *Osbeckia parvifolia* has high content of total phenols, flavonoids and tannins. Also noticed that Soxhlet methanol extract has higher anti-radical property compared to the extract obtained by solvent extraction method.

Anthocyanin diversity in *Osbeckia* species has been studied by Bosco and Murugan, (2016) and reported remarkable variation in anthocyanin content in leaves and flowers among species. Highest content was noticed in *O. aspera* (L.) var. *wightiana* and *O. reticulata*.

IX. Medicinal property

A few species of *Osbeckia* are potential source of many drugs. The decoction preparing from the roots of *O. chinensis* is used as a remedy for variety of ailments including diabetes mellitus (Syiem & Khup, 2006). The crude extract of *O. aspera* (L) Blume, is traditionally used to treat liver diseases (Renee & Grayer, 2008). Similarly, *O. octandra* is used against jaundice and liver disorders (Thabrew *et al.*, 1995). The methanolic extract of *O. wynaadensis* is used against microbial activity (Sujina & Ravi, 2012). The studies revealed that petroleum ether extract of *O. stellata* exhibits better antimicrobial activities in comparison with ethanol extract (Suman & Anjeza, 2013). Moreover, petroleum ether extract was very effective against the fungus *Aspergillus niger* and bacteria like *Escherichia coli*, *Proteus vulgaris* and *Staphylococcus aureus*. Petroleum ether extract shows better antioxidant activity by scavenging DPPH free radical. Perera *et al.* (2013) identified the antiglycation effect, antioxidant activity and the high phenolic content of *Osbeckia octandra*.

The materials for the present study are collected from different parts of India by conducting field trips during the period 2014–2018. About 287 days were spent in the field as part of 84 field trips and 26 taxa of *Osbeckia* were collected. Except North East endemics, all other members were maintained in the Botanical Garden of St. Joseph's college, (Autonomous) Devagiri, Calicut for future studies (Appendix- VII). Besides the personal collection by the author, specimens deposited at various herbaria viz. ASSAM, ARUN, BSD, BSI, BSHC, CAL, CALI, DD, DEV, DUH, FRLH, JCB, MH, RHT, TBGT, KFRI, SUK, XCH and herbarium of North Bengal University, Sikkim Forest Department herbarium are also examined to study the variation, ecology and distribution (Details of herbaria consulted is provided as Appendix-III). The digital images of types obtained from BM, BR, B-W, C, E, G, G-DC, HAL, JE, K, K-W, L, LINN, P, S, S-G, U, US, W, WA and WU virtual herbaria were also consulted. Acronyms of herbaria are cited in accordance with Index Herbariorum (Thiers, 2018). Four hundred and thirty eight populations were studied in the field and about 850 herbarium specimens were consulted, including type images available in virtual herbaria.

Specimens were critically examined both in the field as well as in the laboratory. Photographs of floral parts and flower as whole were recorded in the field itself owing to their deliquescent nature. Data sheets were prepared for each population studied. The data covered information on habitat, habit, root system, shoot system carrying stem, leaves, inflorescence, details of flower and floral parts, hypanthium, emergences and hairs and also other

features that are not faithfully represented in herbarium specimens. A model of data sheet used is provided as Appendix IV. Ecological notes on each taxa are provided as part of taxonomic treatment.

Identification of each species is done in consultation with types and protologues. In the case of non availability of type specimens, cibachromes, microfisches and images obtained from K, US, BM, BR, C, G, L, and P are consulted. Detailed morphological studies are done using all the available materials and variations are recorded. Descriptions of each taxon are prepared after proper determination and examination of a wide range of specimens. Observations are done under Leica EZ4 HD 75 Stereo Microscope. Dried specimens soaked in water for 1–2 hours and boiled in water prior to microscopic observations. Photographs are taken using Leica EZ4HD Stereo Microscope.

Literature and significant information related to the taxa under study are obtained from various sources such as institutional libraries and online information retrieval systems. The literature retrieval systems of Biodiversity Heritage Library of New York Botanical garden (<http://www.biodiversityheritagelibrary.org>), and Missouri Botanical garden library (<http://www.botanicus.org>) were also utilized. International Plant Name Index (IPNI) available online (<http://www.ipni.org>), has been followed for citations of taxa. Database of Missouri Botanic Garden (www.theplantlist.org) and World checklist of Selected Plant Families, The database of Royal Botanic Garden Kew (<http://apps.kew.org>) were also utilized. The nomenclature of each species was updated as per the Shenzhen Code (Turland *et al.*, 2018). Name of authors were cited in corroboration with Brummitt and Powell (1992) and IPNI. For description of taxa, the

terminology followed Lawrence (1951), Radford and Bell (1968), Stearn (1983) and Simpson (2010). The distribution maps are prepared on the basis of specimens collected and examined during the present investigation. Metric system has been followed in all kinds of measurements. Data on phenology is mostly from field studies and exceptionally from the literature and herbarium sheets.

Morphometric analysis

Morphometric analysis of 27 Indian taxa was performed with NTSYS software. A total of 37 characters were selected for the cluster analysis of each species. Data collected from the field, herbaria as well as the experimental garden were used for the morphometric analysis is discussed in chapter 7.

Anatomy

Anatomical study of leaf and stem was conducted in almost all species using fresh samples collected from the field and wet preserved specimens. The detailed methodology used for anatomical studies is discussed in chapter 8.

The species of *Osbeckia* are annual or perennial herbs, or small to large shrubs very rarely woody when old. Members are usually erect. Prostrate habit is observed only in two or three cases. Plants vary in height from 5 to 650 cm. Young stems are more or less quadrangular in outline. The leaves are opposite, acrodromously veined and isophyllous. Stems and leaves are covered with hairs, bristles and emergences.

Flowers are primarily arranged in cymes which may be few to many flowered. The cymes may be solitary or arranged as paniculate inflorescence. Cymes are long in many species sometimes remaining short, resulting in a dense cluster of flowers. Flowers are either tetramerous or pentamerous. Occasionally tetramerous and pentamerous flowers occur in the same taxa.

Ovary is inferior, seen adnate to the hypanthium. Hypanthium may be campanulate, urceolate, globose or obconic. The vestiture of the hypanthium is very variable and often unique because of the presence of "emergences". Emergences are vascularised projections of tissue on the hypanthium. The emergences are terete, stalked which may be flat and scale-like. Sepals and intersepalar emergences arise from the rim of the hypanthium.

Stamens are 8 or 10, isomorphic, fall off after anthesis. Anthers are embedded in anther pockets while in the bud stage. The filaments are more or less flat, pink or purple in colour. Anthers are yellow, cells mostly united at the apex into a single tube forming a short to long beak.



Figure 2. Genus *Osbeckia* L. General morphology

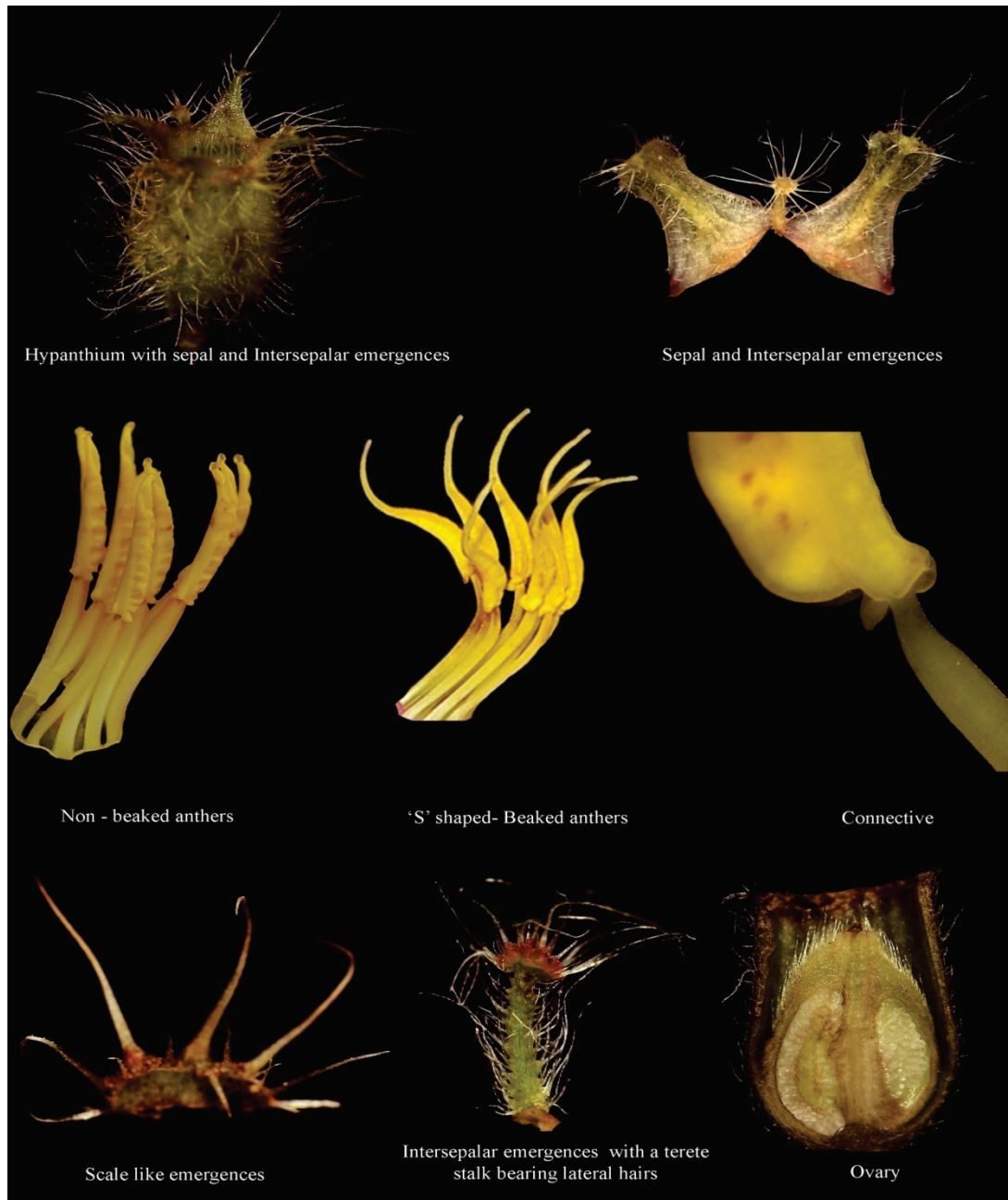


Figure 3. Genus *Osbeckia* L. General morphology

The ovary is 4 or 5 loculed. The placenta protrudes from the axils of the locules as compressed, longitudinally furrowed bars, carrying the ovules on the distal, widened part. The capsular fruit consists of ovary and hypanthium. The capsule may be campanulate, urceolate, obconic or globose in shape.

Osbeckia L.

Osbeckia L., Sp. Pl. 345. 1753; L.f., Suppl. Pl. 215. 1782; Hook., Exot. Fl. 1(2): 31. 1822; Buch.-Ham., Bot. Reg. 8: 674. 1822; D. Don., Prodr. Fl. Nepal. 221. 1825; A.DC., Prodr. 3: 142. 1828., Blume., Flora 14: 474. 1831; Wallich., Numer. List. 4072. 1831; Wight & Arn., Prodr. Fl. Ind. Orient. 1: 323. 1834; Arn., Companion Bot. Mag. 2: 308. 1837; Naudin, Ann. Sci. Nat., Bot. Ser. 3, 14: 56. 1850; Bedd., Madras J. Lit. Sci. Ser. 3, 1864; Triana, Trans. Linn. Soc. London 28: 53. 1871; C.B. Clarke in Hook. f., Fl. Brit. India 2(6): 513. 1879; Cogn. in A.DC. & C.DC., Monogr. Phan.. 7: 311. 1891; Gamble, Fl. Pres. Madras 1: 489. 1919; C. Hansen, Ginkgoana 4: 84. 1977; Jie & S. Renner., Fl. China 13: 361. 2007. **Type:** – *Osbeckia chinensis* L.

Katoukadalai Rheede, Hortus Malabaricus. 43. 91. 1493. (*nom. illeg.*)

Kadali Adans., Fam. Pl. (Adanson) 2: 234. 1763 (*nom. illeg.*)

Echinophora Adans., Fam. 2: 234. 1763. (*pro. syn.*)

Kadalia Raf., Sylv. Tellur. 101. 1838. (*nom. rej.*)

Amblyanthera Blume, Mus. Bot. 1(4): 50. 1849. **Type:** – *A. truncata* Blume

Asterostoma Blume, Mus. Bot. 1(4): 50. 1849. **Type:** – *A. aspera* Blume

Ceramicalyx Blume, Mus. Bot. 1(4): 50. 1849. **Type:** – *C. stellatus* Blume

Annual or perennial herbs or shrubs, erect, procumbent, much branched, rarely un-branched, 0.3—7.5 m tall. Young stems sub-quadrangular to quadrangular, very rarely winged at angles, covered with thin to dense hairs or bristles hairs brown or purple, short to long, appressed to patent, straight or curved, rarely bulbous, sometimes shaggy, very rarely glabrous or hairy at nodes only. Leaves simple, opposite, petiolate rarely sessile; petioles 1–15 mm long; lamina ovate to elliptic, or narrowly ovate to

lanceolate, 1–15 × 0.5–9 cm; 3–5 or 5–7-nerved, venation acrodromous, very rarely non acrodromous; apex acute, attenuate or very rarely acuminate; base obtuse to attenuate, subcordate, or sometimes cordate; margins entire, ciliate; glabrous on both sides or only above, or much more often with a thin or rarely dense indumentum of hairs, ascending or appressed or patent. Inflorescence terminal, consisting of few to many flowers, arranged in dense clusters in cyme or such cymes in a panicle, subtended by 1 or 2 pairs of leaves, occasionally solitary in upper leaf axils. Flowers bracteate, pedicellate, actinomorphic, 4 or 5-merous; bracts ovate, triangular or orbicular, 1–17 mm long, margins ciliate, glabrous or with few to many appressed hairs; pedicel 0.5–5 mm long. Hypanthium urceolate, campanulate, obconic or globose, 2–14 × 1–7 mm, thinly to densely clothed with appressed to patent emergences or hairs or both. Intersepal emergences 0.5–7 mm long, terete, glabrous or with few to many patent hairs, rarely appressed hairy, head stellate or with few hairs; other emergences similar, but smaller, size decreases towards base, restricted to the upper or lower part of the hypanthium; hairs patent, rarely reflexed, ascending or appressed, short to long, sometimes bristly, often curved, rarely bulbous. Sepals triangular, ovate, oblong or subulate, 1–14 × 1–7 mm, apex obtuse, acute, rarely asymmetrical, often resembling the head of the stellate emergences, with few indistinct nerves, or with a single distinct, prominent nerve, glabrous dorsally, or with few to many, patent hairs mostly confined to nerve, caducous or persistent. Petals obovate, elliptic or orbicular, 5–29 × 2–18 mm. with various shades of purple, white, white tinged with pink, ciliate at least on apical part of margin, caducous. Stamens 8 or 10, equal; filaments 2.5–15 mm long; anthers narrowly ovate, 4–17 mm long including beak of 2–7 mm, yellow, beaked or not, twisted or not, pore 1

or 2, on ventral side at the apex; connective widened into a variously shaped collar-like body surrounding the insertion of the filament immediately below the anther sacs. Ovary 4 or 5 celled, adnate to hypanthium for about half the length, deep anther pockets present or absent, crown present or absent; style 2–25 mm long, glabrous, stigma capitate. Capsule urceolate, campanulate, obconic or globose, 3–19 × 2–10 mm. Seeds minute, numerous, curved, 0.1–0.5 mm long.

Ecology and Habitat:—The members are found to occur in a wide variety of habitats such as evergreen forests, sholas, forest margins, mountains, grasslands as well as rock crevices and marshy swamps in higher altitudes.

Flowering and Fruiting:—July – January.

Distribution:—Africa, Australia, Bangladesh, China, India, Nepal, Bhutan, Myanmar, Thailand, and Sri Lanka.

Intrageneric classification of the genus was first attempted by Naudin (1850) in his *Annales des Sciences Naturelles Botanique*. He recognized five groups under the genus *viz.* *Macrodesmiae*, *Antierotoma*, *Arrhinae*, *Oxyrhinae* and *Amphibolium*, exclusively based on the floral characters. However, he did not indicate the rank of these infrageneric groups hence these groups cannot be taken as sections according to the latest code of botanical nomenclature (Turland *et al.*, 2018).

Later, Triana (1871) in his treatment of *Osbeckia* in *Transactions of the Linnaean Society* included 32 species under 4 sections *viz.* *Amblyanthera*, *Genuinae*, *Ceramicalyx* and *Asterostoma*. Triana considered floral characters such as number of petals, shape of anther and beak of anther for his sectional classification.

Clarke (1879) followed Triana (*l.c.*) and enumerated 26 species under 4 sections *viz.* *Amblyanthera*, *Genuinae*, *Ceramicalyx* and *Asterostoma*.

Cogniaux (1891) systematically revised the infrageneric classification of the genus *Osbeckia* to include 51 species, in his monographic treatment of Melastomataceae and recognized 6 sections, *viz.* *Asterostoma*, *Arrhinae*, *Genuinae*, *Ceramicalyx*, *Antherotoma* and *Pseudodissotis*.

In the present treatment the sectional classification of Triana is adopted with trivial modifications. The whole Indian taxa are grouped under 4 sections. A key to the sections is given as follows:

Key to the sections of *Osbeckia*

- 1a. Flowers tetramerous.....2
- 1b. Flowers pentamerous..... Sect. *Asterostoma*
- 2a. Anthers not beaked..... Sect. *Amblyanthera*
- 2b. Anthers beaked3
- 3a. Plants herb; hypanthium campanulate, neck absent..... Sect. *Osbeckia*
- 3b. Plants shrub; hypanthium urceolate, neck present Sect. *Ceramicalyx*

The section *Amblyanthera* is established by Triana (1871) to accommodate species having tetramerous flowers and anthers without beak. He has included 3 species viz., *O. truncata*, *O. brachystemon* and *O. parvifolia* under this section. Clarke (1879) followed Triana (*l.c.*) and included 4 species namely, *O. truncata*, *O. cupularis*, *O. parvifolia* and *O. rheedii* under this section of which, *O. cupularis* is a synonym of *O. parvifolia* and *O. rheedii* is a native of Sri Lanka. Naudin (1850) included 7 species under the section *Arrhinae* including the above 4 species. Among them, *O. confertiflora* is a synonym of *O. parvifolia* and *O. australiana* is a native of Australia. However, *O. australiana* is pentamerous and not satisfying the sectional characteristics. Cogniaux (1981) followed Naudin and included two more species viz. *O. gracilis* and *O. madagascariensis*. *O. gracilis* is pentamerous unlike other members. In the present treatment the author admitted the section *Amblyanthera* (Triana, *l.c.*) as it is supported by the type *Amblyanthera truncata* and the members satisfy the sectional characters whereas, the section *Arrhinae* (Naudin, *l.c.*) is not supported by type and also the members are not satisfying sectional characters. In India, the section *Amblyanthera* consists of 4 species including the new taxa described recently.

Species belong to Sect. Amblyanthera *O. brachystemon* Naudin, *O. muralis* Naudin, *O. saddlepeakensis* Prashob *et al.* and *O. parvifolia* Arn.

Osbeckia Sect. Amblyanthera Triana, Trans. Linn. Soc., London 28: 53. 1871;

C.B. Clarke in Hook.f., Fl. Brit. India, 2(6): 514. 1879. **Type:**—
Amblyanthera truncata Blume

Arrhinae, Naudin, Ann. Sci. Nat. Bot. ser. 3. 14: 56. 1850; Cogn. in A.DC. & C.DC., Monogr. Phan. 7: 313: 1891.

Annual herbs; flowers tetra merous; anthers without beak; hypanthium campanulate/ obconic with emergences and hairs.

Distribution:—Distributed mainly along wet tropical and subtropical Asia including India and Sri Lanka.

Key to the species of Sect. *Amblyanthera*

- 1a. Anthers truncate at apex..... 2
- 1b. Anthers not truncate at apex..... 3
- 2a. Petals purple; bracts ciliate *O. muralis*
- 2b. Petals white tinged with pink; bracts densely hairy *O. brachystemon*
- 3a. Hypanthium obconic with emergences only on the lower half; sepals elliptic *O. saddlepeakensis*
- 3b. Hypanthium globose with emergences throughout; sepals triangular *O. parvifolia*

Osbeckia brachystemon Naudin, Ann. Sci. Nat. Bot. Ser. 3, 14: 57. 1850; C. Hansen, Ginkgoana 4: 100. 1977; Manilal, Fl. Silent Valley 111. 1988; Subram., Fl. Thenmala Div. 141. 1995; Sasidh., Fl. Shenduruny WLS 130. 1997; Sasidh., Fl. Periyar 144. 1998; Mohanan & Sivad., Fl. Agasthyamala 278. 2002; **Type:**—India, Tamil Nadu, Nilgiris (as Nelligery), 1840, *M. Perrottet* 189 (P02441103 image!).

Osbeckia cupularis D. Don ex Wight & Arn., Prodr. 323. 1834. C.B. Clarke in Hook. f., Fl. Brit. India 2: 514. 1879; Gamble, Fl. Pres. Madras 1: 494. 1919. (*pro parte*). **Figs. 4 & 5.**

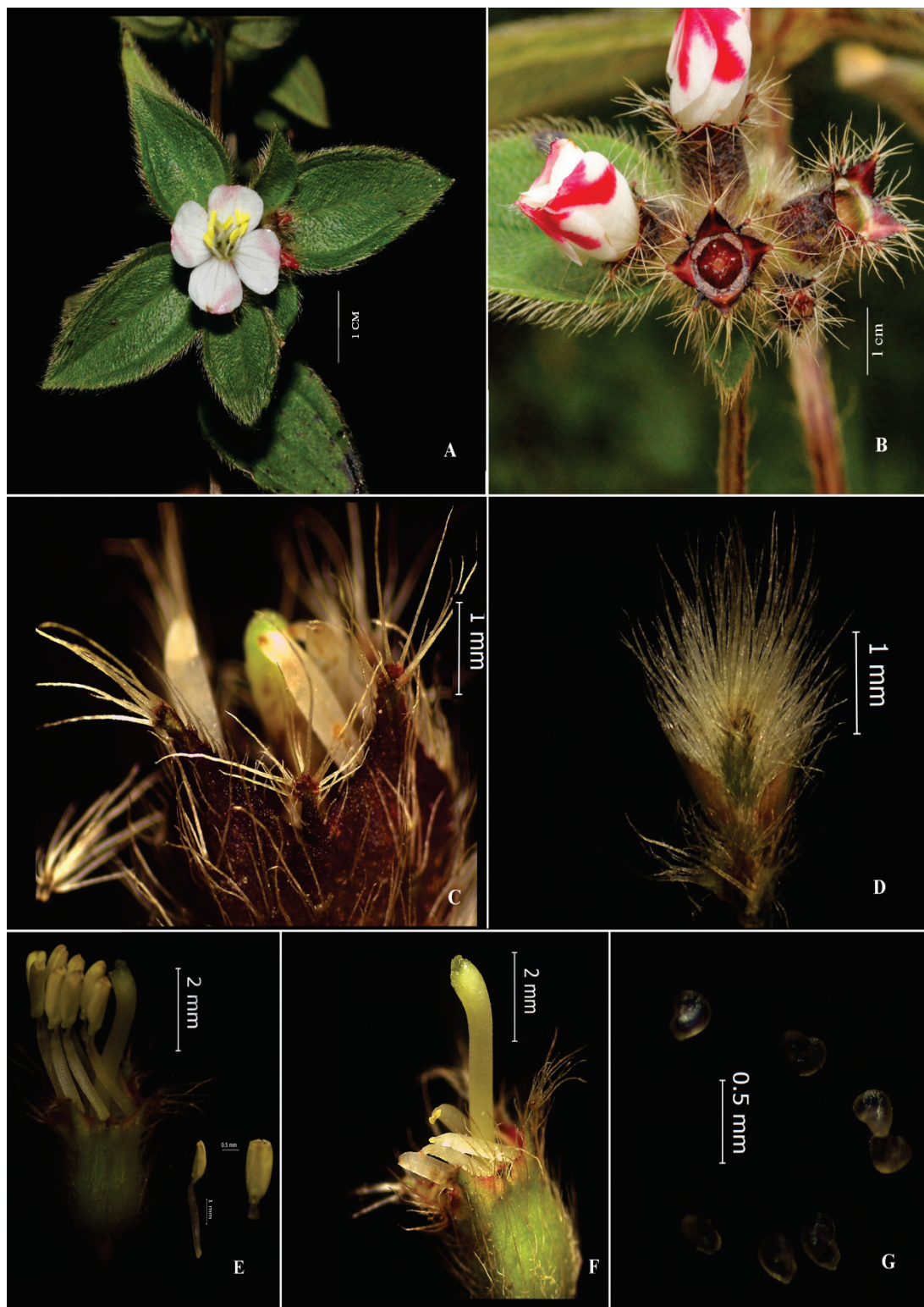


Figure 4. *Osbeckia brachystemon* Naudin: **A.** Habit; **B.** Inflorescence; **C.** Sepal & Intersepalar emergences; **D.** Bract; **E.** Stamens in hypanthium; **F.** Gynoecium; **G.** Seeds.

Annual, erect, branched herbs, 10–65 cm tall, generally having profuse short branches at the base. Stems covered with appressed, long, thin hairs. Leaves simple, opposite and petiolate; petioles 1–4 mm long; lamina ovate, 2.2–4.5 × 1.5–2.5 cm, apex acute to broadly acute or acuminate, base obtuse, margins ciliate, 3 – 5-nerved, both sides with patent, thin and long hairs. Inflorescence a terminal cluster of panicle, 5–9-flowered, subtended by the upper 1 or 2 pairs of leaves. Flowers tetramerous, pedicellate, bracteate; bracts green, narrowly ovate, 1–2.5 × 0.5–1.5 mm long, densely hairy; pedicels 1–1.5 mm long. Hypanthium campanulate, 3–7 × 2–5 mm, thinly clothed with hairs and stellate emergences; intersepalar emergences stalked, 0.5–2 mm long, stalk with patent short hairs, head stellate with long bristles; other emergences few, occurring only on the uppermost part of the hypanthium, hairs patent, light brown, long and thin. Sepals 4, persistent in fruit, triangular to attenuate, 1.2–3 mm long, 1-nerved, ciliate, tip stellate with long hairs, hairy on nerves. Petals 4, obovate, 4–8 mm long, white tinged with pink, ciliate at apex. Stamens 8; filaments 2–3 mm long, white, glabrous; anthers oblong, 1–1.5 mm long, yellow, not twisted, not beaked, pores one or two, oblique on dorsal side; connective prolonged into a small collar. Ovary united with hypanthium for about half of its length; anther pockets absent; crown absent, clothed with bristles around base of style; style 3.5–5 mm long, glabrous. Capsules campanulate, slightly ribbed, 4–4.5 × 3–4 mm; seeds minute, 0.1–0.2 mm long, curved, muricate.





Figure 5. Holotype of *Osbeckia brachystemon* Naudin: [M. Perrottet 189 (P02441103)] © The Board of Trustees of *Muséum national d'Histoire naturelle* (MNHN - Paris, France).

Chromosome Number:— $n = 10$ (Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—August–November.

Ecology and Habitat:— Seen mostly on borders of evergreen forests and grass lands at an altitude above 500 m. Like *O. muralis*, this species is also seen as large clusters. The associated species are *O. virgata* and *O. parvifolia*.

Notes:—*Osbeckia brachystemon* is often confused with *O. parvifolia*, because of their similarity. They share more or less the same habit and habitat. Both are small herbs occur in altitudes above 500 m and also seen together. However, the former can be distinguished from the later in having white flowers with pink blotches and 2-pored short anthers as opposed to pink to purple flowers and single pored long anthers.

Distribution:— Kerala and Tamil Nadu.

Specimens examined:—**Kerala.** Idukki Dist., Anamudi shola N.P., 08.11.14, Prashob & Sibichen 5552 (DEV); *ibid.*, Methap, 08.11.14, Prashob & Sibichen 5555 (DEV); Devikulam, 12.1910, A. Meebold 171757 (CAL); Eravikulam N.P., Petimudi, 23.08.14, Prashob & Sibichen 5528 (DEV); on the way to Edamalakudi, 23.08.2014, Prashob & Sibichen 5530 (DEV); Munnar, Lockhurt gap, 10.10.1963, K.M. Sebastine 17507 (CAL). Palakkad Dist., Silent Valley, Sispara, 12.10.14, Prashob & Sibichen 5537 (DEV); Silent Valley, Sispara, Anginda, 12.10.14, Prashob & Sibichen 5539 (DEV); Vengitapal, 12.10.14, Prashob & Sibichen 5540 (DEV). **Tamilnadu:** Coimbatore Dist., *S.loc.*, C.E.C. Fischer 171760 (CAL). Valparai, Anaimalais, 02.10.1984, K.M. Matthew 18314 (RHT). Dindigul Dist., Berijam slope, Kodaikanal, 06.08.1984, K.M. Matthew 40604 (RHT); Berijam Lake, Mathikettan range, 06.10.1994, V.S. Ramachandran 10333 (FRLH); Kodaikanal, 15.09.1956, J. Pallithanam 2135

(RHT); Leving path, Kodaikanal, 09.1955, K.M. Matthew 240 (RHT); Thoopithooki parai, Kodaikanal, 16.08.1987, K.M. Matthew 50254 (RHT); Pillar rocks, Kodaikanal, 13.08.1912, S.J. Manju 171749 (CAL); *ibid.*, 27.07.1965, K.M. Matthew 24555 (RHT); Upper Palani, 06.09.1911, C.E.C. Fischer 171756 (CAL); Vandaravu Marian shola, Kodaikanal, 29.08.1987, K.M. Matthew 50534 (RHT). Nilgiri Dist., *S.loc.*, 10.1910, A. Meebold 171755 (CAL); *S.loc.*, 08.1887, G. King 171761 (CAL); Cinchona plantation, 24.02.19707, A.A. Ansari 1005 (CAL); Coonoor, 08.1883, J.S. Gamble 171743 (CAL); Morley lake, 20.07.1948, V. Narayanaswami 2232 (CAL); Mukuruti N.P, 20.09.2006, K. Ravikumar, R. Murugan & Shyla 105175 (FRLH); Kotagiri- Aravenu, 22.10.1956, K. Subramanyam 1063 (CAL); Kodanad, 10.11.1970, E. Vajravelu 3815 (MH); Kunnacombai road, 01.09.1957, K.M. Sebastine 4205 (CAL); Way to Pykara, 12.09.1930, V. Narayanaswami 4216 (MH). Mullimund, 12.10.1972, K. Vivekananthan 42920 (MH); Naduvattam, 02.10.1956, N.P. Balakrishnan 141 (MH); Mettukal, 28.07.1990, V.B. Hosagondan 162905 (MH); Sholar, 26.08.1970, B.D. Sharma 35761 (MH); Parsons valley, Ooty, 10.07.1970, J.E. Ellis 34607 (MH).

Osbeckia muralis Naudin, Ann. Sci. Nat. Bot. Ser. 3. 14: 56. 1850; C. Hansen, Ginkgoana 4: 41. 1977; C.J. Saldanha, Fl. Karnataka. 42. 1984; Mohanan, Fl. Quilon Dist. 187. 1984; Ansari, Fl. Kasaragod Div. 165. 1985; J.L. Ellis, Fl. Nallamalais 187. 1987; Ramach. & V.J. Nair, Fl. Cannanore Dist. 187. 1988; Babu, Fl. Malappuram Dist. 257. 1990; Sasidh. *et al.*, Bot. Stud. Med. Pl. Kerala 18. 1996; Sasidh. & Sivaraj., Fl. Pl. Thrissur 190. 1996; Sivaraj. & Mathew, Fl. Nilambur 273. 1997; Pullaiah & Chennaiah, Fl. Andhra Pradesh 389. 1997; B.D. Sharma *et al.*, Fl. Maharashtra, Dicot. 28. 2000; Sasidh. Fl. Parambikulam WLS

129. 2002; S.R. Yadav & M.M. Sardesai, Fl. Kolhapur Dist. 196. 2002; T. Pullaiah *et al.*, Fl. Eastern Ghats 56. 2002. K.G. Bhat, Fl. Udupi 219. 2003; G.V.S. Rao & G.R. Kumari, Fl. Visakhapatnam Dist. Andhra Pradesh, 339. 2003; Anil Kumar *et al.*, Fl. Pathanamthitta 223. 2005; Sunil & Sivad., Fl. Alappuzha Dist. 296. 2009. *Osbeckia zeylanica* Steud. ex Naudin., Ann. Sci. Nat. Bot. ser. 3. 14: 56. 1850 (*pro syn.*) **Lectotype** (designated by Hansen, 1977):— India, Mangalore, R.F. Hohenacker 577 (P02441130 image!)

Osbeckia truncata D.Don ex Wight & Arn., Prodr. 332. 1834. *Osbeckia truncata* Arn., (*pro parte*) Companion Bot. Mag. 2: 308. 1837; C.B. Clarke in Hook. f., Fl. Brit. India 2: 514. 1879; Gamble, Fl. Pres. Madras 1: 494. 1919; Antony, Syst. Stud. Fl. Kottayam Dist. 167. 1989. *Amblyanthera truncata* Blume, Mus. Bot. 1(4): 50. 1849. (*nom. nud.*)

Osbeckia truncata var. *kurzii* C.B. Clarke in Hook.f., Fl. Brit. India 2: 514. 1879.

Type:— India. Bihar, Parasnath, top, *S.die*, Kurz *s.n.* (K000890021 image!). **Figs. 6 & 7.**

Annual, erect herbs, 5–55 cm tall, branched or not. Stem quadrangular, sparsely covered with patent thin hairs, laxly villous. Leaves petiolate; petiole 2–9 mm long; lamina elliptic to ovate, 1–4.5 × 0.8–2 cm, apex acute, base obtuse, margin ciliate, both sides thinly clothed with ascending to patent thin hairs, 3-nerved. Inflorescence terminal dense panicle, 6–15-flowered, subtended by 1 or 2 pairs of leaves, occasionally one or a few flowers arise from adjacent nodes. Flowers tetramerous, pedicellate, bracteolate; bracts triangular, 1.5–3 mm long, margins ciliate; pedicels 1–3

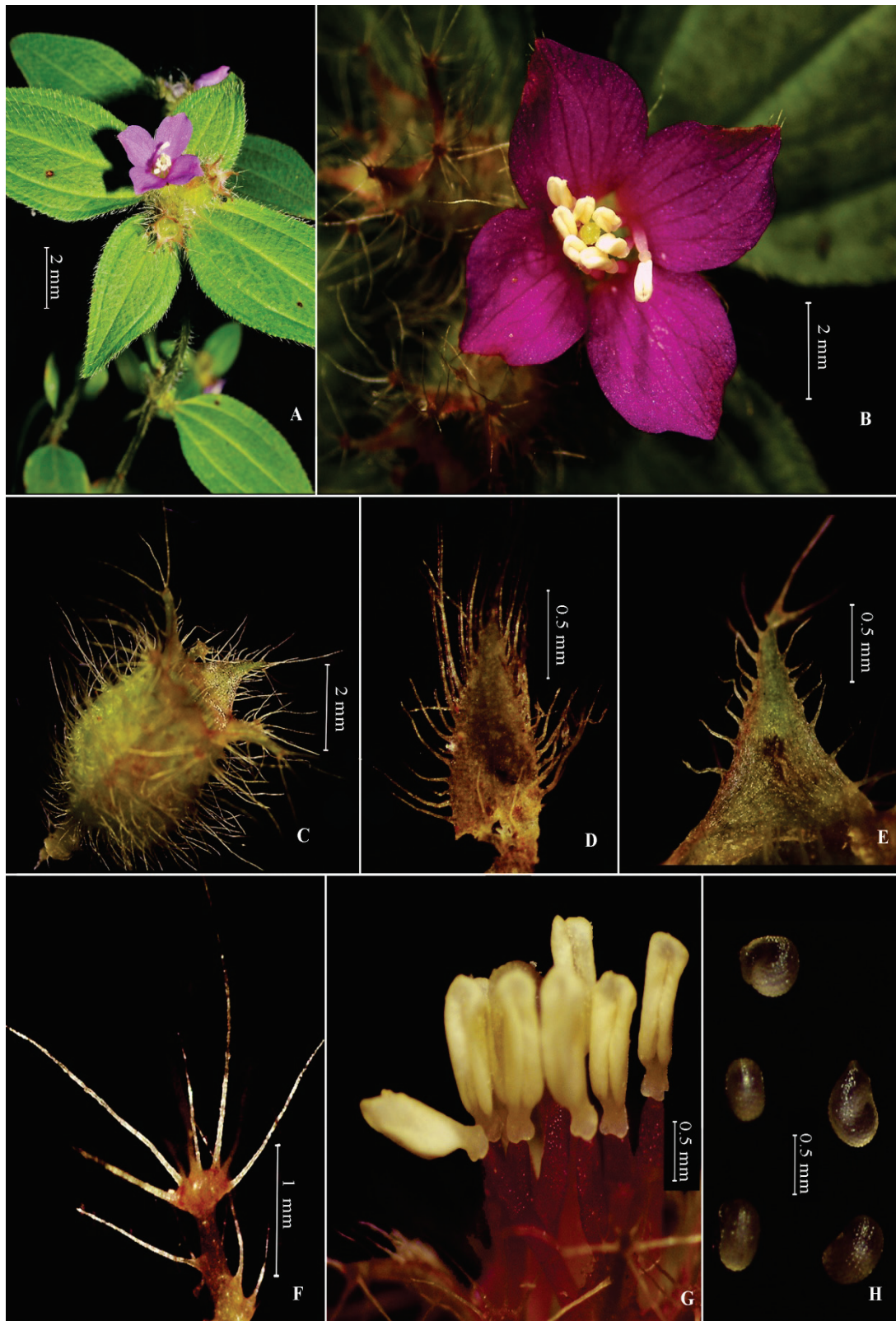


Figure 6. *Osbeckia muralis* Naudin: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Sepal; **F.** Intersepal emergence; **G.** Stamens; **H.** Seeds.

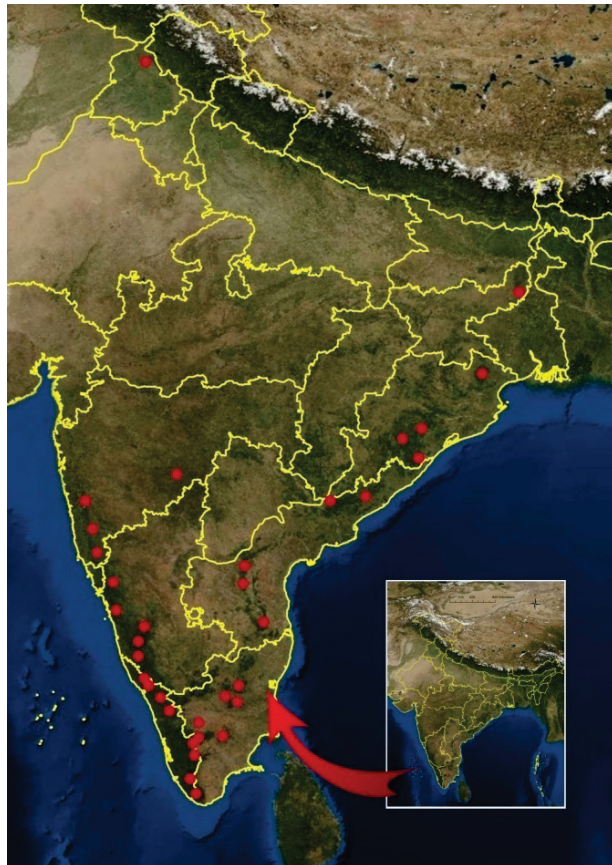


Figure 7. Lectotype of *Osbeckia muralis* Naudin: [R.F. Hohenacker 577 (P02441130)] © The Board of Trustees of Muséum national d'Histoire naturelle (MNHN - Paris, France).

mm long, covered with patent thin hairs. Hypanthium campanulate, 3–4.5 × 2–3.5 mm, sparsely covered with patent emergences and long hairs. Intersepal emergence stalked 0.5–1.5 mm long, stalk terete with patent hairs, head stellate with a few long persistent hairs. Other emergences similar, smaller in size towards base, or restricted to uppermost part of hypanthium. Sepals 4, broadly triangular, 0.5–2 mm long, 1-nerved, persistent in fruit, margins ciliate, apex with one to few patent hairs and sometimes emergences on nerves dorsally. Petals 4, broadly ovate, 4–6 × 3–4 mm, pink, with few hairs at apex. Stamens 8, isomorphic; filaments 1–2 mm long; anthers ovate-oblong, 2–4 mm long, yellow, glabrous, apex truncate not twisted, pore large, oblique on dorsal side, connective prolonged in to a small, slightly widened collar. Ovary united with hypanthium for about half its length, 1.5–2.5 mm long, 4-locular, anther pockets absent; crown absent, apically with many erect bristles; style 2–4 mm long, glabrous; stigma slightly widened. Capsule campanulate, ribbed, 3–4.5 × 2–3.5 mm; seeds numerous, 0.1–0.2 mm long, minute, curved.

Chromosome number:— $n=10$
(Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—July – December.



Ecology and Habitat:—Occurs as clumps in lateritic soil and in rock crevices. It appears on earth cuttings immediately after the monsoon. Being an annual herb, it appears by July and ends by December. It has been collected from altitudes ranging from 50 to 650 m.

Distribution:—Andhra Pradesh, Karnataka, Kerala, Maharashtra, Orissa, West Bengal and Uttarakhand.

Notes:—Considering the size of the plant *O. muralis* may be one of the smallest among the species, ranging from 5–55 cm tall, with small flowers. The species is often confused with *O. chinensis* var. *pusilla*. and the morphological similarities even lead to misidentification. However it can be distinguished from the latter by its thin patent hairs on the stem and considerably smaller flowers (4–8 mm diam.).

Specimens examined:—**Karnataka:** Mysore Dist., Hosuru Agumbe, 05.10.1962, R.S. Raghavan 83008 (CAL). Shimoga Dist., *S.loc.*, 26.09.1978, K.P. Sreenath & K.R. Keshava Moorthy 2910 (CAL). **Kerala:** Ernakulam Dist. Tripunithura, 10.10.1975, K.N. Subramanyam 5366 (CAL). Idukki Dist., Kattappana, 08.11.1981, R. Ramanujan & C.N. Mohanan 72426 (CAL); Kozhikannam, 11.11.1975, K. Viveakananthan 46629 (CAL). Kannur Dist., Karimbam, 16.11.1977, *S.call.* 52369 (CAL). Kollam Dist., Parackode, 11.08.1978, C.N. Mohanan 58464 (CAL). Kozhikode Dist., Medical College campus, 22.09.2014, Prashob & Sibichen 5946 (DEV); Thodayad, 21.09.2014, Sibichen & Prashob 5944 (DEV). Malappuram Dist., Calicut University campus, 17.07.1984, A. Babu 38296, (CAL). Palakkad Dist., Attapadi, South Malabar, 10.1910, C.E.C. Fischer 2305 (CAL); Kanjarampuzha, 26.10.1964, K.M. Sebastine 21074 (CAL). Pathanamthitta Dist., Punaloor, 24.08.1913, M. Ramaswami 1412 (CAL). Thrissur Dist., Chalakudi, 11.1910, A. Meebold

171884 (CAL); Edamadathara peak, 02.09.1913, C.C. Calder & S. Ramaswami 497 (CAL). Travancore, 09.1884, J.S. Gamble 14694 (CAL). **Maharashtra:** Pune Dist., Ambavne village, 29.12.1964, S.call. 101092 (CAL); Dalkhand forest, 15.10.1967, K.V. Billori 111878 (CAL); Malani forest, 26.10.1967, K.V. Billori 113026 (CAL); Jamboti, S.die., Nilesh V. Mulpure 2381 (SUK); Dajipur, S.die., Milind Sardesi s.n. (SUK). **Uttarakhand:** S.loc., 12.1869, G. King 171717 (CAL); Hindugragh, 11.1891, Prain 171724 (CAL). **West Bengal:** Jambalpur-Hatigirdha, 04.11.1986, S. Panda & A.P. Das 270 (CAL).

Osbeckia parvifolia Arn., Companion Bot. Mag. 2: 308. 1837; C.B. Clarke in Hook. f., Fl. Brit. India 2: 515. 1879; C. Hansen, Ginkgoana 4: 104. 1977; Ramach. & V.J. Nair, Fl. Cannanore Dist. 188. 1988; B.D. Sharma *et al.*, Fl. Maharashtra, Dicot. 28. 2000.; S.R. Yadav & M.M. Sardesai, Fl. Kolhapur Dist. 196. 2002. *Amblyanthera parvifolia* Blume, Mus. Bot. 1(4): 50. 1849. *Osbeckia cupularis* var. *parvifolia* (Arn.) Trim., J. Ceylon Branch Roy. Asiat. Soc. 9: 34. 1885. **Lectotype** (designated by Hansen, 1977):— Sri Lanka, Ceylon, S.die, Walker 332 (K000867959 image!).

Osbeckia cupularis D. Don ex Wight & Arn., Prodr. Fl. Indiae Orient. 1: 323. 1834 (*pro parte*).

Osbeckia confertiflora Naudin, Ann. Sci. Nat. Bot. ser. 3, 14: 59. 1850. **Type**:— India, Tamil Nadu, Nellore, S.die, Perrottet 235 (P02441140 image!).

Osbeckia erythrocephala Naudin, Ann. Sci. Nat. Bot. ser. 3, 14: 58. 1850. *Osbeckia cupularis* var. *erythrocephala* (Naudin) C.B. Clarke in Hook.f., Fl. Brit. India 2: 514. 1879. **Type**: — Sri Lanka, Ceylon, 1838, Macrae s.n. (P02441138 image!).

Osbeckia cupularis var. *purpurascens* Wawra, Itin. Princ. S. Coburgi 1: 33.1883.

Type:—Ceylon, Piselava, *S. die*, *H. Wawra* 1163 (W 0056490 image!).

Osbeckia rosea Fyson, J. Indian Bot. Soc. 11: 49. 1932. **Type:**—India, Tamil Nadu, Nilgiri, *S. die*, *Fyson* 5731 (not seen). **Figs. 8 & 9.**

Prostrate to erect, branched herbs, up to 30–90 cm tall. Stems quadrangular, brownish, with appressed or patent to slightly retrorse, long hairs. Leaves petiolate; petioles 3–6 mm long; lamina green, ovate, 1.5–6 × 0.8–3 cm, 3-nerved, apex acute to acuminate, base acute to broadly attenuate, both sides with ascending to patent, thin long hairs. Inflorescence a terminal loose cluster, 5–15-flowered, subtended by the upper 1 or 2 pairs of leaves; bracts ovate, 1.5–4 × 0.5–1.5 mm, green, ciliate. Flowers tetramerous or pentamerous, pedicellate; pedicels 1–5 mm long. Hypanthium globose, 2–5 × 1.4–4 mm, clothed with emergences and hairs; intersepal emergences 1–2 mm long, stalk slender, terete to slightly flattened, with a few patent hairs, head small, stellate with a few long purplish bristles, persistent; other emergences similar, patent, large on upper part and much reduced below; hairs patent, white to purplish. Sepals 4, triangular, 2–4 × 0.5–2 mm long, one nerved, margins ciliate with a few patent hairs on nerve, persistent. Petals 4, broadly obovate, 5–12 × 4–10 mm long, pink to purple, ciliate at apex. Stamens 8, filaments 2–5 mm long; anthers narrowly ovate, 2–3.5 mm long, pore slightly oblique on dorsal or ventral side, connective prolonged into a collar with a small dorsal lobe and a larger ventral lobe. Ovary united with hypanthium for about half of its length; anther pockets not extending to the base of ovary; crown ciliate; style 5–9 mm long. Capsules globose, 5–7 × 4.5–6.5 mm; seeds minute, 0.1–0.2 mm long, numerous, curved.



Figure 8. *Osbeckia parvifolia* Arn.: **A.** Habit; **B.** Flower; **C & D** Hypanthium; **E.** Sepal; **F&I.** Stamens; **G.** Intersepal emergence; **H.** Style; **J.** Seeds.



Figure 9. Lectotype of *Osbeckia parvifolia* Arn.: [Walker 332 (K000867959)] © The Board of Trustees of Royal Botanic Gardens, Kew.

Chromosome number:— $n=10$
(Subramanyam, 1946)

Flowering and Fruiting:—
August – March.

Ecology and Habitat:—Occurs
in forest margins, high altitude
open grasslands and tea
plantations.

Distribution:—Karnataka,
Kerala and Tamil Nadu.
Endemic.



Notes:—*Osbeckia parvifolia* closely resembles and often confuses with *O. brachystemon*. But it can be easily distinguished from *O. brachystemon* by its globose hypanthium.

Specimens examined:—**Karnataka:** Chikmagalur Dist., Tithkole, 19.10.1965, R.K. Arora 5080 (CAL); Kadur, 09.1893, W.A. Taecot 171759 (CAL); Kutheramukha, 16.03.1997, Ramesh, Udayan & Subramani 10220 (FRLHT); Kemmanaguddi, 05.09.1997, Ravikumar & Udayan 09643 (FRLHT); Kemmanaguddi, 29.09.1996, Devar 09463 (FRLHT); Bababudangiri, 03.03.2016, Prashob & Sibichen 6023 (DEV); Kemmanaguddi, 03.03.2016, Prashob & Sibichen 6024 (DEV). **Kerala:** Idukki Dist., Kadar, Munnar, 09.1937, Barnes 119542 (DD); Marapalam, 20.01.1957 K.M. Sebastine 2109 (CAL); Rajamala, 02.02.1970, B.V. Shetty 31787 (CAL). Thiruvananthapuram Dist., Kallar, 09.1037, Barnes 119539 (DD). Wayanad Dist., Tirunnelli, 16.11.1978, V.S. Ramachandran 17804 (CAL); Chembra, 08.12.2014, Prashob & Sibichen 5559 (DEV). **Tamil Nadu:** Coimbatore Dist., Sholayar submergible,

25.12.1963, K. Ramamurty 18097 (MH). Nilgiris Dist., Coonoor, 10.1910, Meebold 171754 (CAL); *ibid.*, S.die, J.S. Gamble 21380 (MH); *ibid.*, 18.11.1940, Brown 85986 (MH); Marapalam, Coonoor, 20.01.1957, K.M. Sebastine 2109 (MH); *ibid.*, 18.11.1940, Brown 85986 (MH); *ibid.*, Hulical Droog, 27.08.1957, K.M. Sebastine 4140 (CAL, MH); Gudalur, 09.1937, Barnes 119540 (DD); Kotagiri Avenue, 22.10.1956, K. Subramanyam 1063 (MH); Kengarai, Kotagiri, 25.01.1972, E. Vajravelu 39636 (MH); Naduvattam, 30.08.1970, B.D. Sharma 35929 (MH); Ooty, 09.1883, J.S. Gamble 12456 (DD); Gudalur light house, 10.1910, A. Meebold 172075 (CAL); Nilgiri, 10.1884, J.S. Gamble 172072 (CAL); Gudalur- Naduvattam Road, 17.11.1958, K.M. Sebastine 7313 (CAL, MH); Sholurmattam, 23.07.1970, E. Vajravelu 35058 (MH).

***Osbeckia saddlepeakensis* Prashob, Manudev, Sibichen & Nampy**,
Phytotaxa 344 (2): 185–190. **Type**:—India, North Andaman Islands:
Saddle Peak, 690 m alt., 29.09.2010, Santhosh Nampy & K.M. Manudev
3526 (holotype CAL, isotype CALI, DEV, MH). **Fig. 10.**

Annual, erect, branched herbs, 1.5–8 cm tall. Stems quadrangular, sparsely covered with patent thin hairs, laxly villous. Leaves petiolate; petiole 1–3 mm long; lamina ovate, 0.5–1.5 × 0.3–1 cm, apex acute, base obtuse, margin ciliate, both sides sparsely clothed with ascending to patent thin hairs, 3-nerved. Inflorescence a terminal short panicle, 3–5-flowered, subtended by 1 or 2 pairs of leaves. Flowers pedicellate, bracteate, tetramerous, 1–2 mm; pedicel 0.3–1.0 mm long, covered with thin hairs; bracts triangular, 0.3–0.8 mm long, ciliate. Hypanthium obconic, 1.8–2.5 × 1.5–2.3 mm, sparsely covered with emergences on lower portion, upper portion glabrous. Intersepal emergences 0.5–1.0 mm long; head stellate with a few long persistent hairs; stalk terete, 0.2–0.5 mm long, glabrous. Other emergences sessile, smaller in size, restricted to lowermost part of hypanthium. Sepals 4, lanceolate, 1.5–2.5 mm long, ciliate, caducous. Petals 4, obovate, 1.5–3.0 × 1–2

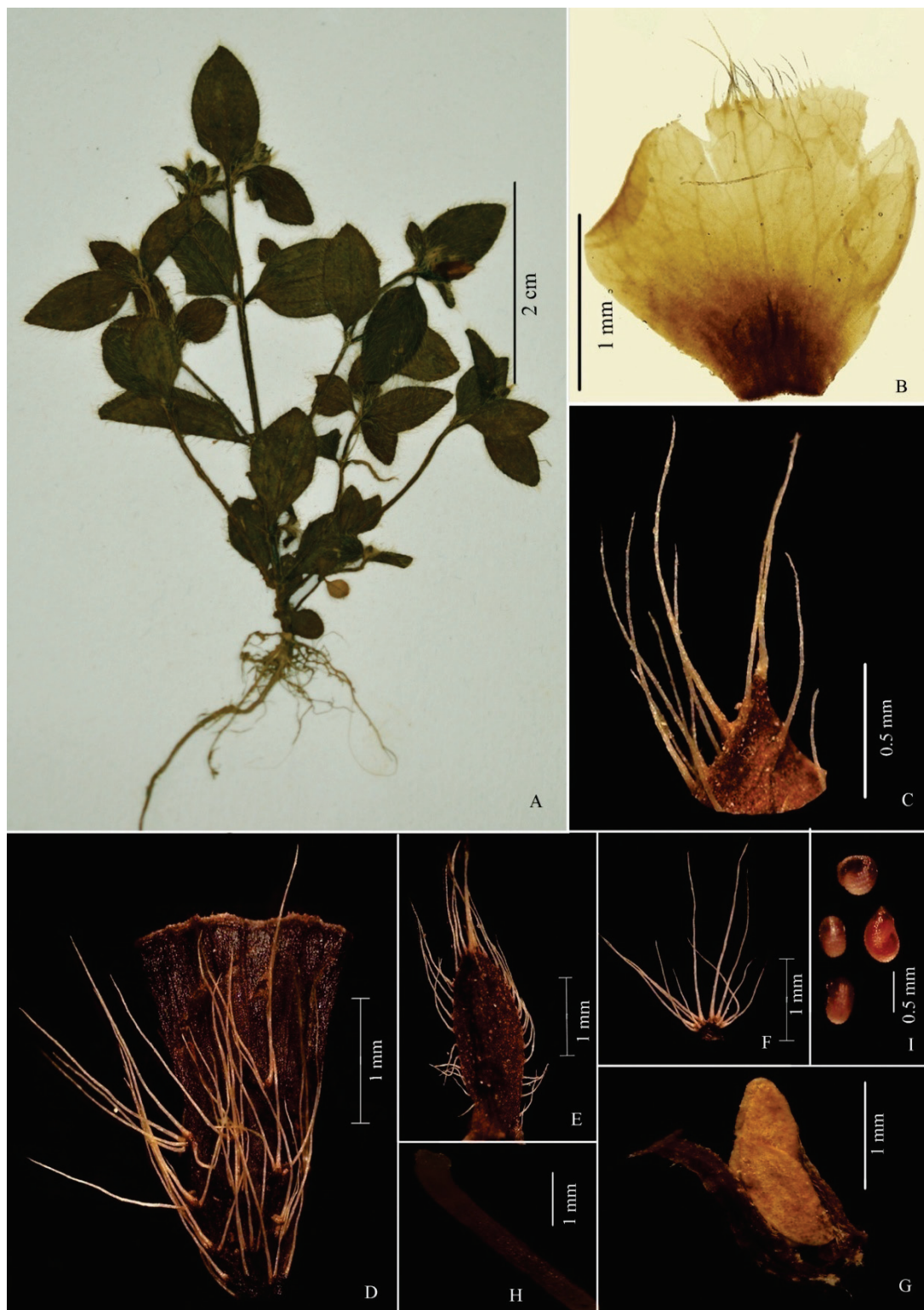


Figure 10. *Osbeckia saddlepeakensis* Prashob, Manudev, Sibichen & Nampy: **A.** Habit; **B.** Petal; **C.** Bract; **D.** Hypanthium; **E.** Sepal; **F.** Intersepal emergence; **G.** Stamen; **H.** Style; **I.** Seeds.

mm, with few hairs at apex, pink. Stamens 8; filaments 2–2.5 mm long, pink; anthers ovate, 1–2 mm long, glabrous, acute at apex, not twisted; pore single, oblique on dorsal side, connective with conspicuous collar having two small dorsal lobes or tubercles and two ventral lobes. Ovary 4–locular, 1.8–1.5 mm long, united with hypanthium for about half its length; anther pockets present; crown absent; style 2–4 mm long, glabrous; stigma capitate. Capsule obconic, 4-ribbed, 1.8–2.5 × 1.5–2.3 mm, many seeded; seeds 0.2–0.5 mm long, minute, curved.

Flowering and Fruiting:—

August – November.

Ecology and Habitat:—Hitherto known only from type locality. It grows as a forest under growth at an elevation of 650–700 m.

Distribution:— Andaman and Nicobar Islands. Endemic.

Notes:—The species is named after the type locality ‘Saddle



Peak’, the highest peak in Andaman and Nicobar Islands. *Osbeckia saddlepeakensis* is similar to *O. muralis* and *O. brachystemon*, but differs by its small flowers (2–4.5 mm across), triangular bracts, obconic hypanthium with emergences on basal portion only, short stalked intersepal emergences, lanceolate and ciliate sepals and oblong to narrowly ovoid anthers with a single apical pore.

The section *Asterostoma* is established by Triana (1871) and treated 19 species under the section. Earlier Naudin (1850) placed most of these species under two sections *viz.*, *Oxyrhinae* and *Amphibolium*. The sections composed of species with tetramerous and pentamerous flowers. Triana merged these two sections together after eliminating the tetramerous members. Clarke (1879) admitted Triana's classification and treated 14 species under the section. Cogniaux (1891) also followed the same sectional classification and accommodated 23 species under the section *Asterostoma*. The members are all perennial shrubs and one woody shrub, *O. reticulata*.

The section *Asterostoma* is characterized by species having pentamerous flowers and campanulate hypanthium with emergences and hairs. Currently this section consists of 13 species and 1 variety in India.

Species belong to Sect. *Asterostoma*: *O. abrahamii* G.S. Giri & M.P. Nayar, *O. aspera* (L) Blume, *O. gracilis* Bedd., *O. leschenaultiana* DC., *O. mehrana* G. S. Giri & M. P.Nayar, *O. nepalensis* Hook., *O. nepalensis* Hook. var. *albiflora* Lindl., *O. nutans* Wall. ex C.B. Clarke, *O. reticulata* Bedd., *O. tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek., *O. travancorica* Bedd. ex Gamble, *O. virgata* D. Don ex Wight & Arn., *O. wightiana* (Benth.) Wight & Arn. and *O. wynaadensis* C.B. Clarke

Osbeckia* Sect. *Asterostoma Triana, Trans. Linn. Soc, London 28: 54. 1871; C.B. Clarke in Hook. f., Fl. Brit. India 2(6): 518. 1879; Cogn. in A.DC. & C.DC., Monogr. Phan. 7: 313: 1891. **Type:**—*Asterostoma aspera* Blume

Oxyrhinae Naudin, Ann. Sci. Nat. Bot. Ser. 3. 14: 60. 1850.

Amphibolium Naudin, Ann. Sci. Nat. Bot. Ser. 3. 14: 74. 1850.

Perennial, erect, shrubs. Flowers pentamerous; hypanthium campanulate with emergences and hairs; anthers attenuate, straight, not beaked.

Distribution:—Mainly along wet tropical and subtropical Asia including India, China, Sri Lanka, Nepal, and Bhutan.

Key to the species of Sect. *Asterostoma*

- 1a. Hypanthium with simple hairs only, emergences and bristles absent.....2
- 1b. Hypanthium with simple hairs, emergences and bristles4
- 2a. Hairs (on hypanthium) with a bullate base, lamina turns yellow when dried*O. gracilis*
- 2b. Hairs (on hypanthium) without a bullate base, lamina not turns yellow when dried3
- 3a. Sepals subulate; Intersepalmer emergences stalked, with terminal and lateral hairs *O. tirunelvelica*
- 3b. Sepals triangular; Intersepalmer emergences sessile, with hairs at apex only.... *O. aspera*
- 4a. Hypanthium clothed with large scale like emergences only5
- 4b. Hypanthium clothed with stellate headed emergences.....7
- 5a. Leaves small (4 × 1 cm); panicle 2–3-flowered; sepals exceeding hypanthium *O. nutans*

- 5b. Leaves large (8 × 3 cm); panicle 8–12-flowered; sepals not exceeding
hypanthium6
- 6a. Lamina sessile, base truncate..... *O. nepalensis*
- 6b. Lamina petiolate; petiole 0.5–1.5 cm long, base obtuse.....
..... *O. wynaadensis*
- 7a. Branchlets pilose; leaves sessile, ascending; bracts orbicular.....
.....*O. leschenaultiana*
- 7b. Branchlets otherwise; leaves petiolate; bracts ovate to cordate 8
- 8a. Leaves 5–7-ribbed9
- 8b. Leaves 3–5-ribbed10
- 9a. Lamina bullate, densely hairy; base subcordate; venation acrodromous
..... *O. reticulata*
- 9b. Lamina not bullate; sparsely hairy; base obtuse; venation non-
acrodromous *O. wightiana*
- 10a. Inflorescence terminal cluster of cymes; lamina lanceolate *O. virgata*
- 10b. Inflorescence terminal panicle; lamina ovate to elliptic.....11
- 11a. Bracts ovate, woolly dorsally; sepals triangular*O. mehrana*
- 11b. Bracts cordate, not woolly; sepals not triangular.....12
- 12a. Calyx lobe symmetrical; branches sparsely hirsute.....*O. travancorica*
- 12b. Calyx lobe asymmetrical; branches densely strigose*O. abrahamii*

Osbeckia abrahamii G.S. Giri & M.P. Nayar, J. Bombay Nat. Hist. Soc. 81(2): 434. 1984. *Type*:—India, Kerala, Travancore, *S.die.*, *Narayanaswami* 1379 (CAL0000015606!). **Figs. 11 & 12.**

Perennial, erect shrubs, 1–1.5 m tall. Stems quadrangular, branched, densely strigose. Leaves petiolate; petioles 5–15 mm long; lamina elliptic to lanceolate, green, 10–16 × 3–5 cm, 5-nerved, apex acute, base attenuate, both sides thinly clothed with short stiff subappressed to ascending hairs, hairs on the nerve longer. Inflorescence terminal or axillary lax, panicles, 7–17-flowered. Flowers pentamerous, pedicellate, bracteolate and pentamerous; pedicels 1–3 mm long, covered with patent thin hairs; bracts ovate to cordate, 1.5–4 × 2–6 mm, green, broader than long, margin ciliate, appressed hairy above, glabrous beneath. Hypanthium campanulate, 4.5–7.5 × 3.5–6.5 mm, densely clothed with stellate or stalked emergences, intermixed with bristles and brown hairs; intersepalary emergences stalked, 1–3 mm long, stalk terete, with patent hairs, head stellate with tuft of hairs, caducous; other emergences smaller. Sepals 5, subulate, asymmetric, 1.5–3.5 × 2.5–4.5 mm, broader than longer, with a prominent midrib having patent hairs dorsally; margin ciliate; apex with stellate emergences, caducous. Petals 5, obovate, 15–20 × 11–14 mm, pink. Stamens 10; filaments 5–8 mm long, glabrous; anthers narrowly ovate to oblong, 5.5–7 mm long, yellow, twisted, glabrous, pore apical large, oblique on dorsal side; connective prolonged in to a small, indistinctly lobed collar. Ovary 4–7 mm long, united with hypanthium; anther pockets covered with brownish appressed hairs; crown absent; style 15–19 mm long, glabrous, curved; stigma slightly swollen. Capsules broadly urceolate, 7–9.5 × 4–5.5 mm; seeds numerous, minute, 0.1–0.2 mm long, curved.

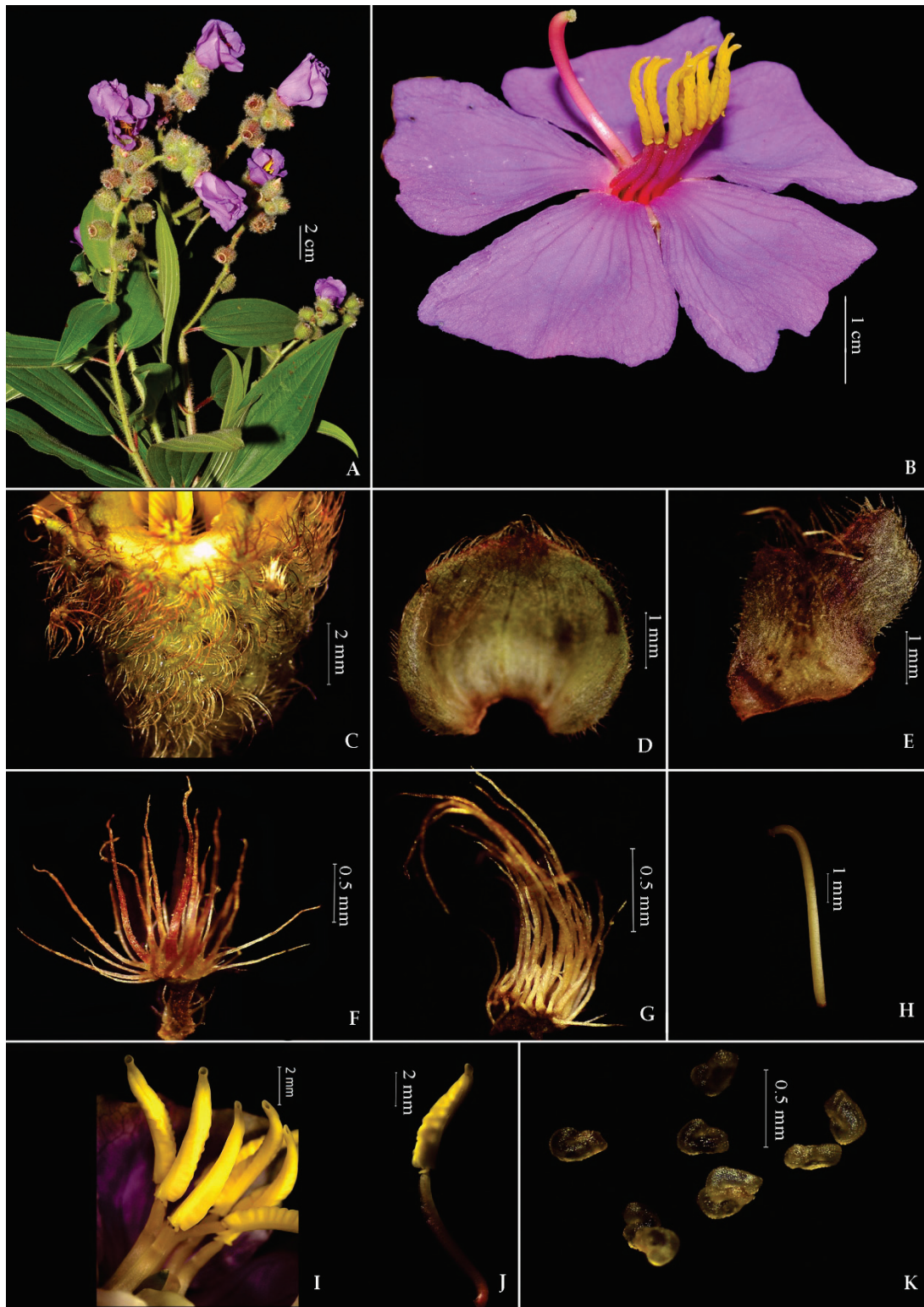


Figure 11. *Osbeckia abrahamii* G.S. Giri & M.P. Nayar: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Sepal; **F.** Intersepal emergence; **G.** Other emergence; **H.** Style; **I & J** Stamens; **K.** Seeds.

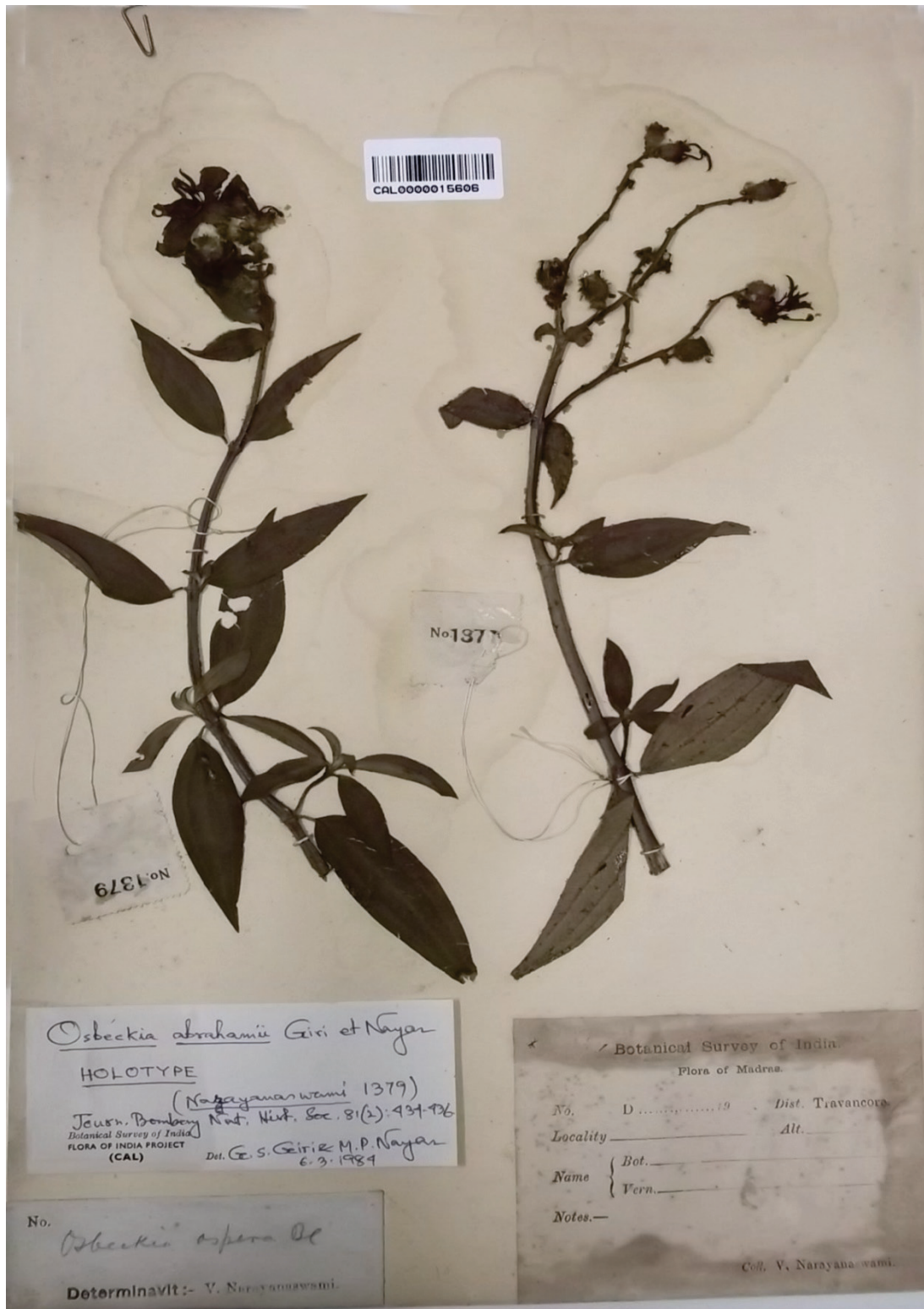


Figure 12. Holotype of *Osbeckia abrahamii* G.S. Giri & M.P. Nayar: [Narayanawami 1379 (CAL0000015606)] © Botanical Survey of India, Central National Herbarium.

Chromosome number:—Not reported.

Flowering and Fruiting:—July – December.

Ecology and Habitat:—Rare, found on forest borders and in open grasslands of altitude more than 300 m.

Distribution:—Kerala.

Notes:—*Osbeckia abrahamii* is a branched erect shrub often found in forest margins and



open grasslands. Many flowered lax panicle with large pink flowers add beauty to this species. It resembles *O. travancorica* in having ovate to lanceolate leaf with dense pubescence on stems and leaves but distinguished by its long, lax panicle and asymmetric sepals as opposed to the short, compact panicle and symmetric sepals of latter.

Specimens examined:—**Kerala.** Kottayam Dist., Vagamon, 20.11.2014, Prashob & Sibichen 5564 (DEV). Pathanamthitta Dist., Ranni, 30.07.2014, Prashob & S. Syam Radh 5510 (DEV).

Osbeckia aspera (L.) Blume, Flora. 14: 474. 1831; C.B. Clarke in Hook.f., Fl. Brit. India 2: 519. 1879; Gamble, Fl. Pres. Madras 1: 492. 1919; *Melastoma aspera* L., Sp. Pl. 391. 1753. *Asterostoma aspera* Blume Mus. Bot. 1(4): 50. 1849. *Osbeckia aspera* (L.) Blume var. *aspera* C. Hansen, Ginkgoana 4. 82. 1977; Vivek. in N.C. Nair & A.N. Henry, Fl. Tamil Nadu 1: 161. 1983;

Mohanan, Fl. Quilon Dist. 186. 1984; Manilal, Fl. Silent Valley 110. 1988; Antony, Syst. Stud. Fl. Kottayam Dist. 166. 1989; Vajr., Fl. Palghat Dist. 203. 1990; M. Mohanan & Henry, Fl. Thiruvanthapuram 198. 1994; Subram., Fl. Thenmala Div. 142. 1995; Sasidh. *et al.*, Bot. Stud. Med. Pl. Kerala 24. 1996; Sasidh. & Sivar., Fl. Pl. Thrissur For. 189. 1996; Sasidh., Fl. Periyar Tiger Reserve 143. 1998; Sasidh., Fl. Parambikulam W.L.S. 127. 2002; Mohanan & Sivad., Fl. Agasthyamala 278. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 222. 2005; Manickam *et al.*, Fl. Tirunelveli Hills 406. 2008; Sunil & Sivadasan, Fl. Alappuzha Dist. 296. 2009. *Osbeckia aspera* (L.) Blume var. *typica* C.B. Clarke in Hook.f., Fl. Brit. India 2: 519. 1879. **Lectotype**:—(designated by Hansen, 1977) Sri Lanka, *S.die.*, Herman s.n. (BM000621501 image!).

Katou kadalai Rheede, Hortus Malabaricus. 43. 91. 1493.

Osbeckia kleinii Wight & Arn., Prodr. Fl. Ind. Orient. 1: 323. 1834.
Asterostoma kleinii (Wight & Arn.) Blume, Mus. Bot. 1(4): 50. 1849.
Osbeckia aspera Blume var. *kleinii* (Wight & Arn.) C.B. Clarke in Hook.f., Fl. Brit. India 2: 519. 1879. **Type**:—Sri Lanka, Trincomalee, 25.01.1796, Klein s.n. (K000867979 image!)

Osbeckia kewensis C.E.C. Fisch., Bull. Misc. Inform. Kew (1): 34. 1938.

Osbeckia glauca Wall. ex Naudin, Ann. Sci. Nat., Bot. Sér. 3, 14: 68. 1850
Melastoma glaucum Wall., Numer. List n. 4055. 1831 (*nom. Nud.*).
Lectotype (designated here):— Herbarium specimen gathered from a plant grown at Kew Gardens (K000867986 image!).

Osbeckia minor Triana, Trans. Linn. Soc. London 28(1): 55. 1872. **Type**:— Sri Lanka, *S.die.*, Thwaites 1569 (K000867985 image!).

Osbeckia courtallensis Gamble, Bull. Misc. Inform. Kew 1918(7): 242. *Type*:—
India, Tamil Nadu, Courtallum, Tirunelveli, *Wight* 1103
(K000867983image!).

Osbeckia lawsonii Gamble, Bull. Misc. Inform. Kew 1918(7): 242. *Type*:—
India, Travancore, 650 m., 03.12.1893, *M.A. Lawson* 46 (K000867989
image!). **Figs. 13 & 14.**

Perennial, erect shrubs, 1–2.5 m tall. Stems branched, young stems quadrangular, sparsely clothed with appressed to patent hairs, intermixed with curved strong bristles. Leaves petiolate; petioles 5–10 mm long; lamina green, ovate to lanceolate, 2–11 × 1–4.5 cm, 3–5-nerved, apex acute to acuminate, base acute, both sides thinly clothed with patent hairs. Inflorescence terminal 6–12-flowered cymes or a panicle of 2 or 3 such cymes, subtended by bracts and a pair of leaves. Flowers pentamerous, pedicellate and bracteate; pedicels 2–5 mm long; bracts green, ovate to cordate, 1–5 mm long, ciliate and densely appressed-hairy. Hypanthium campanulate, 4–8 × 3–6 mm, with a thin cover of hairs; intersepal emergences 0.5–2.5 mm long, sessile, ending in a tuft of hairs; other emergences restricted to the upper part of the hypanthium or absent; hairs short, bristly, subappressed, patent, curved upwards. Sepals triangular, 2–5 × 2–3.5 mm, apex attenuate, 1-nerved, hairy at apex, caducous. Petals obovate, 1–2.5 × 1–1.5 cm, pink to purple. Stamens 10; filaments 5–10 mm long; anthers narrowly ovate to oblong, 5–9 mm long, yellow, twisted, pore oblique on ventral side of the tip; connective with collar having one tubercle dorsally and another irregularly lobed one ventrally. Ovary united with hypanthium about half of its length; anther pockets extending to base of ovary; crown with short bristles; style 8–19 mm long, glabrous, curved; stigma slightly pointed. Capsules campanulate, 4–8 × 3–6 mm; seeds minute, 0.1–0.2 mm long, numerous, curved.



Figure 13. *Osbeckia aspera* (L) Blume: **A.** Habit; **B.** Inflorescence; **C.** Hypanthium; **D.** Bract; **E.** Sepal; **F.** Intersepal emergence; **G.** Stamens; **H.** Style; **I.** Seeds.



Figure 14. Lectotype of *Osbeckia aspera* (L.) Blume [Herman s.n. (BM000621501)] © The Board of Trustees of Natural History Museum (BM).

Ecology and Habitat:—Found on the margins of evergreen forests at an altitude above 500 m in association with *O. virgata* and *O. parvifolia*. Variations in size and appearance is noticed among populations at varying altitudes. Plants growing in lower altitudes are generally tall and having larger leaves whereas, those at higher altitudes are usually short with smaller leaves.

Chromosome Number:— $n=10$
(Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—
October—March.

Distribution:—Kerala, Tamil Nadu.

Notes:—On the basis of superficial resemblance, Hansen (1977), treated *O. travancorica* and *O. wightiana* as varieties of *O. aspera*. However, the latter two are distinct in their habitat, altitudinal preferences, and micro-morphological characters hence reinstated as distinct species in the present work. A comparative account of morphological characters are provided in Table.2.



Table: 2 Comparison of *O. aspera*, *O. travancorica* and *O. wightiana*

Character	<i>O. aspera</i>	<i>O. travancorica</i>	<i>O. wightiana</i>
Leaf	Acrodromous , 3-nerved	Acrodromous , 3–5-nerved	Non- acrodromous, 5– 7-nerved
Hypanthium	simple hairs only, Emergences absent	Emergences all over; simple hairs present	Emergences all over; simple hairs present
Bracts	Ovate to cordate, 1–5 mm long	Cordate, 3–8 mm long	Ovate, 6–10 mm long
Sepals	Triangular	Subulate	Subulate
Intersepalar emergences	Sessile, ending in a tuft of hairs	Stalked; stalk terete, hairy, head stellate with tuft of bristles	stalked; stalk hairy, ending in a small tuft of patent stellate hairs
Other emergences	Absent	Stalked, head stellate	Stalked, head stellate

Specimens examined:—**Kerala**, Idukki Dist., Munnar, 13.05.1935, *E. Barnes* 118853 (DD). Palakkad Dist., Nelliampathy, Karapara forest, Pothumalai, 19.12.1980, *N.C. Nair & P. Bharghavan* 6928 (MH). Thiruvananthapuram Dist., Agasthyamala, Peppara, 08.03.1994, *N. Mohanan & T. Shaju* 01973 (FRLH); Ponnudi, 13.12.2014, *Prashob & Sibichen* 5566 (DEV); Athirumala, Agasthyamala, 16.03.2016, *Prashob & Sibichen* 6030 (DEV); Bonacaud, 16.03.2016, *Prashob & Sibichen* 6029 (DEV); Ponnudi hills, 14.09.1977, *N.C. Nair* 51071 (MH); *ibid.*, 16.08.1980, *M. Mohanan* 69224 (MH). Thrissur Dist., Karimala hills, 23.10.1990, *N. Sasidharan* 5736 (KFRI); Vazhachal, 04.11.1989, *N. Sasidharan* 5500 (KFRI). Travancore, 28.08.1902, *S.F. Baurdillon* 1237/7104 (DD). **Tamil Nadu**: Coimbatore Dist., Attakatti, 06.07.1961, *J. Joseph* 12753 (MH). Dindigul Dist., Kodaikanal, Palamalai path, 10.05.1985, *K.M. Matthew*

& N. Rajendren 44923 (RHT); Kodaikanal, Puthur – Kavalapatty path, 02.05.1988, K.M. Matthew 52853 (RHT); Vandaravu – Marion shola Levinge path, 25.10.1988, K.M. Matthew 53634 (RHT); Perumal peak, 14.12.1989, K.M. Matthew 53859 (RHT). Kanyakumari Dist., Pechiparai, Kalasekaram range, 20.07.1975, S.P. Subramani 14620 (FRLH); Upper Kothayar hills, 07.08.1996, V.S. Manickam 10049 (XCH); Road to Karimoni, 26.02.1998, V.S. Manickam 14798 (XCH); Alagiapandiapuram, Mahendragiri hills, Kurusadi mottai, 24.09.1998, V.S. Manickam 17508 (XCH). Madurai Dist., Maharajamethu, 15.08.1990, V. Lakshmanan, 91166 (MH). Tirunelveli Dist., Inchikuzhi, 22.09.1988, R. Gopalan 88717 (MH); Kakachi, 12.10.1957, K.M. Sebastine 4416 (MH); Kannikatti, 08.06.1957, K.M. Sebastine 409 (MH); *ibid.*, 10.11.1959, K.M. Sebastine 9614 (MH); Kakachi, Kothayar, 02.02.1997, V.S. Manickam 12250 (XCH); Kakachi to Sengaltheri path, 21.12.1996, V.S. Manickam 11840 (XCH); Kallar hills, 03.02.1998, V.S. Manickam 14707 (XCH); Kuthiravetti shola, View point, 20.12.1996, V.S. Manickam 11796 (XCH); Manjanam parai, 30.05.1963, A.N. Henry 16377 (MH); Martanamparai, 04.09.1962, A.N. Henry 17450 (MH); Manjolai hills, 25.06.1957, K.M. Sebastien 3595 (MH); Muthukuzhi Vayal 09.09.1976, A.N. Henry 48311 (MH); *ibid.*, 26.08.1976, A.N. Henry 47592 (MH); Vullar forest, Agastiar hills, 06.08.1998, V.S. Manickam 16838 (XCH); Kudamadi hills, Mundanthurai, 26.06.1997, V.S. Manickam 13058 (XCH); Sengaltheri, 09.03.1963, J. Joseph 15872 (MH).

Osbeckia gracilis Bedd., Madras J. Lit. Sci. Ser. 3, 1. 45. 1864; Trans. Linn. Soc. 24. 216. 1865; C.B. Clarke in Hook. f., Fl. Brit. India 2: 518. 1879; Gamble, Fl. Pres. Madras 1: 494. 1919; C.Hansen, Ginkgoana 4. 77. 1977; Mohanan, Fl. Quilon Dist. 187. 1984; M. Mohanan & Henry, Fl. Thiruvanthapuram 198. 1994; Sasidh., Fl. Shenduruny W.L.S. 130. 1997;

Sasidh., Fl. Periyar Tiger Reserve 144. 1998; Sasidh., Fl. Parambikulam W.L.S. 127. 2002. *Type*:—India, Sispara Ghats, 4000 ft., *S.die.*, *Beddome* 2975 (BM 000944355 image!).

Osbeckia sublaevia Cogn. in A. DC. & C. DC., Monogr. Phan. 7: 321. 1891; Gamble, Fl. Pres. Madras 1: 492. 1919. *Type*:— India, Tamil Nadu, Nilgiris, *S.die.*, *Perrottet* 377 (BR0000005208722image!).

Osbeckia lineolata Gamble., Kew Bull. Misc. Inform. 7: 241. 1918; Fl. Pres. Madras 1: 492. 1919. *Lectotype* (designated here):— India, South India, *S.die.*, *Sauliere* 312 (K000867991 image!).

Osbeckia lineolata Gamble var. *anamalayana* G.S. Giri & M.P. Nayar, Bull. Bot. Surv. India 25: 244. 1983. *Type*:— India, Tamil Nadu, Coimbatore as Coimbatour, Kanalar, Anamalai Hills, 1950 m, 17.11.1980, *M. Chandrabose* 57793 (CAL).

Osbeckia walkeri auct. Amitha Bachan & Pradeep, Int. J. Adv. Res. 5(7): 339. 2017. *non* Arnot, 1837. **Figs. 15 & 16.**

Perennial, erect, branched shrubs; 1 m tall. Stems quadrangular, winged at angles, sparsely covered with short rigid hairs, hairs at nodes larger. Leaves petiolate; petiole 1–3 mm long; lamina lanceolate or oblanceolate, 2–7 × 1–2.5 cm, apex attenuate to acute, base attenuate, rarely acute, 3–5-nerved, both sides sparingly clothed with ascending short hairs, turns yellowish green when drying. Inflorescence a terminal cyme, 3–7-flowered, sometimes axillary. Flowers pentamerous, pedicellate, bracteate; pedicels 0.5–2 mm long; bracts green, ovate, 5–10 mm long, ciliate, both sides spatially clothed with short hairs. Hypanthium campanulate, 3.5–5.5 × 3–5 mm, clothed with patent or ascending hairs with bullate base; intersepal emergences rounded, tuberculoid with elongated slightly flattened tips ending in a tuft



Figure 15. *Osbeckia gracilis* Bedd.: A. Habit; B & C. Hypanthium; D. Bract; E. Sepal; F. Intersepal emergence; G. Stamens; H. Seeds.



Figure 16. Holotype of *Osbeckia gracilis* Bedd. [Beddome 2975 (BM 000944355)]

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of bristles, caducous; other emergences usually absent. Sepals 5, triangular to oblong, 2–5.5 mm long, ciliate, with a very prominent midrib having appressed to patent hairs, apex with a tuft of long hairs, caducous. Petals 5, broadly obovate, 20–25 × 12–17 mm, purple, ciliate. Stamens 10; filaments 7–12 mm long; anthers narrowly ovate to oblong, yellow, 7–9 mm long, twisted, pore slightly oblique on ventral side; connective with two small dorsal and two ventral tubercles. Ovary partially fused with hypanthium, usually exceeding hypanthium, anther pockets present, crown distinct in fruit; style 1.5–3 cm long. Capsules campanulate, 5–8 × 4.5–7 mm; seeds minute, 0.1–0.2 mm long, numerous, curved.



Chromosome number:—Not reported.

Flowering and Fruiting:— September – December.

Ecology and Habitat:— This species occurs commonly in borders of shola forests and in open grasslands. above 1000 m. to 2000 m elevation from sea level. Plants at lower altitude are characterized by their tall size, long inter nodes and pale green leaves whereas, those at higher altitude are shorter, having short internodes and dark green leaves. The species is usually seen associated with *O. leschenaultiana* and *O. brachystemon*.

Distribution:— Kerala, Tamil Nadu.

Notes:—Analysis of populations from various localities has shown diversity in the indumentum pattern of *O. gracilis*. Hairs on the hypanthium are long and profuse in higher altitude specimens (from Sispara, Silent valley) whereas, it is short and sparse in lower altitude specimens (Munnar hills). Similarly, leaves are broadly ovate to lanceolate in lower altitude specimens whereas it is lanceolate among high altitude specimens. Irrespective of these variations, all populations are characterized by the brown, patent, curved, bristly hairs at least on the lower part of the hypanthium.

In the protologue of *O. gracilis*, Beddome (1864) described the flower as tetramerous with 8 anthers. However, pentamerous flowers with 10 stamens are noticed throughout the collections (including specimens from type locality). Tetramerous and pentamerous flowers are noticed in species such as *O. parvifolia* and *O. stellata* var. *crinite*.

Specimens examined:—**Kerala:** Idukki Dist., Devikulam, 11.09.1968, *D.B. Deb* 62192 (MH); *ibid.*, Upper Vagaruai, 16.11.1965, *B.V. Shetty* 62192 (MH); Munnar, Lockhurt gap, 10.10.1963, *K.V. Sebastian* 17480 (MH); Pamba range, 05.10.1976, *K. Vivekananthan* 48604 (MH). Palakkad Dist., Silent Valley N.P., Sispara, 13.10.2014, *Prashob & Sibichen* 5543, 5544, 5545 (DEV). Palakkad, Silent Valley N.P., Wallakad station, 13.10,2014, *Prashob & Sibichen* 5547 (DEV). **Tamil Nadu:** Coimbatore Dist., Anamali, 12.09.1961, *J. Joseph* 13327 (MH); Berijam road to Periar path, 07.07.1986, *K.M. Matthew & N. Rajendren* 45727 (RHT); Blackburne cliff, 10.08.1987, *K.M. Matthew & K.T. Mathew* 50036 (RHT); Valparai, 23.03.1990, *V.B. Hosagoosan* 92472 (MH); Valparai, 06.09.1983, *K. Ramamurty & R. Chandrasekaran* 78431 (MH). Madurai Dist., Thenkikalparai, 25.08.1990, *V. Lakshmanan* 94321 (MH). Dindigul Dist.,

Kodaikanal-Leving, 09.08.1984, K.M. Matthew 40809 (RHT); *ibid.*, 03.09.1985, S.J. Britto 42147 (RHT); Kodaikanal Shembaganur path, 03.08.1985, K.M. Matthew 41634 (RHT); Kodaikanal-Leving path, 09.07.1986, K.M. Matthew & N. Rajendran 45769 (RHT); Korappur, 09.09.1986, K.M. Matthew & M. Charles 46804 (RHT); Palani hills, Perumal peak, 12.12.1986, K.M. Matthew 47911 (RHT).

Osbeckia leschenaultiana DC., Prodr. 3: 42. 1828. C.B. Clarke in Hook.f., Fl. Brit. India 2: 520. 1879; Gamble, Fl. Pres. Madras 1: 493. 1919; C. Hansen, Ginkgoana 4. 87. 1977; Swarup. *et al.*, Shola For. Kerala 59. 1998; Sivar. & Mathew, Fl. Nilambur 272. 1997; Sasidh., Fl. Periyar Tiger Reserve 145. 1998; Sasidh., Fl. Chinnar W.L.S. 131. 1999; Sasidh., Fl. Parambikulam W.L.S. 129. 2002; Mohanan & Sivad., Fl. Agasthyamala 279. 2002. **Type**:—India, Tamil Nadu, Nilgiris (as Nellygerry), 1823, *Leschenault* 10, (G00310433image!).

Osbeckia wightiana Benth. var. *erythrotrica* Benth. ex Wall., Numer. List 143. 1831 (*nom. nud.*).

Osbeckia gardneriana Wight, Icon. Pl. Ind. Orient. 3: t.997. 1845. **Lectotype** (designated here):—India, Tamil Nadu, Nilgiris, Sispara, April, *Wight* 1085 (M0165759 image!). **Figs. 17 & 18.**

Perennial, erect shrubs, up to 1 m tall. Stems quadrangular, branched, covered with thin, patent, ascending, curved, brown to reddish hairs. Leaves ovate, 1.3–4.5 × 0.8–2.5 cm, sessile, dark green on upper side and light green on lower side, 3–5-nerved, apex acute, base obtuse to subcordate, both sides thinly clothed with hairs. Inflorescence terminal, dense panicles, 5–7-flowered, subtended by 2–4 pairs of leaves, upper pair of leaves reduced to

semi bracts; bracts orbicular, 3–6.5 mm broad, green, apex acute, margin ciliate, appressed-hairy dorsally. Flowers pentamerous, pedicellate; pedicels 2–5 mm long. Hypanthium campanulate, 8–13 × 5–9 mm, densely clothed with patent emergences and hairs; intersepal emergences 1–3 mm long stalked; stalk terete with patent short hairs; head disc-like with stellate long hairs with thick bases, persistent in young fruit; other emergences similar but smaller; a few hairs present in between the emergences. Sepals triangular, 4–6.5 × 0.5–2 mm, narrowed into an oblong lobe, with acute to obtuse apex, ciliate at margin, 1-nerved, with many patent hairs on nerves. Petals obovate, 15–22 × 10–15 mm, purple, ciliate at apex. Stamens 10; filaments 5–8 mm long; anthers yellow, narrowly ovate to oblong, 5–8 mm long, twisted, pore oblique on ventral side; connective tuberculate with a small dorsal and a large ventral lobe. Ovary united with hypanthium for about half of its length, densely covered with hairs; anther pockets extending to base of ovary; crown hairy; style 12–18 mm long, glabrous. Capsules campanulate, 8–12 × 5–9 mm; seeds numerous, minute, 0.1–0.2 mm long, curved.

Chromosome number:—Not reported

Flowering and Fruiting:— August – December.



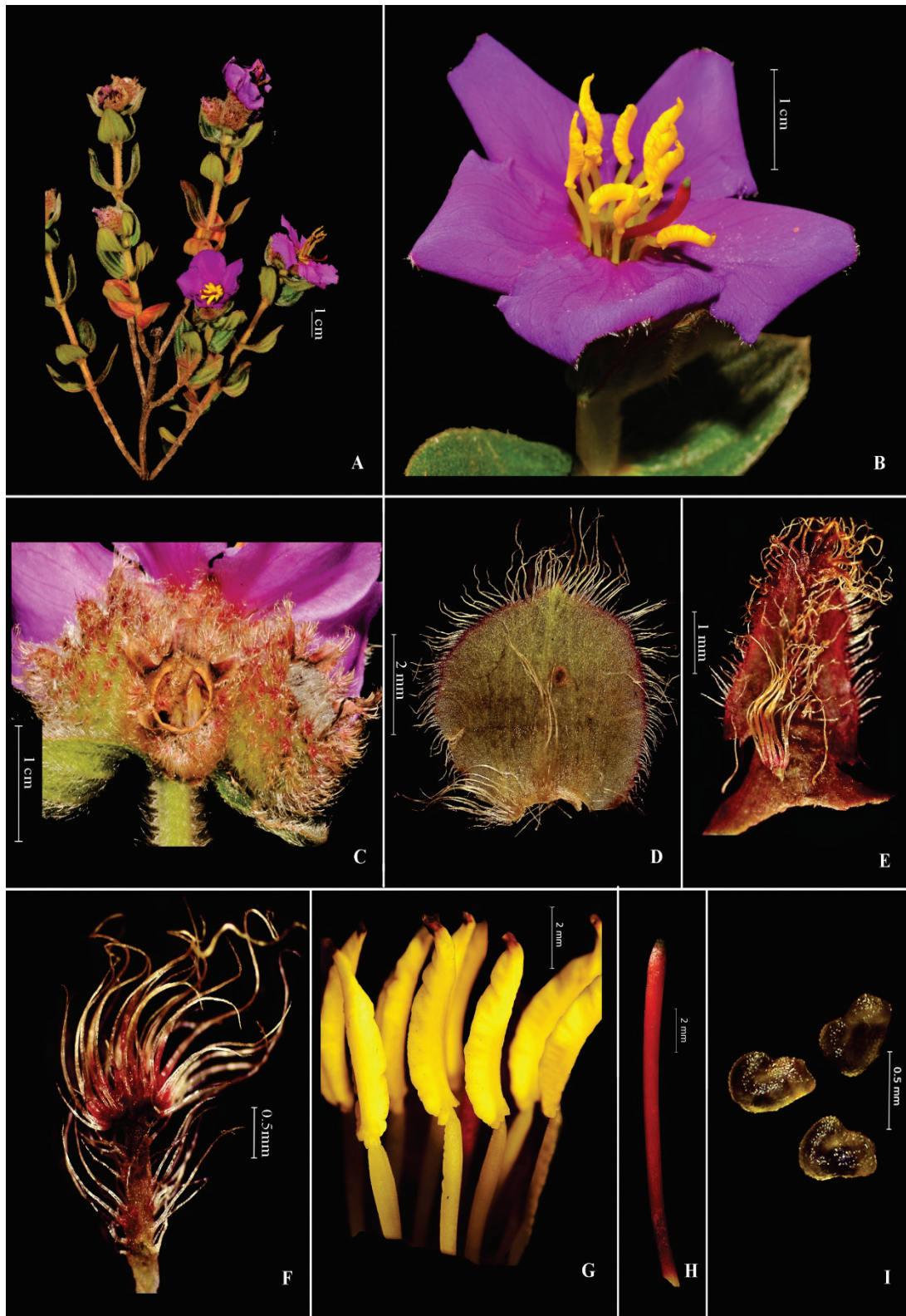


Figure 17. *Osbeckia leschenaultiana* DC.: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Sepal; **F.** Intersepal emergence; **G.** Stamen; **H.** Style; **I.** Seeds.



Figure 18. Holotype of *Osbeckia leschenaultiana* DC. [Leschenault 10, G-DC (G00310433)] © The Board of Trustees of De Candolle Herbarium (GDC).

Ecology and habitat:—Occurs in high altitudes from 1800 to 2500 m above sea level, seen in forest borders and in open grasslands in association with *O. reticulata*, *O. brachystemon* and *O. gracilis*.

Distribution:—Kerala, Tamil Nadu.

Notes:—Distinct variation in external morphology has been noticed in populations. Plants found in higher altitudes are short (c. 0.5 m), profusely branched with very short internodes (hardly 5 mm long) and those found in lower altitudes are tall (c.1 m.), sparsely branched with long internodes (c. 3-5 cm long).

Specimens examined:—**Kerala:** Idukki Dist., Anamudi shola N.P., 10.11.2014, *Prashob & Sibichen* 5556 5557, 5586 (DEV); Devikulam, 02.02.1970, *B.V. Shetty* 31788 (CAL, MH); Edamalakudi, 16.01.2015, *Prashob & Sibichen* 5587, 5589, 5591 (DEV); Eravikulam Western slope, 04.12.1987, *P. Bhargavan* 87329 (CAL, MH); Eravikulam N.P., Rajamala, 16.01.2015; Eravikulam N.P., Eravikulam N.P., Pettimudi, 16.01.2015, *Prashob & Sibichen* 5592 (DEV); Eravikulam N.P., 16.01.2015, *Prashob & Sibichen* 5593 (DEV); Kulamavu, 12.10.1982, *C.N. Mohanan & V.S. Ramachandran* 74592 (MH). Kollam Dist., Shenduruny high range, 05.1937, *E. Barnes* 118851 (DD); Travancore hills, 09.1937, *E. Barnes* 112219 (DD). **Tamil Nadu:** Coimbatore Dist., Anamalai, Akkamalai Grass hills, 11.03.1978, *D.K. Hore* 657 (CAL). Dindigul Dist., Kodaikanal, 25.08.1898, *A.G. Bourne* (CAL); Kodaikanal, upper Palani, 16.08.1911, *C.E.C. Fischer* 2856 (CAL); Kodaikanal, 21.03.1956, *Pallithanam* 1576 (RHT); Kodaikanal, Berijam slope above the shola, 24.07.1984, *K.M. Matthew* 40496 (RHT); Kodaikanal, Vandaravu peak, Kerala peak (Kerala border), 12.05.1985, *K.M. Matthew* 41430 (RHT); Kodaikanal Berijam - Vembadi, 19.11.1985, *K.M. Matthew* 42739 (RHT); Kodaikanal to Berijam road, 19.11.1985, *K.M. Matthew* 42860 (RHT);

Mathikettan shola, 06.12.1986, K.M. Matthew & M. Charles 47752 (RHT); Kodaikanal, Vandaravu, 09.01.1987, K.M. Matthew 48151 (RHT); Kodaikanal, Kukkal, 08.04.1987, K.M. Matthew & M. Charles 49087 (RHT); Kodaikanal Vandaravu main shola, 29.08.1987, K.M. Matthew 50553 (RHT); Kodaikanal, 19.03.1950, Danial Sundaraj & Sankaran Rao 94117 (MH); Palany hills, 1869, Beddome 21180 (MH). Nilgiri Dist., Bhavani, 19.12.1970, B.V. Shetty 37489 (MH); Ketu, 24.01.1957, K.M. Sebastine 2206 (CAL); Kottabettu, 25.02.1970, A.A. Ansari 1046 (CAL); Kotagiri-Ooty road, 26.04.1971, N.C. Rathakrishnan 38086 (MH); Mullimand – Avalanche, 26.12.1970, B.V. Shetty 37605 (MH); Nilgiri, 20.03.1870, C.B. Clarke 111188 (CAL); Ooty, 10.1910, A. Meebold 11867 (CAL); Perumal hills, 12.04.1987, C. Sudharsan 281 (CAL); Pykara river bank, 12.09.1930, V. Narayanaswamy 4245 (MH); Sispara, 05.1889, J.S. Gamble 21174 (MH). Tirunelveli Dist., Way to Pothagiri, 05.02.1989, R. Gopalan 88727 (MH).

Osbeckia mehrana G.S. Giri & M.P. Nayar, Kew Bull. 41(2): 429. 1986. **Type:**–
India, Thiruvananthapuram, way to Chemungi, 1200 m, 08.03.1979,
M. Mohan 61706 (CAL0000015811!). **Figs. 19 & 20.**

Perennial, erect, woody shrubs, up to 3 m tall. Stems branched, quadrangular, densely clothed with long, brown ascending or sub-patent hairs. Leaves petiolate; petioles 7–13 mm long, clothed with thin ascending hairs; lamina ovate, 1.5–4.5 × 0.8–3 cm, 5-nerved, dark green, apex acute, base obtuse, margins entire, upper side with ascending to sub patent hairs, lower side with patent hairs, hairs on the nerves are longer and occur in groups. Inflorescence terminal and axillary panicles, 5–7-flowered; bracts ovate, 2.5–4.5 × 1–2.5 mm, green, margin ciliate, woolly dorsally, caducous;



Figure 19. *Osbeckia mehrana* G.S. Giri & M.P. Nayar: **A.** Habit; **B.** Flower; **C** & **D.** Hypanthium; **E.** Bract; **F.** Sepal; **G.** Intersepal emergence; **H.** Stamens & Style; **I.** Seeds.



Figure 20. Holotype of *Osbeckia mehrana* G.S. Giri & M.P. Nayar: [M. Mohanan 61706 (CAL0000015811)] © Botanical Survey of India Central National Herbarium.

Flowers pentamerous, pedicellate; pedicels 2–5 mm long. Hypanthium campanulate, 4–6 × 3–5 mm, densely clothed with patent hairs and stellate emergences, sometimes emergences absent; intersepalar emergences stalked 1–2 mm long, stalk terete with ascending hairs, head disc-like with stellate long hairs, caducous; other emergences similar but smaller. Sepals 5, triangular, 3–5 × 1.5–2 mm, with acute apex, 1-nerved, margins ciliate, hairs at apex longer, midrib prominent with long patent hairs dorsally. Petals 5, obovate, 11–23 × 6–8 mm, pink, margins ciliate. Stamens 10; filaments 4–6 mm long, glabrous; anthers narrowly ovate, 4.5–5.5 mm long, yellow, pore oblique on ventral side of the tip; connective extended to a small collar with small dorsal and ventral lobe. Ovary 3–4.5 mm long, united with hypanthium for about half of its length; anther pockets extending to base of ovary, with dense cover of ascending hairs; crown with ascending hairs; style 12–17 mm long, glabrous, curved; stigma capitate, papillose. Capsules campanulate, 6–10 × 6–8 mm, enclosed by the calyx tube; seeds minute, numerous, 0.1–0.2 mm long, curved and muricate.



Chromosome number:— $n=10$

(Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—November – April.

Ecology and Habitat:—Commonly occurs in evergreen forests and in grasslands at an altitude above 1500 m., seen in association with *O. aspera* var. *wightiana* and *O. tirunelvelica*.

Distribution:—Kerala, Tamil Nadu.

Notes:—Giri and Nayar (1986) described *O. mehrana* from the collection of Mohanan maid in 1979. The species is endemic to Agasthyamala Biosphere reserve, distributed in Pongalapara and Kothayar hills of Kalakkad Mundanthurai Tiger Reserve.

This taxon is allied to *O. gracilis* but can be easily distinguished by the dense long hairs on stem and leaves, hypanthium with emergences and stellate headed intersepalar emergences. In *O. gracilis* stem and leaves are thinly covered with hairs, hypanthium with simple hairs only, emergences absent.

Specimens examined:—**Kerala:** Thiruvananthapuram Dist., Agasthyamala, Pongalapara, 15.03.2016, *Prashob & Sibichen* 6025, 6026, 6028 (DEV); Agasthyamala, Chemungi, 08.03.1979, *M. Mohanan* 61706 (CAL); Near Natarikal, Travancore boundary, 04.03.1917, *S.call.* 21111 (MH); Poonkulam, on the way to Agastyarkudam, 05.03.1980, *M. Mohanan* 115996 (MH). **Tamil Nadu:** Tirunelveli Dist., Kothayar Dam house, 16.04.1997, *V.S. Manickam* 12532 (XCH); Papanasam hills, Uppuma mottai, 07.04.1999, *V.S. Manickam* 18856 (XCH); Kothayar, Muthukuzhivayal, 11.03.1998, *V.S. Manickam* 14944 (XCH); Kothayar Hills, Stream across Dam house, 10.03.1998, *V.S. Manickam* 14878 (XCH); Kothayar Hills, Dam valley, 12.03.1998, *V.S. Manickam* 14994 (XCH).

Osbeckia nepalensis Hook. var. *nepalensis*, Exot. Fl. 1(2): t. 31. 1822; C.B. Clarke in Hook. f., Fl. Brit. India 2: 521. 1879; C. Hansen, Ginkgoana 4.

67. 1977; N.P.Balakr, Fl. Jowai & Vicinity, 205. 141. 1983. **Lectotype** (designated by Hansen, 1977):— Nepal, Katmandu, *J.E. Smith s.n.* (K000867999 image!).

Osbeckia speciosa D. Don, Prodr. Fl. Nepal. 222. 1825. (*nom. illeg.*).

Melastoma nepalensis Lodd., Bot. Cab. 8: pl. 707. 1823 (*nom. nud.*).

Osbeckia chulesis D. Don, Prodr. Fl. Nepal. 221. 1825. *Melastoma chulesis* Ham. ex D. Don, Prodr. Fl. Nepal. 221. 1825 (*pro. syn.*). **Type**:— Nepal, Narainhetty, 27.07.1802, *Hamilton s.n.* (BM 000521788 image!).

Figs. 21 & 22.

Perennial, erect, branched shrubs, up to 2 m tall. Stems clothed with appressed to ascending or shaggy hairs. Leaves sessile or sub sessile; petioles 0.5–1.5 mm long; lamina lanceolate, 5–16 × 2–5.5 cm, 5–7-nerved, apex acute, base cordate or subcordate, both sides clothed with ascending shaggy hairs above, soft beneath. Inflorescence terminal or axillary panicle, 5–10-flowered. Flowers pentamerous, pedicellate and bracteolate; bracts ovate to broadly ovate, 7–15 × 5–9 mm, ciliate and appressed-hairy; pedicels 1–6-mm long. Hypanthium campanulate, 6–10 × 5.5–7 mm, with few to several subappressed scale like emergences, simple hairs absent; intersepal emergences 1–1.5 × 1–2 mm, lobed, with a tuft of short bristles, caducous; other emergences similar in shape. Sepals 5, ovate, 8–11 × 4–7 mm, apex often acute, with few indistinct nerves, margins ciliate, caducous. Petals 5, broadly obovate to obcordate, 15–20 × 4–7 mm long, pink, margins ciliate. Stamens 10; filaments 4–6 mm long; anthers narrowly ovate, 6–9 mm long, attenuate, not twisted, pore oblique on ventral side at the apex, connective sometimes slightly prolonged between collar and sacs. Ovary united with hypanthium for about half of its length; anther pockets extending to the base of ovary; crown distinct; style 13–19 mm long. Capsules campanulate, 6–10 × 5–8 mm, rim of hypanthium exceeding the crown; seeds minute, curved, 0.1–0.2 mm long, numerous.

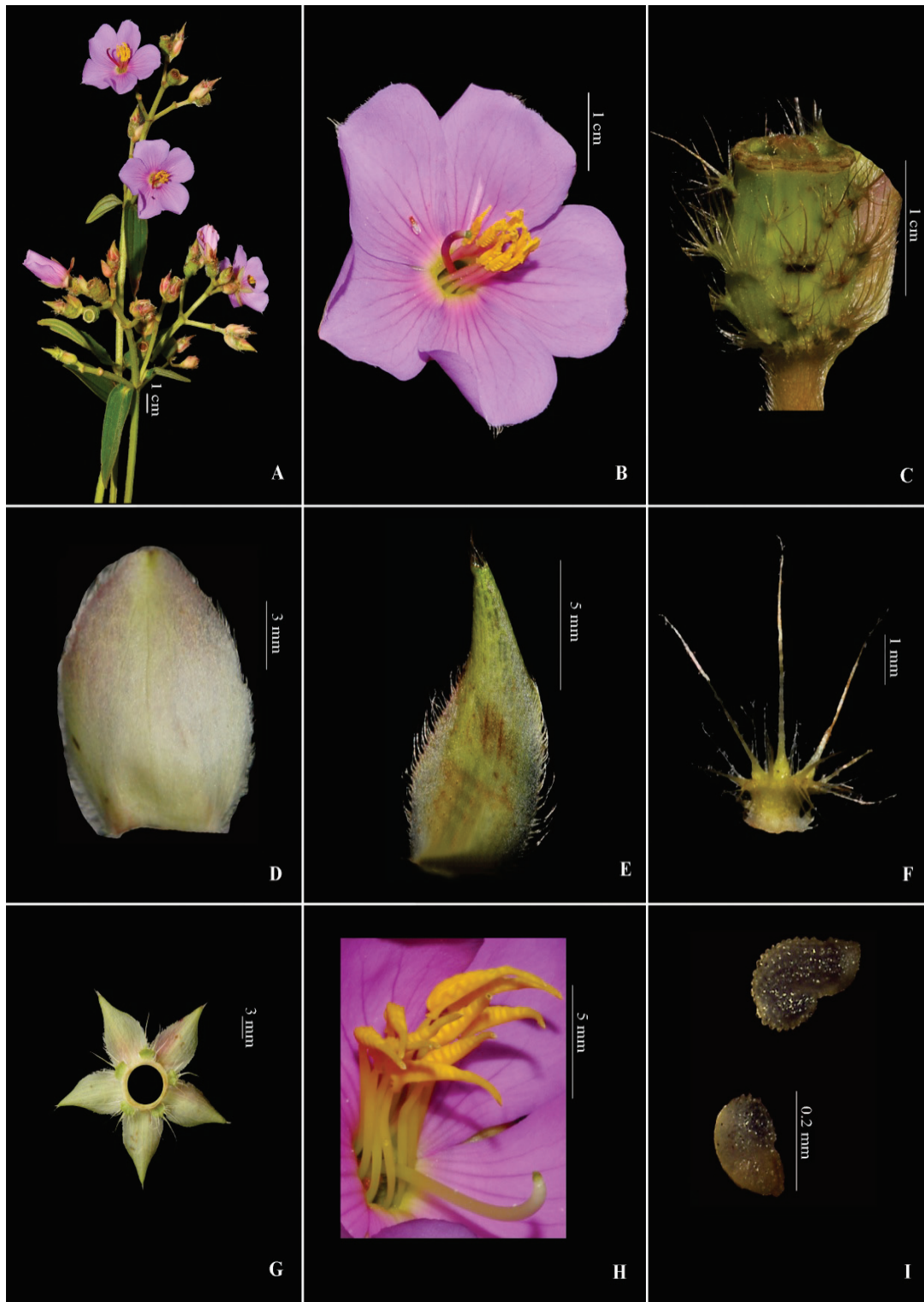


Figure 21. *Osbeckia nepalensis* Hook. var. *nepalensis*: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Sepal; **F.** Intersepal emergence; **G.** Sepal & Intersepal emergences **H.** Stamens; **I.** Seeds.



Figure 22. Lectotype of *Osbeckia nepalensis* Hook. var. *nepalensis*: [J.E. Smith (K 000867999)] © The Board of Trustees of Royal Botanic Gardens, Kew.

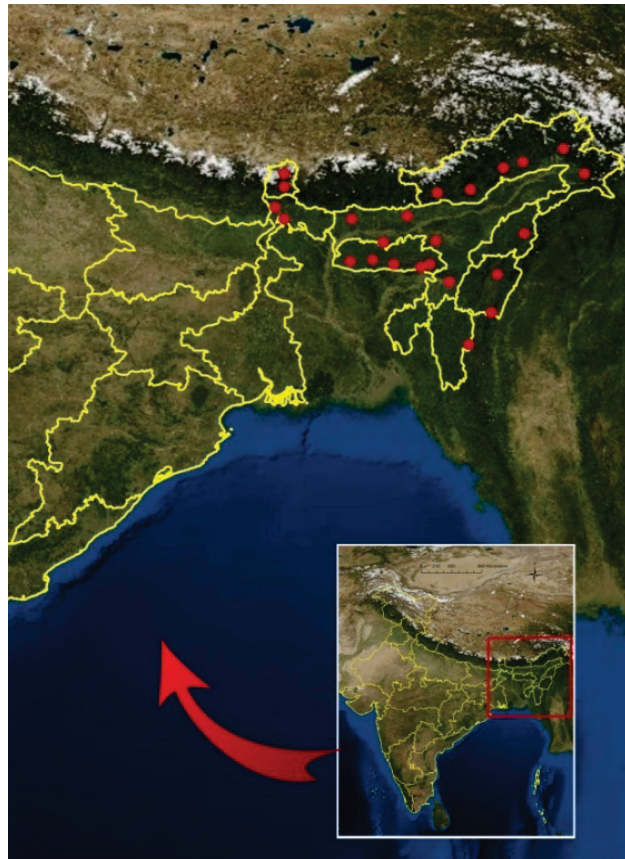
Chromosome number:— $n=19$ (Favarger, 1962), $n=20$ (Mehra & Khosla, 1969)

Flowering and Fruiting:—June–December.

Ecology and Habitat:—Common in open grasslands of higher altitudes (500–1500 m); also in swampy areas of evergreen forests.

Distribution:—Arunachal Pradesh, Assam, Meghalaya, Manipur, Nagaland, West Bengal and Sikkim.

Notes:—*Osbeckia nepalensis* can easily be recognized by its large sessile leaves with cordate or subcordate base and the large scale-like intersepal emergences on the hypanthium with a tuft of bristles. *Osbeckia nepalensis*



closely resembles *O. wynaadensis*, but can be distinguished by the characteristic cordate or subcordate leaf base, as opposite to obtuse leaf base in *O. wynaadensis*. Moreover, they are allopatric in distribution.

Specimens examined:—**Arunachal Pradesh:** East Siang Dist., Pasighat, Pangin, 12.07.2015, Prashob & Hareesh 6121 (DEV); Lohit Dist., Amidust boarders, 28.09.1969, A.S. Rao 48174 (CAL). Tirap Dist., Bimalpur, 07.09.1958, G. Panigrahi 17044 (ASSAM). Subansiri Dist., Nyapin, 21.11.1964, A.R.K. Sastry 40837 (ASSAM); Pagba, 11.17.1974, C.L. Malhotra 55927 (ASSAM).

Kameng F.D., Kalaktang, 14.01.1958, *G. Panigrahi* 15515 (CAL). West Kameng Dist., Kalaktang, 14.11.1973, *P.K. Hajra* 54112 (ASSAM); Sessa Orchid Sanctuary, Tippi, 01.07.2015, *Prashob & Sibichen* 6118 (DEV). **Assam:** Darrang Dist., Bornadi W.L.S., 19.03.2012, *N. Sarma* 124700 (ASSAM). Goalpara Dist., Kachugaon, 02.1947, *M.M. Srinivasan* 21937 (ASSAM); Goalpara, 08.09.1937, *G.K. Deka* 17057 (ASSAM); Ultapani, 27.12.1975, *B.N.M. & party* 5583 (ASSAM). Kamrup Dist., Digboi gorhat, 11.07.1959, *G. Panigrahi* 19002 (ASSAM, CAL). Ghagrachuk, 18.06.1964, *A.S. Rao* 38964 (ASSAM); Ghagrachuk forest, 18.07.1964, *A.S. Rao* 38946 (CAL); Kimini river, 23.11.1957, *G. Panigrahi* 11476 (ASSAM, CAL). Kokrajhar Dist., Chakrasila W.L.S., 04.11.2006, *Ranjit Daimary* 111929 (ASSAM). Newgong Dist., Belsiri river, 22.07.1958, *G. Panigrahi* 14219 (CAL); Dhoka R.F., 25.08.1964, *N.P. Balakrishnan* 39424 (ASSAM, CAL); Kohora, 22.09.1957, *R.S. Rao* 9779 (CAL); Upper Dikking river, 08.07.1957, *G. Panigrahi* 18746 (ASSAM, CAL). **West Bengal:** Darjeeling Dist., Between Sukia & Siliguri, 07.1957, *N.L.H. Krauss* 323 (CAL); Below Mangpoo, 20.02.1914, *S.call.* 40646 (CAL). Kalimpong Dist., Darjeeling, 06.1880, *J.S. Gamble* 749 (DD); *ibid.*, 09.1880, *J.S. Gamble* 172187 (CAL). Jalpaiguri Dist., 08.12.1995, *S. Chandra & S.K Mandal* 1080 (CAL); New Jalpaiguri, 26.08.1912, *N.C. Banargi* 4048 (DD); Nemati, 18.11.1999, *G.S. Giri* 20486 (CAL); Rajavathkhawa forest, 05.09.1981, *B.Safui & Party* 10359 (CAL); Kathambari New Jalpaiguri, 25.04.1962, *S.K. Mukarji* 5550 (CAL); Missiva compound, 10. 1913, *H.J.C. Kinghoran* 172177 (CAL); Kalimpong, 11.1879, *J.S. Gamble* 4000 (DD). **Manipur:** Kangpokpi Dist., Laimakhong, 31.08.1952, *D.B. Deb* 594 (CAL); Lakhama, 03.1906, *A. Meebold* 5604 (CAL). **Meghalaya:** East Khasia hills Dist., Barapani road, 11.09.1970, *A.S. Rao* 38634 (CAL); Barapani, 13.10.1954, *G.K. Deka* 11425 (ASSAM); Cherrapunji, 21.12.1956, *G. Panigrahi* 4959 (CAL); Karhan, 05.10.1948, *S.K.*

Mukherjee 3617 (CAL); Lockhart hills, 1905, *Abu Hassan* 167 (CAL); Khasia, 08.1880, *C.E.C. Fischer* 172171 (CAL); Khasia, 12.1887, *H. Collett* 172173, 172171 (CAL); Khasia-Bhilasa, 06.08.1886, *C.B. Clarke* 172175 (CAL); Makum, 21.11.1911, *I.H. Burkill* 35744 (CAL); Khasia & Jaintia Hills, 25.08.1956, *G. Panigrahi* 3003 (CAL); Tipperah, Champamoor hills, 23.10.1915, *P.M. Debbarman* 172212 (CAL); Khasia & Jaintia Hills, 25.08.1918, *H.H. Haines* 172210 (CAL); Pynursla, 12.09.2015, *Prashob & Sibichen* 6131 (DEV); *ibid.*, 12.09.2015, *Prashob & Sibichen* 6132 (DEV); *ibid.*, 25.08.1956, *R.S. Rao* 3003 (ASSAM, CAL); Khasia & Jaintia Hills, 21.12.1956, *G. Panigrahi* 4959 (ASSAM); 09.10.1930, *S. Sharma* 2565 (ASSAM); *ibid.*, 23.01.1931, *S. Sharma* 9002 (ASSAM); East Khasi hills, Pommora, 07.09.2011, *Santhosh Nampy* 4725 (DEV). Jaintia hills Dist., Jowai, 18.11.1969, *N.P. Balakrishnan* 49990 (ASSAM); Raling, 21.08.1968, *N.P. Balakrishnan* 46892 (ASSAM); Jowai to Jarain, 16.08.1968, *N.P. Balakrishnan* 42961 (ASSAM); Jarain pitcher plant garden, 19.09.2015, *Prashob & Sibichen* 6144 (DEV); Nongtalang village, 19.09.2015, *Prashob & Sibichen* 6147 (DEV). Garo hills Dist., Napak area, 19.09.1975, *M.K.V. Rao* 64181 (ASSAM); Garo hills, 01.1903, *J. Marten* 172193 (CAL); Garo hills, *T.D. Srinivasan* 246 (CAL); Songsak R.F., 29.11.2006, *R. Shanprne* 113114 (ASSAM). Ri-Bhoi Dist., Nongpoh, 07.1949, *B.B. Sagma* 22779 (ASSAM).

Nagaland: Kohima Dist., Dzulake valley, Naga hills, 09. 1935, *N.L. Bor* 6161 (DD); Naga hills, 09. 1939, *N.L. Bor* 90571 (DD); Naga hills, 07.1944, *N.L. Bor* 21001 (ASSAM); Naga hills, 11.1979, *R.R. Fernandes* 008 (DD); Naga hills, 09.1886, *Prain* 172189 (CAL).

Sikkim: East Sikkim Dist., Baluwa khani khola, 04.08.1980, *P.K Hajra* 271 (CAL, BSHC); East Sikkim, 06.10.1875, *C.B. Clarke* 6073 (CAL); East Sikkim, 1862, *T. Anderson* 172198 (CAL); East Sikkim, 11.1900, *Prain's collector* 58 (CAL); Kalpana Nag, 01.17.1876, *G. King* 187 (CAL); Chumbi valley, 12.1904, *G.L. Searight* 0096 (CAL); East Sikkim,

08.1903, *Prain's collector* 169 (CAL); Rung Beliver Valley, 22.09.1908, W.W. Smith 61 (CAL); Tarku, 21.09.1968, N.C. Majumdar & R.N. Banerji 583 (CAL); Dikchu, 08.09.1997, B.K. Singh 19603 (BSHC); Faramsa, 08.10.1986, S. Singh 4500 (BSHC); Gangtok, Lower Sinchey, 09.09.1981, B. Krishna 1696 (BSHC); Gangtok, 06.08.1981, B. Krishna 1659 (BSHC); Saramsa, 23.08.1980, P.K. Hajra 598 (BSHC); Ruspo, 14.11.1998, S.S. Dash 20961 (BSHC); Taring to Dikchu, 07.09.1989, N.R. Mandal 11336 (BSHC); Saramsa, 23.08.1980, P.K. Hajra 599 (BSHC); Saramsa, 23.08.1980, P.K. Hajra 599 (CAL). North Sikkim Dist., Dzangu, 24.11.1995, Sujit Kumar Janna 17955 (BSHC); Lingza, 14.09.1986, B. Mitra 6868 (BSHC); Rangrang bridge, Mangan - Rangrang Bridge, 25.08.2002, S.K. Rai 20586 (BSHC); Mangan - Rangrang Bridge, 17.09.2016, Prashob, Sibichen & Anilkumar 6616 (DEV); 09.09.1968, N.C. Majumdar & R.N. Baner 341 (CAL); Nampik, 12.09.2000, D. Maity 23124 (BSHC); Singhik, 21.10.1984, B. Krishna 3237 (BSHC); Tingbong, 14.08.1989, N.R. Mandal 10163 (BSHC). South Sikkim Dist., Kewzing, 18.08.1985, A.K. Verma 4231 (BSHC); Sulphuk, 13.12.1985, A.K. Verma 4948 (BSHC); Sakyong to Pentong, 16. 09. 1986, A.K. Verma 7070 (BSHC). West Sikkim Dist., Dentam, 29.08.1997, P. Singh 16338 (BSHC); Dantam to Pelling, 13.09.2016, Prashob, Sibichen & Anilkumar 6604 (DEV).

Key to the varieties.

1a. Petals pink or rarely purple..... *var. nepalensis*

1b. Petals white *var. albiflora*

Osbeckia nepalensis Hook. *var. albiflora* Lindl., Edwards's Bot. Reg. 17: t.

1475. 1831. *Lectotype*:— (designated here) Illustration t. 1475.

Figs. 23 & 24.

Perennial, erect, branched shrubs, up to 2 m tall. Stems clothed with appressed to ascending or shaggy hairs. Leaves sessile or sub sessile; petioles 0.5–1.5 mm long; lamina lanceolate, 5–16 × 2–5.5 cm, 5–7-nerved, apex acute, base cordate or subcordate, both sides clothed with ascending shaggy hairs above, soft beneath. Inflorescence terminal or axillary panicle, 5–10-flowered. Flowers pentamerous, pedicellate and bracteolate; bracts ovate to broadly ovate, 7–15 × 5–9 mm, ciliate and appressed-hairy; pedicels 1–6 mm long. Hypanthium campanulate, 6–10 × 5.5–7 mm, with few to several subappressed scale like emergences, simple hairs absent; intersepal emergences 1–1.5 × 1–2 mm, lobed, with a tuft of short bristles, caducous; other emergences similar in shape. Sepals 5, ovate, 8–11 × 4–7 mm, apex often acute, with few indistinct nerves, margins ciliate, caducous. Petals 5, broadly obovate to obcordate, 15–20 × 4–7 mm long, white, margins ciliate. Stamens 10; filaments 4–6 mm long; anthers narrowly ovate, 6–9 mm long, attenuate, not twisted, pore oblique on ventral side at the apex, connective sometimes slightly prolonged between collar and sacs. Ovary united with hypanthium for about half of its length; anther pockets extending to the base of ovary; crown distinct; style 13–19 mm long. Capsules campanulate, 6–10 × 5–8 mm, rim of hypanthium exceeding the crown; seeds minute, curved, 0.1–0.2 mm long, numerous.

Chromosome number:— $n=19$ (Favarger, 1962), $n=20$ (Mehra & Khosla, 1969)

Flowering and Fruiting:— June–December.

Ecology and Habitat:— Occurs in swampy areas of evergreen forest while in high altitudes it is seen in open grasslands.

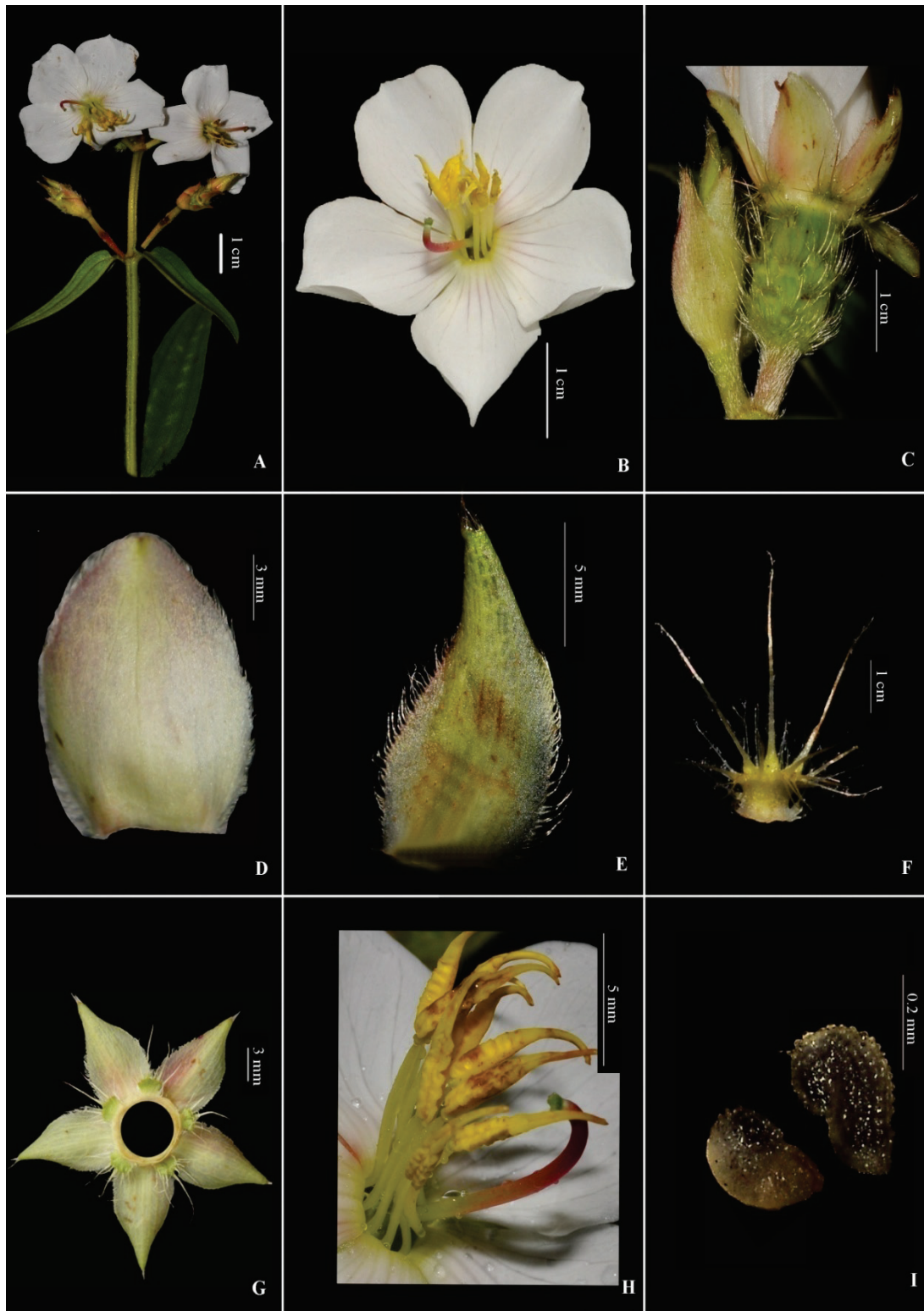


Figure 23. *Osbeckia nepalensis* Hook. var. *albiflora* Lindl.: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Sepals; **F.** Intersepal emergence; **G.** Sepals & Intersepal emergences; **H.** Stamens; **I.** Seeds.



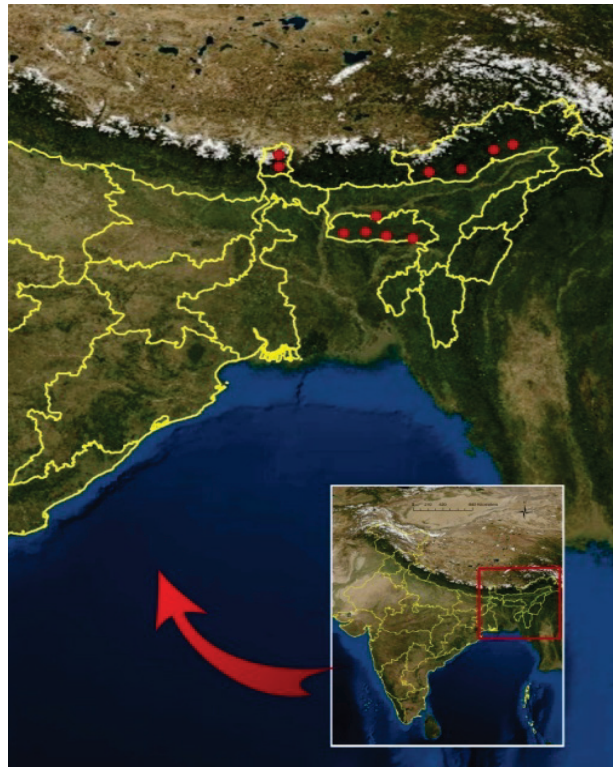
Figure 24. Lectotype of *Osbeckia nepalensis* Hook. var. *albiflora* Lindl. (designated here). © Illustration Edwards's Bot. Reg. 17: t. 1475. Reproduced with permission.

Distribution:—Arunachal Pradesh, Meghalaya, Sikkim.

Notes:—*Osbeckia nepalensis* var. *albiflora* is distinct from the type variety by its white corolla.

Specimens examined:—

Arunachal Pradesh: East Siang Dist., Kameng F.D., Kalaktang, 14.01.1958, G. Panigrahi 15615 (CAL). West Kameng Dist., Kalaktang, 14.11.1973, P.K. Hajra 54102



(ASSAM); Sessa Orchid Sanctuary, Tippi, 01.07.2015, Prashob & Sibichen 6110 (DEV). **Meghalaya:** East Khasi hills Dist., 11.08.2014, Prashob & Sibichen 5931 (DEV); Barapani, 13.10.1954, G.K. Deka 11435 (ASSAM); Pynursula, 12.09.2015, Prashob & Sibichen 6133 (DEV); Khasia & Jaintia Hills, 21.12.1956, G. Panigrahi 4949 (ASSAM); Shillong, 23.01.1931, Shriram Sharma 9003 (ASSAM). Jaintia hills Dist., Jowai, 18.11.1969, N.P. Balakrishnan 49989 (ASSAM). **Sikkim:** West Sikkim Dist., Dantam to Pelling, 13.09.2016, Prashob, Sibichen & Anilkumar 6105 (DEV); Khecheopalri lake, 14.09.2016, Prashob, Sibichen & Anilkumar 6609 (DEV).

Osbeckia nutans Wall. ex C.B. Clarke in Hook. f., Fl. Brit. India 2: 521. 1879; C.Hansen, Ginkgoana 4. 75. 1977; N.P. Balakr., Fl. Jowai & Vicinity, 206. 141. 1983; Hajra & Verma, Fl. Sikkim 296, 1996; Noltie, Fl. Bhutan 1994. *Osbeckia nepalensis* Hook. var. *nutans* (Wall. ex C.B. Clarke) D.Maity, Econ. Taxon. Bot. (27) 1235. 2003. **Syn. nov.** *Osbeckia nutans* Wall., (*nom. nud.*) Numer. List 144, no. 4068. 1831. **Lectotype** (designated by Hansen, 1977):— India, Wallich 4068 (K000867997 image!).

Figs. 25 & 26.



Figure 25. *Osbeckia nutans* Wall. ex C.B. Clarke: **A.** Habit; **B.** Hypanthium; **C.** Sepal; **D.** Intersepal emergence; **E.** Stamens; **F.** Seeds.

Perennial, erect, branched shrubs, up to 1.5 m tall. Stems covered with appressed hairs. Leaves petiolate; petioles 1–3 mm long; lamina narrowly lanceolate, 3–6.5 × 0.5–1 cm, 3-nerved, apex acute, base obtuse, glabrous throughout except on nerves below. Inflorescence terminal panicles, 4–6-flowered, subtended by a pair of reduced leaves. Flowers pentamerous, bracteate, pedicellate; pedicels 3–5 mm long; bracts green, ovate to cordate 4–7 mm long, both sides spatially clothed with short hairs. Hypanthium campanulate, 4–4.5 × 4–4.5 mm, glabrous or with appressed scale like emergences having hairs at apex; intersepalar emergences exactly resembles normal emergences, both are caducous. Sepals 5, triangular, 6.5–7.5 mm long, with a few indistinct nerves, minutely ciliate, otherwise glabrous, caducous. Petals 5, obovate, 13–16 mm long, pink or purple, apex ciliate. Stamens 10; filaments 4–6 mm long; anthers narrowly ovate to oblong, 3–6 mm long, not twisted, pore oblique on ventral side of the tip; connective slightly prolonged into an undulating lobed collar. Ovary united with hypanthium; anther pockets extending to base of ovary, free part densely covered with appressed hairs; crown small, distinct, with short hairs; style 13–14 mm long. Capsules campanulate, 6.5–8.5 × 5–6.5 mm; seeds minute, curved, 0.1–0.2 mm long, numerous.

Chromosome number:—not reported

Flowering and Fruiting:—August–March.

Ecology and Habitat:—Occurs in swampy areas and river margin.

Distribution:—Arunachal Pradesh, Manipur, Meghalaya and Sikkim.

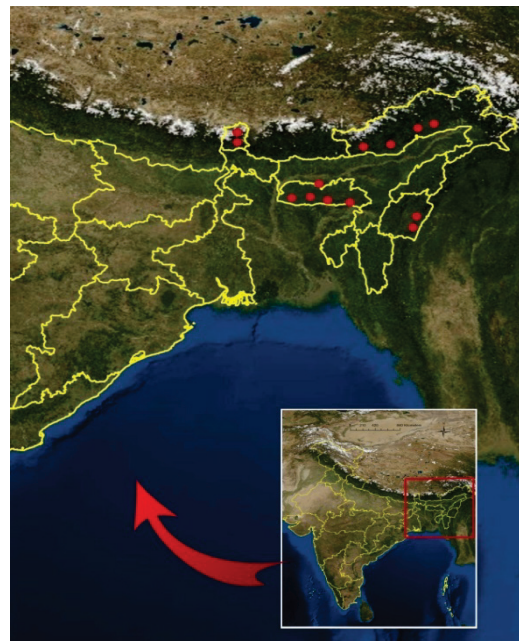




Figure 26. Lectotype of *Osbeckia nutans* Wall. ex C.B. Clarke: [Wallich 4068 (K000867997)] © The Board of Trustees of Royal Botanic Gardens, Kew.

Notes:—*Osbeckia nutans* can be recognized by its small lanceolate leaves and large sepals exceeding the hypanthium. It is interesting to note that two types of hypanthium are met with this species. On the same plant, both glabrous hypanthium and hypanthium with scaly emergences are noticed.

Maity (2003) treated *O. nutans* as a variety of *O. nepalensis*. But critical examination of the type, protologue and live specimens led us to reinstate its original status. Leaves are small, narrow, petiolate and glabrous in *O. nutans* whereas it is large, sessile; lamina with shaggy hairs in *O. nepalensis*.

Specimen examined:—**Arunachal Pradesh:** Changlang Dist., Namdapha National Park, 10.06.1982, *J. Joseph* 81114 (ASSAM); Vijaynagar, 26.12.1996, *Das Chauhan* 99555 (ASSAM). Lohit Dist., Chamba village, 17.12.1969, *A.S. Rao* 48687 (CAL, ASSAM); Deopani river, north of Roing, 03.10.1969, *A.S. Rao* 48210 (CAL, ASSAM); Zunglua-Rusa, 05.09.1958, *G. Panigrahi* 16775 (CAL). Subansiri Dist., Subansiri Reserve forest Kimin-Kumin, 24.09.1959, *G. Panigrahi* 19302 (CAL, ASSAM); Papum Pare Dist., Kimin to Zero, 23.11.1957, *G. Panigrahi* 11465 (ASSAM). West Kameng Dist., Orchid Research centre, Tippi, 30.06.2015, *Prashob & Sibichen* 6117 (DEV); Tippi to Balupara 16.09.2016, *Prashob & Arun* 6117 (DEV); Chaku, 21.04.1957, *G. Panigrahi* 6307 (CAL, ASSAM); Champari, 03.12.1916 *H. Haines s.n.* (CAL); Shukhanala, *S.die.*, *P.K. Hajra* 54483 (ASSAM); Kameng, *S.die.*, *A.S. Rao* 50761 (ASSAM); Kameng, Chopai forest camp, 18.02.1974, *A.S. Rao* 56443 (ASSAM); Sissini to foot hill camp, 18.04.1957, *G. Panigrahi* 7042 (ASSAM). Tirap Dist., Zunghua-Rusa, 05.09.1958, *G. Panigrahi* 16775 (ASSAM). **Assam:** Goalpara Dist., *S.loc.*, 03.12.1918, *Upendranath Kanjilal* 7450 (ASSAM). Kokrajhar Dist., Chakoarila W.L.S, 03.07.2003, *Ranjit Daimary* 118075 (ASSAM). Lakhimpur Dist., Kimin river, 23.11.1957, *G. Panigrahi* 11465

(CAL, ASSAM); Subansiri Reserve forest Lakhimpur, 24.09.1959, *G. Panigrahi* 16775 (CAL); North Lakhimpur, Naharani Reserve, 17.05.1966, *D.M. Verma* 46390 (ASSAM); Upper Assam, Dikhow river forest, 30.03.1895, *S.call.* 11093 (CAL). **Manipur:** Naga hills, 12.1907, *A. Meebold* 7339 (CAL); Chamoo, 01.14.1882, *George Watt* 172153 (CAL). **Meghalaya:** East khasi hills Dist., Shillong, *Griffith s.n.* (CAL). Garo hills Dist., Napak lake, 19.07.1976, *M.K.V. Rao* 64614 (ASSAM). Jaintia hills Dist., 17.12.1911, *I.H. Burkill s.n.* (CAL); West Jaintia Hills, Nartiang, 28.08.1968, *N.P. Balakrishnan* 47194 (ASSAM). **Sikkim:** East Sikkim Dist., Bumbing on the way to Rangto, 19.12.1981, *P. Chakrabarty* 2001 (BSHC); *S.loc.* 18.12.1903, *Prain* 25 (CAL); East Sikkim, 25.07.1985, *D.C.S. Raju* 3921 (BSHC); 20th Mile side, Bordang, 17.11.01, *S.S. Dash & S.K. Rai* 23920 (BSHC); East Sikkim, 24.11.1980, *S.B. Ram* 00870 (CAL); Rangpo, Namthang, 19.12.1981, *P. Chakrabarty* 867 (CAL); Rhenock, 24.11.1980, *S.B. Ram* 00841 (BSHC); Rongly, 07.12.1980, *P. Chakrabarty* 1030 (CAL); Reshi, 02.01.1996, *S.K. Jana* 18013 (BSHC); way to Rongli, 07.12.1980, *P. Chakrabarty* 1030 (BSHC). South Sikkim Dist., Teesta valley, 15.11.1901, *Prain s.n.* (CAL). West Sikkim Dist., Labdang, 11.1990, *Dr. Prain* 60 (CAL); Sikkim, 10.1874, *C.B. Clarke* 28650 (CAL).

Osbeckia reticulata Bedd. Trans. Linn. Soc. 25: 216. 1865; C.B. Clarke in Hook. f., Fl. Brit. India 2: 520. 1879; Gamble, Fl. Pres. Madras 1: 493. 1919; C. Hansen, Ginkgoana 4: 115. 1977. *Osbeckia reticulata* Bedd., Madras J. Lit. Sci. Ser. 3(1). 45 1864 (*nom. nud.*). **Lectotype** (designated by Hansen, 1977):— India, Tamil Nadu, Coimbatore, Anamallais, *s. die*, *Beddome* 2998 (BM000944342 image!).

Osbeckia alveolata Bedd., Icon. Pl. Ind. Or. 1: 37. 168. 1874. **Type**:—India, Tamil Nadu, Coimbatore, Anamallais, 6–7000 ft, s. *die*, *Beddome* 239 (K000867948 image !). **Figs. 27 & 28.**

Perennial, woody shrubs or small trees, 2–7.5 m tall; stems branched; young branches quadrangular with dense cover of patent hairs and brownish bristles. Leaves petiolate; petioles 7–18 mm long; lamina ovate, 4–10 × 2.5–6 cm, 5–7- nerved, acrodromous, apex acute, base subcordate, margins reticulate, upper side bullate, densely covered with ascending, incurved and bristly hairs, lower side with patent hairs. Inflorescence terminal cluster of cymes, 3–9-flowered. Flowers pentamerous, pedicellate, bracteate; pedicels up to 5 mm long; bracts brownish, cordate, 4–6 × 5–7 mm, margins ciliate, densely appressed hairy dorsal. Hypanthium campanulate, 9–13 × 8–9 mm, covered with large emergences with hairs; intersepal emergences short, having many patent strong curved bristles, caducous; other emergences few, similar. Sepals 5, triangular, 4–7 × 1.5–3 mm, prominently 1-nerved with patent hairs on nerves, margins ciliate, caducous. Petals 5, obovate, 2–3.5 × 1.4–2.5 cm, purple, apex ciliate. Stamens 10; filaments 7–12 mm long; anthers narrowly ovate, 8–11 mm long, yellow, not twisted, beak absent, pore single, more or less oblique on dorsal side, connective with conspicuous collar having two small dorsal lobes or tubercles and two large ventral lobes. Ovary united with hypanthium about half of its length; anther pockets extending to base of ovary; crown distinct with groups of united hairs; style 16–22 mm long, glabrous; stigma capitate. Capsules campanulate, 9–12 × 8–11 mm, ribbed; seeds numerous, curved.

Chromosome number:— $n=10$ (Meenakumari & Kuriachan, 1990)

Flowering and fruiting:—November–April.



Figure 27. *Osbeckia reticulata* Bedd.: A. Habit; B. Hypanthium; C. Bract; D. Intersepal emergence; E. Sepal; F. Stamen; G. Seeds.



Figure 28. Lectotype of *Osbeckia reticulata* Bedd. [Beddome 2998 (BM000944342) © The Board of Trustees of Natural History Museum (BM).

Ecology and Habitat:—A small tree or large shrub, usually occurs in shola forests and grass lands above 1000 m.

Distribution:—Kerala, Tamil Nadu.

Notes:—Beddome (1864) published this species without an accompanying description which was later validly published in his subsequent publication (Beddome, 1865). This species is distinct from



other taxa by its huge shrubby to small tree habit, large 7–9-nerved, bullate leaves with minute reticulate margin. Characteristic emergences on hypanthium are unique to *O. reticulata*.

Specimens examined: Kerala:— Idukki Dist., Anamudi shola N.P., Methap, 09.11.2014, *Prashob & Sibichen* 5554, 5555 (DEV); Eravikulam N.P., 15.01.2015, *Prashob & Sibichen* 5580, 5581, 5582, 5583, 5584, 5585 (DEV). Palakkad Dist., Perumalmudi, 21.04.1970, *S.call.* 559 (MH). **Tamil Nadu:** Dindigul Dist., Bear shola, Kodaikanal, 07.03.1987, *K.M. Matthew & Rajendren* 48545 (RHT); Kodaikanal, 19.03.1950, *Daniel Sundaraj & Sakharan Rao* 93805 (MH); Kodaikanal, Poomparai, 22.04.1965, *Ramamurthy* 23362 (MH); Poomparai, 09.04.1987, *K.M. Matthew & Charles* 49116, 49146 (RHT); *ibid.*, 20.05.1987, *K.M. Matthew & Charles* 49577 (RHT); Kodaikanal, 19.03.1956, *Pallithanam* 1551 (RHT); Kodaikanal, St. Mary's road, 10.05.1979, *K.M. Matthew* 16634 (RHT);

Berijam, Kodaikanal, 19.11.1985, K.M. Matthew 42755 (RHT); Pambar shola, Kodaikanal, 07.02.1986, K.M. Matthew 44103 (RHT); *ibid.*, 29.04.1986, K.M. Matthew & Rajendren 44696 (RHT); Vandaravu peak, Kodaikanal, 24.01.1998, K.M. Matthew 55124 (RHT).

Osbeckia tirunelvelica Murugan & Manickam ex Kottaim. & Gnanasek. Phytotaxa 231(3): 300. 2015. *O. tirunelvelica* Manickam & Murugan, J. Econ. Taxon. Bot. 25(3): 626. 2002. (*nom. Inval.*). **Type:**— India, Tamil Nadu: Tirunelveli Dist., Manjolai hills, Road below Manjolai, Manickam & Murugan 15109 (XCH!).

Figs. 29 & 30.

Perennial, erect, branched shrubs, up to 1 m tall. Stems subterete, sparsely scabrous. Leaves petiolate; petioles 5–10 mm long; lamina elliptic to lanceolate, 2–6.5 × 1.5–3 cm, 3–5-nerved, green; apex acute to acuminate, base acute, both sides thinly clothed with patent hairs. Inflorescence terminal, condensed cyme or cluster of 6–9-flowers or 2–3 such cymes together, panicle subtended by bracts and a pair of leaves; bracts green, small ovate to broadly ovate, 1–3 mm long, ciliate and densely appressed hairy. Peduncle 2–5 mm long. Flowers pentamerous. Hypanthium campanulate, 4–8 × 2–4 mm, with a thin cover of simple hairs below and tufted hairs above; intersepal emergences 1–2.5 mm long, oblong, stalked, with terminal and lateral hairs; other emergences restricted to the upper part of the hypanthium, or absent; hairs short, bristly, subappressed, patent, curved upwards. Sepals 5, subulate, 2–5 × 2–3.5 mm, prominently 1-nerved, ciliate with long hairs at apex, a few patent hairs on nerves, persistent in fruit. Petals 5, obovate, 1–2.5 × 1–1.5 cm, pink to purple. Stamens 10; filaments 5–10 mm long; anthers narrowly ovate to oblong, twisted, yellow, 5–9 mm long, pore oblique on ventral side of tip; connective with collar

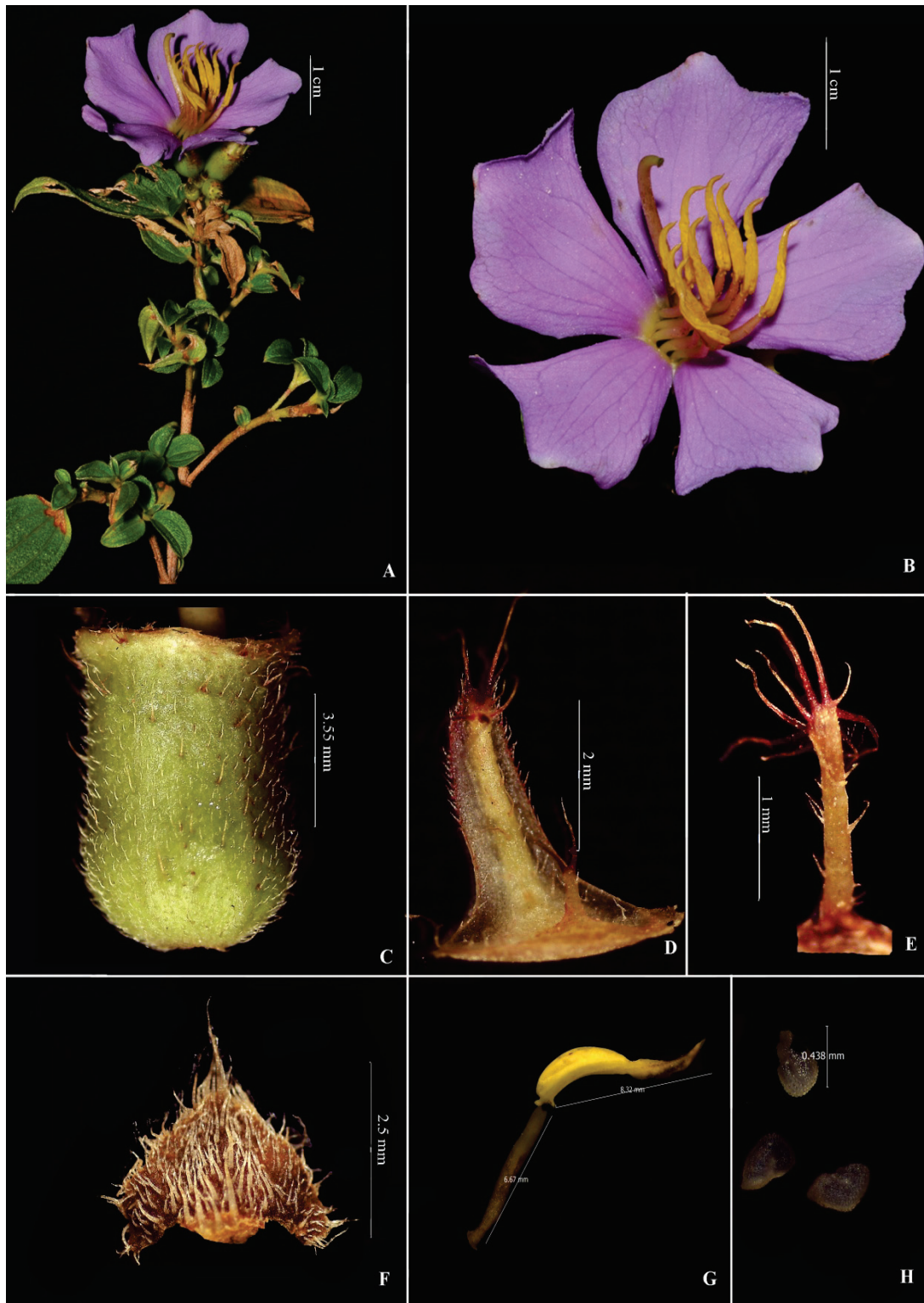


Figure 29. *Osbeckia tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.:
A. Habit; **B.** Flower; **C.** Hypanthium; **D.** Sepal; **E.** Intersepal emergence; **F.** Bract;
G. Stamen; **H.** Seeds.

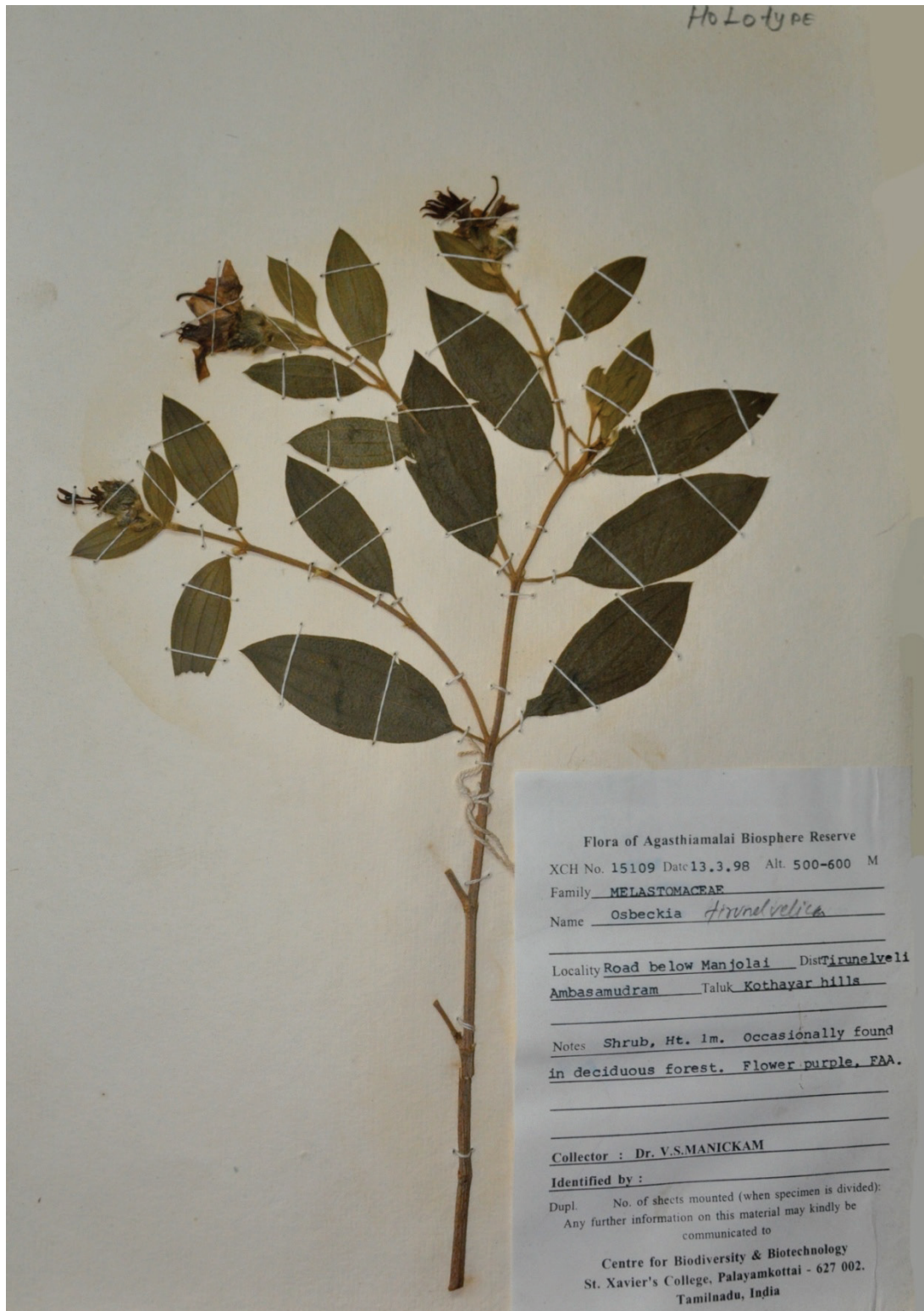


Figure 30. Holotype of *Osbeckia tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.: [Manickam & Murugan 15109 (XCH)] © St. Xavier's College, India. Tamil Nadu. Palayamkottai.

having one tubercle dorsally and slightly or irregularly lobed ventrally. Ovary united with hypanthium about half of its length, anther pockets extending to base of ovary; crown with short bristles, style 8–19 mm long, glabrous, curved; stigma slightly pointed. Capsules campanulate, 4–8 × 3–6 mm; seeds minute, 0.1–0.2 mm long, numerous, curved.

Chromosome Number:—not reported

Flowering and Fruiting:—

August- January.

Ecology and Habitat:— Seen in evergreen forests and tea plantations of Manjolai in Kalakkad Mundanthurai Tiger Reserve at an altitude above 750 m. In association with *O. aspera* and *O. mehrana*.

Distribution:—Tamil Nadu.

Notes:—The publication of *Osbeckia tirunelvelica* by Manickam & Murugan (2002) is



invalid as it is contrary to Art. 40 of ICN (Turland *et al.*, 2018). Two collections were indicated as “type” in the protologue. Later the name was later validated by Kottaimutu and Gnanasekaran (2015).

Specimens examined:—**Tamil Nadu:** Tirunelveli Dist., Manjolai hills ±1115 m, 06.01.2016, *Prashob & Sibichen* 6023 (DEV); Tirunelveli, Kothayar ±1206 m,

06.01.2016, Prashob & Sibichen 6025 (DEV); Tirunelveli, on the way from Kakachi to Ooth ±1161 m, 06.01.2016, Prashob & Sibichen 6027 (DEV).

Osbeckia travancorica Bedd. ex Gamble, Bull. Misc. Inform. Kew 1919(10): 404. 1919; Gamble, Fl. Pres. Madras 493. 1919. *Osbeckia aspera* (L.) Blume var. *travancorica* (Bedd. ex Gamble) C. Hansen, Ginkgoana, 4: 84. 1977. *syn. nov.*; Mohanan, Fl. Quilon Dist. 187. 1984; Babu, Fl. Malappuram Dist. 257. 1990; M. Mohanan & Henry, Fl. Thiruvanthapuram 198. 1994; Sasidh. & Sivar., Fl. Pl. Thrissur For. 190. 1996; Sivar. & Mathew, Fl. Nilambur 272. 1997; Sasidh., Fl. Periyar Tiger Reserve 144. 1998; Sasidh., Fl. Parambikulam W.L.S. 127. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 222. 2005. *Type* :— India, Kerala, Travancore, 23.11.1851, Wight 1100 (K000867975 image!).

Figs. 31 & 32.

Perennial, erect, shrubs, 1–2 m tall. Stems branched, quadrangular; sparsely hirsute, hairs dense at nodes. Leaves petiolate; petioles 2–6 mm long; lamina ovate to lanceolate, 4–11 × 1–4.5 cm, green, 3–5-nerved, apex acute to attenuate, base obtuse, both sides thinly clothed with patent hairs. Inflorescence terminal panicles to cluster of cymes, 5–8-flowered. Flowers pentamerous, pedicellate and bracteate; pedicels 4–7 mm long; bracts green, cordate, 3–8 mm long, margin ciliate, densely appressed-hairy. Hypanthium campanulate, 5–10 × 3–6 mm, densely covered with emergences, bristles and hairs; intersepal emergences stalked, 1–3 mm long, green turns brown, stalk terete, base flat with patent hairs, head stellate with tuft of bristles, caducous; other emergences smaller. Sepals 5, subulate, 2–5 × 1–4 mm; symmetrical, prominently 1-nerved, patent hairs occur on the midrib dorsally, margins ciliate, apex with caducous stellate emergences. Petals 5,

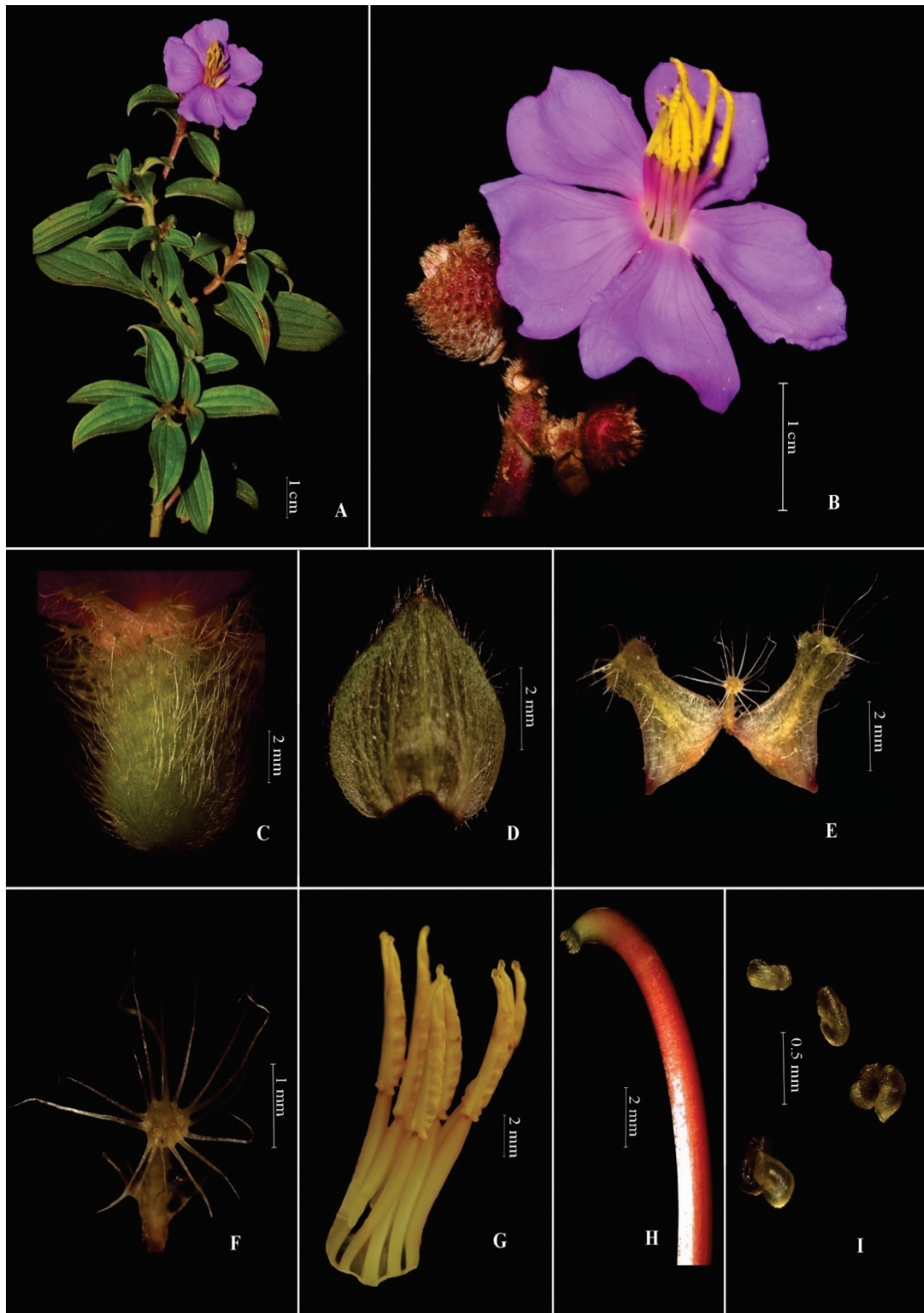


Figure 31. *Osbeckia travancorica* Bedd. ex Gamble: **A.** Habit; **B.** Inflorescence; **C.** Hypanthium; **D.** Bract; **E.** Sepals & Intersepal emergence; **F.** Intersepal emergence; **G.** Stamens; **H.** Style; **I.** Seeds.

obovate, 13–20 × 10–17 mm, pink to purple, margins ciliate. Stamens 10; filaments 6–10 mm long; anthers narrowly ovate to oblong, yellow, 5–11 mm long, twisted; connective prolonged into a collar with one tubercle dorsally and a slightly lobbed one ventrally. Ovary united with hypanthium about half of its length; anther pockets extending to the base of ovary; crown with small bristles; style 8–12 mm long. Capsules campanulate, 6–12 × 4–9 mm; seeds minute, numerous, 0.1–0.2 mm long, curved.

Chromosome Number:— $n=10$ (Meenakumari & Kuriachan, 1990)

Ecology & Habitat:—Found in evergreen forest margins at an altitude above 300 m. Commonly seen in association with *O. virgata* and *O. abrahamii*.

Flowering and Fruiting:—

October– March.

Distribution:—Kerala and Tamil Nadu.

Notes:—Hansen (1977) reduced *Osbeckia travancorica* Bedd. ex Gamble as a variety of *O. aspera* and he remarked that the variety is distinct due to the asymmetrical calyx lobe and curved strong bristles on the stem. After examining the type, verifying the protologue and the illustration on the type





Figure 32. Holotype of *Osbeckia travancorica* Bedd. ex Gamble [Wight 1100 (K000867975)] © The Board of Trustees of Royal Botanic Gardens, Kew.

drawn by Gamble, we have come to the conclusion that *O. travancorica* Bedd. ex Gamble is a distinct species, which can be very well distinguished by the downwardly curved, strong, bristles on the stem and uniform triangular sepals with obtuse or slightly emarginate apex.

Specimens examined:—**Kerala:** Ernakulam Dist., Neriamangalam, 01.12.1993, *E.S. Santhosh kumar* 18389 (FRLH). Idukki Dist., Bison valley, Munnar, 09.1937, *E. Barnes* 118824 (DD); Devikulam, 12.1919; *A. Meebold* 13191 (CAL); Devikulam, 24.03.1980, *K. Ramamurthy* 66344 (CAL); Kattappana, 08.11.1981, *B. Ramanujan & C.N. Mohanan* 72415 (MH); *ibid.*, 27.09.1981, *B. Ramanujan & C.N. Mohanan* 7203 (CAL); Kurisumala, 20.11.2014, *Prashob & Sibichen* 5564 (DEV); Meemutty, 12.12.1982, *C.N. Mohanan* 76018 (MH); Microwave station, 08.11.1981, *V.S. Raju & V.S. Ramachndran* 71207 (CAL); Vagamon, 20.11.2014, *Prashob & Sibichen* 5562 (DEV); Vazhikkadavu, Pindimedu, 02.10.1996, *P. Bhargavan* 92055 (MH). Kollam Dist., Mukkapuzha, 22.12.1972, *C.N. Mohanan* 59605 (MH). Kottayam Dist., Kurisumala, 08.11.1984, *V.T. Antony* 930 (CAL); Kangazha, 29.09.1989, *V.T. Antony* 48476 (MH). Palakkad Dist., Nillical, Silent valley, 23.11.1937, *N.L. Bor* 9161 (DD); Muthikulam, Shiruvani, 02.03.1970, *A A. Ansari* 1070 (CAL); Mukkali forest office, 05.11.1976, *E. Vajravelu* 94523 (MH). Pathanamthitta Dist., Pamba to Anathode, 16.12.1974, *K. Vivekananthan* 45316 (MH). Thiruvananthapuram Dist., Ponmudi, 17.11.1977, *M. Mohanan* 52541 (CAL); Poonkulam, Agastyarkudam, 5.03.1981, *M. Mohanan* 66049 (CAL). Thrissur Dist., Athirapally, 14.10.1994, *N. Sasidharan* 686 (FRLH); Thumboormuzhi, 12.09.1976, *K. Ramamurthy* 48476 (MH). **Tamil Nadu:** Coimbatore Dist., Anaimali hills, Pariuipare, 02.04.1912, *C.E.C. Fischer* 172106 (CAL). Dindigul Dist., Kodaikanal, Upper Palani, 16.08.1911, *C.E.C.*

Fischer s.n. (CAL); Pillar rock, 14.09.1968, *D.B. Deb* 30847 (CAL). Kodaikanal, 16.08.1911, *C.E.C. Fischer* 2865 (CAL). Kanyakumari Dist., Upper Kothayar, *S.call.* 53370 (CAL). Nilgiris Dist., Coonor, 06.1889, *J.S. Gamble* 21437; *ibid.*, 11.1889, *J.S. Gamble*, 13246; *ibid.*, 02.1899, *Prains* 13246 (CAL); Kotagiri Aravenu, 04.01.1957, *K. Subramanyam* 1888 (CAL); Gudalur, Naduvattam, 18.01.1961, *B.V. Shetty* 11911 (CAL); Upper Tiger shola, 19.01.1957, *K. Subramanyam* 2069 (CAL).

Osbeckia virgata D.Don ex Wight & Arn., Prodr. Fl. Ind. Orient. 1: 323. 1834. C. Hansen, Ginkgoana 4. 107. 1977; Mohanan, Fl. Quilon Dist. 188. 1984; Ansari, Fl. Kasaragod Div. 165. 1985; Manilal, Fl. Silent Valley 111. 1988; Antony, Syst. Stud. Fl. Kottayam Dist. 167. 1989; Babu, Fl. Malappuram Dist. 259. 1990; M. Mohanan & Henry, Fl. Thiruvanthapuram 199. 1994; Sasidh. & Sivar., Fl. Pl. Thrissur For. 190. 1996; Sasidh., Fl. Shenduruny WLS 131. 1997; Sivar. & Mathew, Fl. Nilambur 274. 1997; Sasidh., Fl. Periyar Tiger Reserve 145. 1998; Sasidh., Fl. Chinnar WLS 132. 1999; Mohanan & Sivad., Fl. Agasthyamala 280. 2002; T. Pullaiah, D.M. Rao & K.S. Ramamurthy, Fl. Eastern Ghats 59. 2002; Sasidh., Fl. Parambikulam WLS 129. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 223. 2005; Sunil & Sivadasan, Fl. Alappuzha Dist. 297. 2009. *Asterostoma virgata* (D.Don ex Wight & Arn.) Blume, Mus. Bot. 1(4): 50. 1849. **Lectotype** (designated by Hansen, 1977):— India, *S.loc, S.die.* Wight 1147B (E00174614 image!)

Melastoma glomeratum J.G. Klein ex Wight & Arn., Prodr. Fl. Ind. Orient. 1: 323. 1834 (*pro. syn.*)

Osbeckia wightiana Benth., Numer. List . n. 4074. 1831 (*nom. nud.*).

Osbeckia cupularis D. Don ex Wight & Arn., Prodr. Fl. Indiae Or. 1: 323. 1834 (*pro parte*); C.B. Clarke in Hook.f., Fl. Brit. India 2(6): 514. 1879; Gamble, Fl. Pres. Madras 1: 494. 1919. **Type**:— India, Kerala, Trivandrum, 03.1827, Wallich 4074 (K001038091 image!)

Osbeckia octandra auct. C.B. Clarke in Hook.f., Fl. Brit. India 2(6): 521. 1879, non DC., 1828; Gamble, Fl. Pres. Madras 1: 493. 1919; Manilal & Sivar., Fl. Calicut 110. 1982; Subram., Fl. Thenmala Div. 141. 1995. **Lectotype** (designated by Hansen, 1977):— Sri Lanka, *S. die.*, Hermann *s.n.* (BM000621953 image!). **Figs. 33 & 34.**

Perennial, erect shrubs, 30–50 cm tall. Stems branched, young branches quadrangular, with appressed short hairs. Leaves petiolate; petioles 1.5–4 mm long; lamina lanceolate, 2–4.5 × 0.5–1.5 cm, apex acute to acuminate, base attenuate, 3–5-nerved, both sides sparsely clothed with short to very short ascending, rarely appressed bristles. Inflorescence a terminal cluster of cymes, 5–11-flowered, subtended by the upper pair of small reduced leaves. Flowers pentamerous, bracteate, pedicellate; bracts ovate, 1–2 × 0.5–1 mm, green, margins ciliate, both sides glabrous; pedicels 1–2 mm. Hypanthium campanulate, 3–5 × 2–3.5 mm, sparsely clothed with emergences and bristly hairs; intersepal emergences stalked, 0.7–2 mm long, stalk terete, narrow, glabrous, head small, with 2–3 spreading bristles, caducous; other emergences similar, occurring only on upper part of the hypanthium, smaller or reduced to terminal bristles, hairs patent. Sepals 5, triangular, 2–4 × 1–2 mm, narrowed into an attenuate or terete bearing stellate emergence at the apex, margins ciliate with few hairs, 1-nerved with few patent bristles dorsally, caducous. Petals 5, obovate to orbicular, 7–16 mm long, apex ciliate, pink. Stamens 10; filaments 4–6 mm long, glabrous; anthers narrowly ovate, yellow, twisted, 3–5.5 mm long, pore oblique; connective with

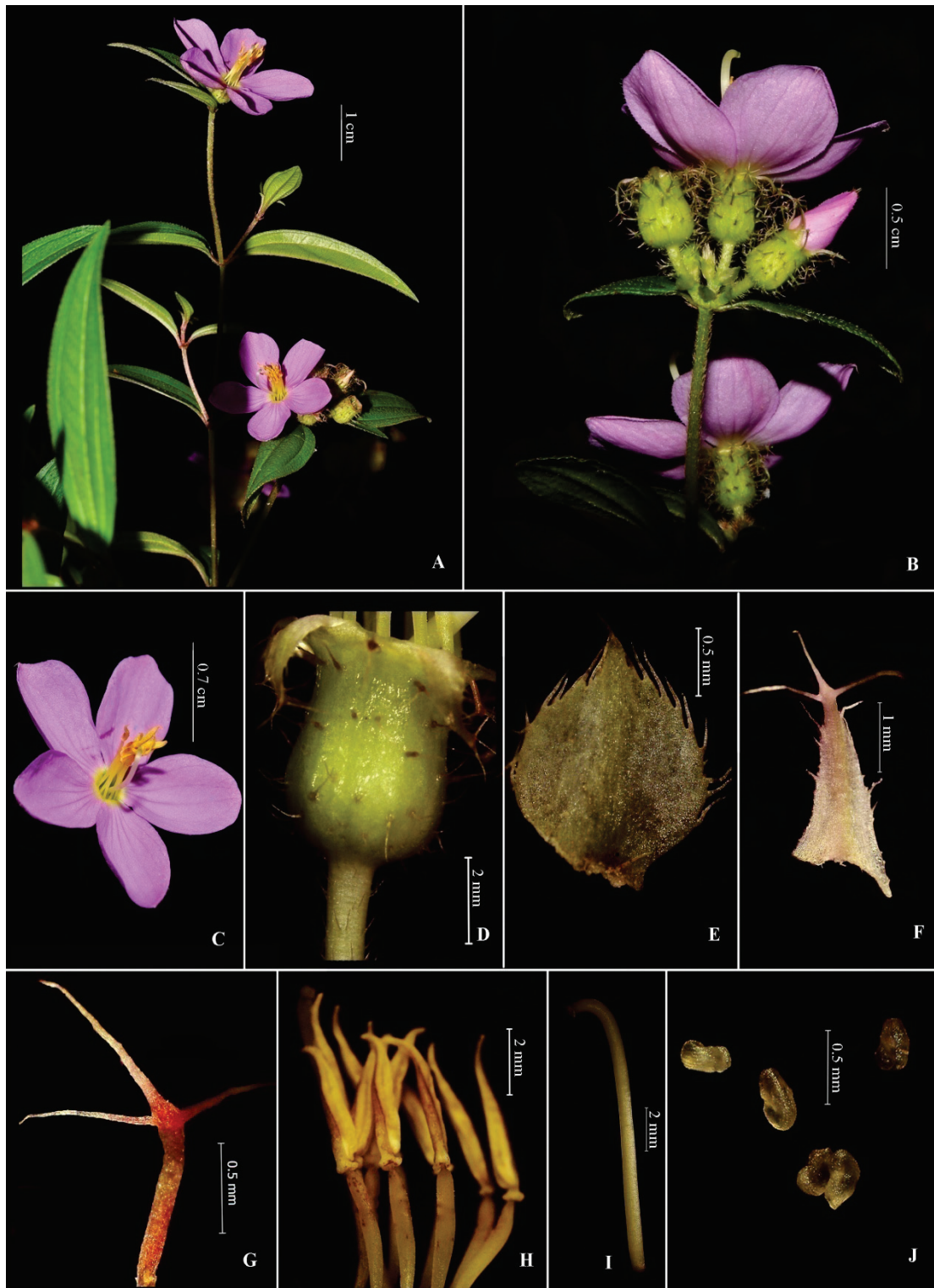


Figure 33. *Osbeckia virgata* D.Don ex Wight & Arn.: **A.** Habit; **B.** Inflorescence; **C.** Flower; **D.** Hypanthium; **E.** Bract; **F.** Sepal; **G.** Intersepal emergence; **H.** Stamens; **I.** Style; **J.** Seeds.



Figure 34. Lectotype of *Osbeckia virgata* D. Don ex Wight & Arn [Wight 1147B (E00174614)] © The Board of Trustees of Royal Botanic Garden Edinburgh.

undulating collar. Ovary united with hypanthium for about half of its length; anther pockets extending to base of ovary; crown with a few strong bristles; style 7–11 mm long. Capsules, campanulate, 4–6 × 4.5 mm; seeds minute, 0.1–0.3 mm long, numerous, curved and muricate.

Chromosome Number: — $n=11$ (Meenakumari & Kuriachan, 1990)

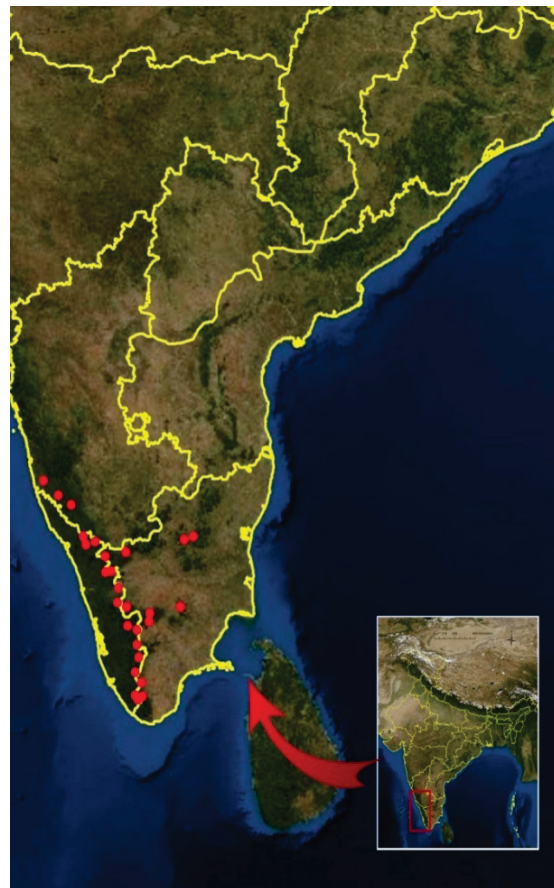
Flowering and Fruiting: — July – March.

Ecology and Habitat:— Commonly occurs in evergreen and shola forest margins at an altitude above 1000 m. Also seen rarely at lower altitudes below 100 m.

Distribution:— Karnataka, Kerala, Tamil Nadu.

Notes:— *Osbeckia virgata* and *O. octandra* resembles in habit. Hansen (1977) also made a similar observation. But *O. virgata* is distinct from the latter due to the sparse vestiture of the hypanthium, thread-like intersepal emergences

having one or a few bristles, much reduced intersepal emergences and by the deciduous sepals. Both species are found in Sri Lanka but in India there is only *O. virgata*.



Specimens examined: **Karnataka:** Chikkamagaluru Dist., Charmudi ghats, 17.04.1979, *Saldanha & Ramesh* 786 (CAL). Kodagu Dist., Virajapete, 18.01.1953, *K.M. Vaid* 23417 (DD). Shimoga Dist., Ghat road to Agumbe, 13.10.1962, *Sundara Raghavan* 83177 (CAL); Begar roud Agumbe, 13.10.1962, *Sundara Raghavan* 67965 (CAL); Agumbe, 15.05.1962, *Sundara Raghavan* 80673 (CAL); Begar road Agumbe, 15.05.1962, *Sundara Raghavan* 80667 (CAL); Agumilar Ghats Edge, North Kanara, 09.03.1960, *R.S. Rao* 61264 (CAL). Udupi Dist., Someshwar, 06.02.1961, *Sundara Raghavan* 69368 (CAL). **Kerala:** Ernakulam Dist., Pooyamkutty, 14.02.1986, *K.K.N. Nair* 4304 (KFRI). Idukki Dist., Kuttikanam, 25.09.1964, *Vivekananthan* 21370 (MH); Peerumadu, Kuttikanam, 15.07.1966, *Vivekananthan* 29325 (MH); Vallakkadavu, 11.03.1973, *B.D. Sharma* 84519 (MH); Kalveri Mount, 08.11.1981, *Ramanujan & Mohanan* 72429 (CAL). Kannur Dist., Thalappalli, 28.01.1979, *V.S. Ramachandran* 59273 (MH). Kollam Dist., Paravur, 07.08.1978, *Mohanan* 58401 (CAL); Kulathupuzha, 19.12.1980, *Sasidharan* 1438 (KFRI). Kozhikode Dist., Thamarassery, 29.10.1965, *J.L. Ellis* 25766 (CAL); Pakranthalam, 10.07.2014, *Prashob & Sibichen* 5520 (DEV); Muthapanpuzha, Vellarimala, 11.07.2014, *Prashob & Sibichen* 5521 (DEV). Malappuram Dist., Nadukani, 08.1956, *E. Barnes*, s.n. (DD). Pathanamthitta Dist., Puthukulam, 07.07.1988, *Arunkumar* 640 (CAL); Konni, 22.12.1957, *S. Negi* 25887 (DD); Ranni, 30.08.1977, *N.C. Nair* 507088 (MH); Manniyar River, Ranni, 10.11.1976, *Chandra Bose* 49075 (MH); Konni, 30.07.1908, *M. Rama Rao* 0064 (DD); Konni, 21.11.1928, *V. Narayanaswami* 1763 (MH). Thiruvananthapuram Dist., Ponmudi, 11.09.1970, *K.M. Matthew* 12328 (RHT); Bonacaud, 04.10.1973, *J. Joseph* 44546 (MH); Ponmudi, 17.11.1977, *Mohanan* 52547 (MH); Nedumangad, 11.1901, *S.call.*, s.n. (MH); *S.loc.*, 12.1937, *N.L. Bor* 83037 (DD); Ponmudi, 17.01.1989, *Sasidharan* 5282 (KFRI); Ponmudi, 01.08.2014, *Prashob & Sibichen* 5513 (DEV).

Thrissur Dist., Vazhachal, 04.11.1989, *Sasidharan* 5500 (KFRI). Wayanad Dist., *S.loc.*, 1881, *Beddome s.n.* (MH); *S.loc.*, 11.1884, *J.S. Gamble* 172054 (CAL). Brahamagiri, 16.11.1978, *V.S. Ramachandran* 58761 (CAL, MH); Chandanathode, 20.12.1979, *V.S. Ramachandran* 65354 (CAL, MH); Tirunelli, 09.02.1978, *V.S. Ramachandran* 53830 (MH); Sulthan Battery, 09.05.1965, *J.L. Ellis* 24009 (MH); Pookode lake, 04.06.2014, *Prashob & Sibichen* 5509 (DEV); Pookode lake, 08.07.2014, *Prashob & Sibichen* 5517, 5518, 5519 (DEV); Chembra lake, 08.12.2014, *Prashob & Sibichen* 5558 (DEV). **Tamil Nadu**, Coimbatore Dist., Atakatti, Anaimalai hills, 12.1911, *C.E.C. Fischer* 2214 (CAL); Sholayar, 20.04.1986, *Sasidharan* 1756 (KFRI); Nilgiri Dist., Gudalur, 11.03.1969, *D.B. Deb* 31651 (CAL); Conoor, 08.1883, *J.S. Gamble* 12307 (DD); Namakkal Dist., Salem, 06.02.1979, *Perumal* 21663 (CAL); Kolli hills, 24.01.1968, *K.M. Matthew* 8478 (RHT); Kolli hills, 11.01.1976, *K.M. Matthew & Alphonse* 711 (RHT); Kolli hills, 13.08.1976, *K.M. Matthew & Alphonse* 3154 (RHT); Selam, Mooduballi village, 15.04.1977, *Arockiasamy* 7639 (RHT). Kolli hills, 03.02.1978, *Mohan* 11587 (RHT); Kolli hills, Kolathukadu, 03.02.1978, *Mohan* 11624 (RHT); Kolli hills, Kolathukadu shola, 20.04.1978, *Mohan* 13192 (RHT); Kolli hills, Selur, 17.10.1978, *K.M. Matthew & Venugopal*, 18378 (RHT); *ibid.*, 07.02.1979, *Perumal* 21591 (RHT); Kolli hills, Kasam, a pond near Sempaththu village, 08.02.1979, *Perumal* 21663 (RHT); Kolli hills, Selur 21.04.1979, *K.M. Matthew* 22963 (RHT); Kolli hills, Solakkadu, 18.12.1979, *K.M. Matthew* 25185 (RHT); Kolli hills, Solakkadu, Pongal Koil shola, 22.02.1980, *K.M. Matthew* 26668 (RHT); Kolli hills, Ariyur shola, 22.04.1980, *K.M. Matthew* 27636 (RHT); Kolli hills, Ariyur shola, 28.04.1981, *K.M. Matthew* 28285 (RHT); Kolli hills, Kuzhivalavu shola, 24.06.2001, *K.M. Matthew* 62736 (RHT); Kolli hills, Kuzhivalavu top, 15.03.2002, *K.M. Matthew* 63342 (RHT); Kolli hills, Sothupparai, 17.03.2003, *K.M. Matthew* 63604 (RHT).

Ramanathapuram Dist., Sethur hills, 13.03.1981, *Srinivasan* 68051 (CAL);
Deviar estate, 11.06.1979, *Srinivasan* 63515 (CAL).

Osbeckia wightiana (Benth.) Wight & Arn., Prodr. Fl. Ind. Orient. 1: 323. 1834; C.B. Clarke in Hook.f., Fl. Brit. India 2: 519. 1879; Gamble, Fl. Pres. Madras 1: 493. 1919; Fyson, Fl. Ind. Hill 173. 1932; Mohanan & Sivad., Fl. Agasthyamala 280. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 223. 2005. *Osbeckia wightiana* Benth. In Wallich Numer. List. n. 4060. 1831 (*nom.nud.*). *Osbeckia aspera* (L.) Blume var. *wightiana* (Benth. ex Wight & Arn.) Trimen, Fl. Ceylon 2: 196. 1894 *syn. nov.*; C. Hansen, Ginkgoana 4. 85. 1977; Vivek. in N.C. Nair & A.N. Henry, Fl. Tamil Nadu 1: 161. 1983; Mohanan, Fl. Quilon Dist. 187. 1984; Vajr., Fl. Palghat Dist. 203. 1990; M. Mohanan & Henry, Fl. Thiruvanthapuram 198. 1994; Sasidh. *et al.*, Bot. Stud. Med. Pl. Kerala 37. 1996; Swarup. *et al.*, Shola For. Kerala 59. 1998; Sasidh., Fl. Periyar Tiger Reserve 144. 1998; Sasidh., Fl. Chinnar WLS 131. 1999; Manickam *et al.*, Fl. Tirunelveli Hills 407. 2008. **Lectotype** (designated by Hansen, 1977):— *S.loc.*, 1831, *Wallich* 4060A (K000867973 image!).

Osbeckia koti-gueda Naudin, Ann. Sci. Nat. Bot. Ser. 3, 14: 64. 1850. **Lectotype** (designated by Hansen, 1977):— India, Tamil Nadu, Nilgiris (as Nellyghery), *S.die.*, *Leschenault* 41 (P02441100 image !) **Figs. 35 & 36.**

Perennial, erect, branched, woody shrubs, 1–3.5 m tall. Young stems quadrangular, thinly clothed with appressed or sub appressed, short bristles. Leaves petiolate; petioles 4–8 mm long; lamina ovate, 3–7 × 2–3.5 cm, apex acute, base obtuse, 5–7-nerved, non-acrodromous, adaxial surface of leaf covers with dense silky sub patent hairs, abaxial side with patent flexuous hairs. Inflorescence terminal cymes, 3–7-flowered, subtended by

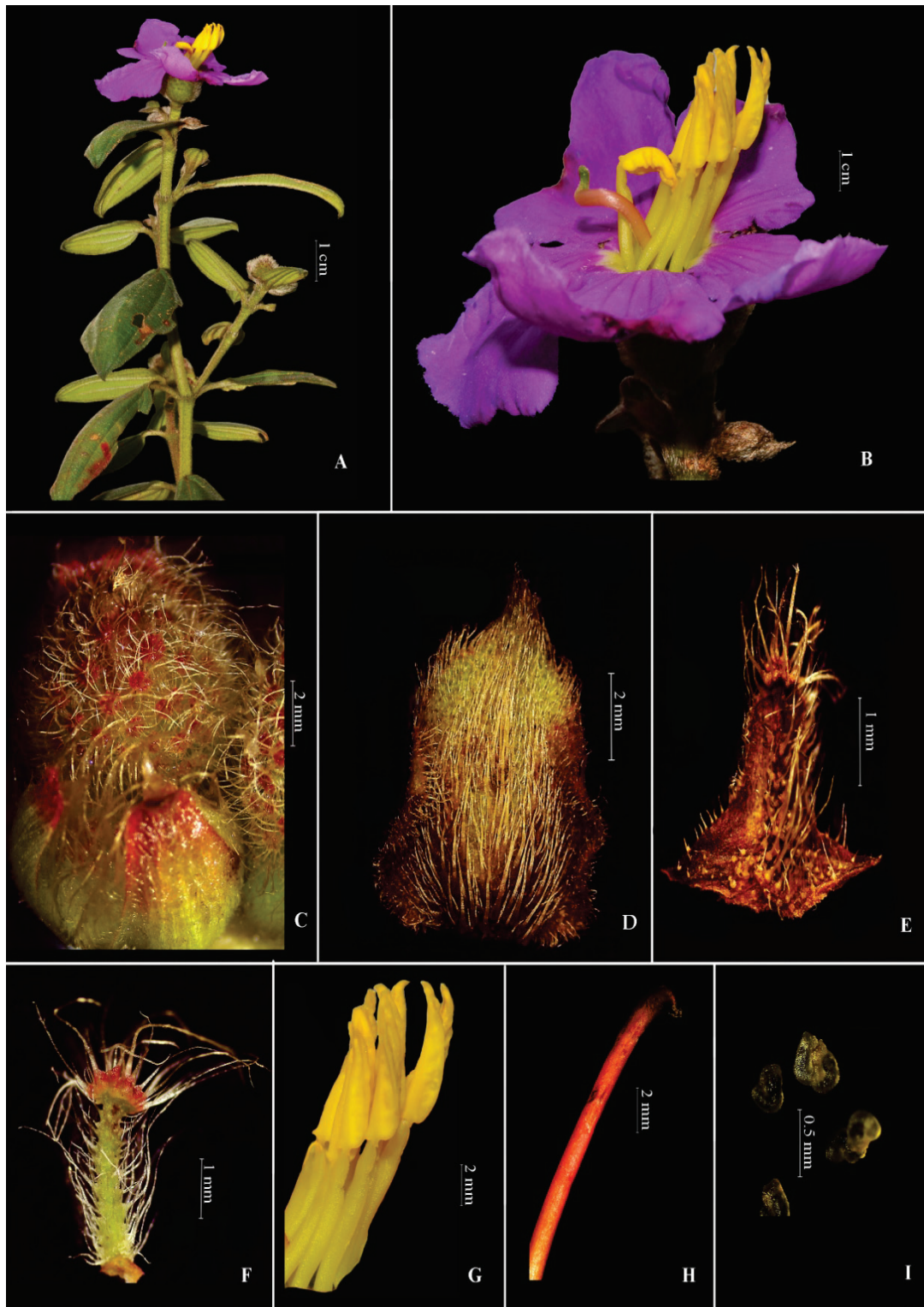


Figure 35. *Osbeckia wightiana* (Benth.) Wight & Arn.: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Sepal; **F.** Intersepal emergence; **G.** Stamens; **H.** Style; **I.** Seeds.

large bracts; bracts ovate, 6–10 mm long, green, margins ciliate and densely rufous hairy. Flowers pentamerous, pedicellate, bracteate; Pedicels 1–3 mm long, covered with thin patent hairs. Hypanthium campanulate, 7–13 × 7–12 mm, densely clothed with large emergences mixed with small hairs and bristles; intersepalar emergences stalked, 1.5–2.5 mm long, hairy and ending in a small tuft of patent stellate hairs; other emergences similar, mixed with small hairs and bristles. Sepals 5, subulate, 2.5–4 × 1.3–3.5 mm long, sparsely hairy, margins ciliate, apex with stellate emergence, caducous. Petals 5, obovate, 15–25 × 10–20 mm long, pink to purple; margins ciliate. Stamens 10; filaments 7–12 mm long, glabrous; anthers narrowly oblong, yellow, 5–9 mm long, twisted, pore apical, oblique on dorsal side; connective prolonged in to a small, indistinctly lobed collar. Ovary 4–8 mm long, united with hypanthium; anther pockets covered with brownish appressed hairs; crown ciliate; style 1–1.5 cm long, glabrous, curved; stigma, swollen. Capsules campanulate, 5–7.5 × 4–5.5 mm; seeds numerous, minute, 0.1–0.2 mm long, curved.

Ecology and Habitat:—Occurs in evergreen forests at an altitude above 1000 m. Seen in association with *O. virgata* and *O. parvifolia*.

Flowering and fruiting:—October–March

Distribution:—Kerala, Tamil Nadu.



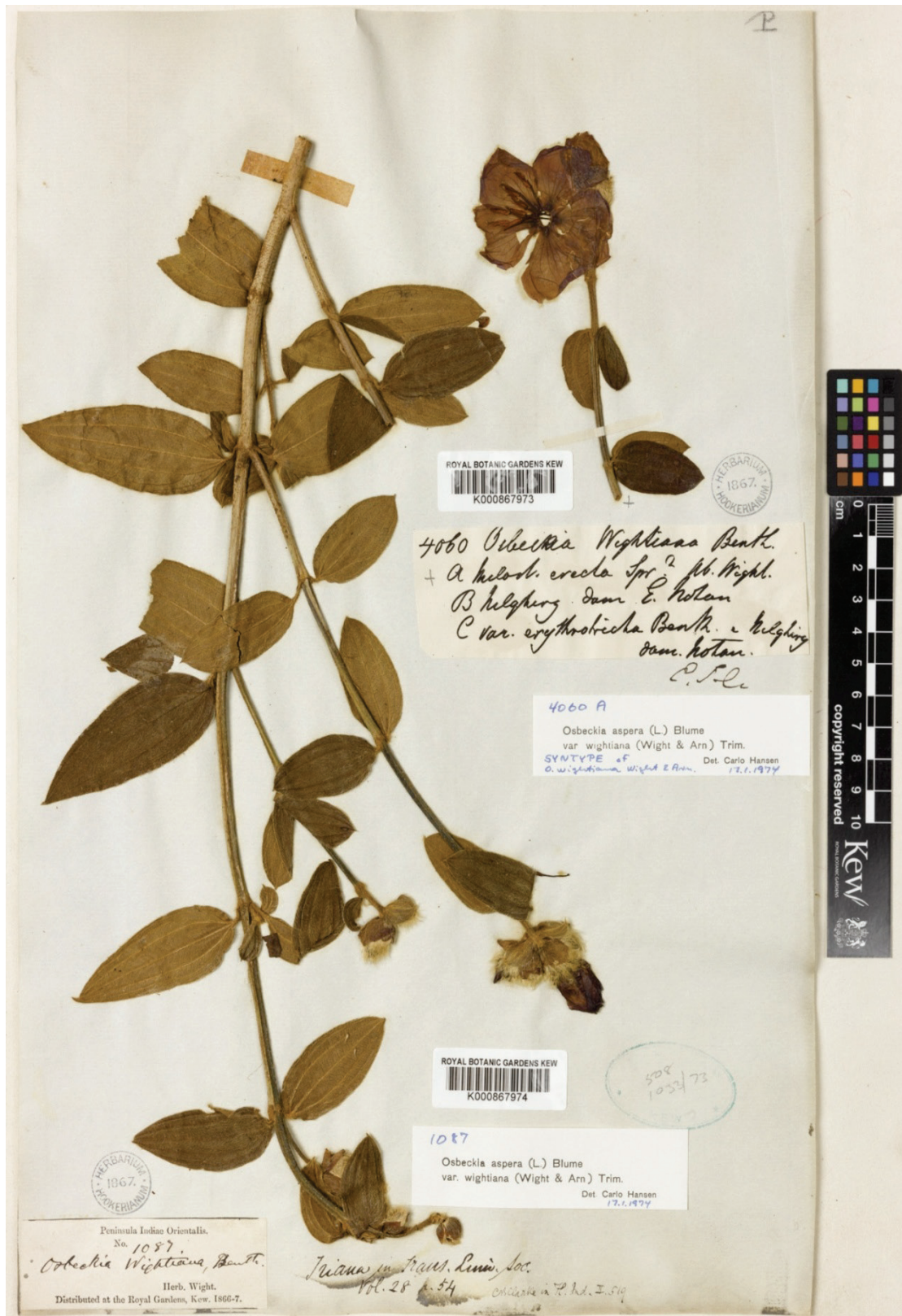


Figure 36. Lectotype of *Osbeckia wightiana* (Benth.) Wight & Arn. [Wallich 4060A (K000867973)] © The Board of Trustees of Royal Botanic Gardens, Kew.

Notes:—Trimen (1894) treated this taxon as a variety under *Osbeckia aspera*. However, this taxon is recognized as a distinct species in the present treatment. Substantiating characters are summarized in the Table-3 below.

Table: 3 Comparison of *O. aspera* and *O. wightiana*

Character	<i>O. aspera</i>	<i>O. wightiana</i>
Leaf	Acrodromous , 3 nerved	Non-acrodromous, 5–7 nerved
Hypanthium	Simple hairs only	simple hairs and Emergences present all over
Bracts	Ovate to cordate, 1–5 mm long	Ovate, 6–10 mm long
Sepals	Triangular	Subulate
Intersepal emergences	Sessile, ending in a tuft of hairs	Stalked, hairy, ending in a small tuft of patent stellate hairs
Other emergences	Absent	Present, Stalked with stellate head

Specimens examined:—**Kerala:** Idukki Dist., Kattappana, 08.11.1981, B. Ramanujan & C. N Mohanan 72415 (CAL); Mathikettan, 08.05.1994, V.S. Ramachandran 1778 (FRLH). Palakkad Dist., Poovancholi, Silent valley, 07.03.1984, N.C. Nair & P. Bhargavan 8112 (CAL); Silent valley R.F., 22.12.1969, E. Vajravelu 33259 (MH). **Tamil Nadu:** Coimbatore Dist., Vadakumalai, 22.12.1970, M.V. Viswanadhan 860 (MH); Velliengiri hills, 21.02.1932, S.R. Raju & Rethnavelu 215 (MH). Dindigul Dist., 6th road to Kodaikanal, 09.03.1958, K. Subramanyam 5525 (MH); Kodaikanal, Pillar rock, 14.10.2015, Prashob & Sibichen 6012 (DEV); Kodaikanal, Perumal peak, 21.07.1984, K.M. Matthew 40344 (RHT); Palamalai Machur path, 10.05.1985, K.M. Matthew & N. Rajendren 44923 (RHT); Palani hills, 29.11.1985, K.M.

Matthew & N. Rajendran 43446 (RHT); Leving path, Kodaikanal, 29.04.1986, *K.M. Matthew & N. Rajendren* 44662 (RHT); Gundur shola, Kodaikanal, 10.07.1986, *K.M. Matthew & N. Rajendren* 45840 (RHT); Kodaikanal, 13.03.1956, *S.J. Pallithanam* 1352 (RHT); Palamalai, 19.02.1986, *K.M. Matthew* 44159 (RHT); Perumal malai, 21.05.1969, *K.M. Matthew* 10243 (RHT); Observatory slope, 11.08.1969, *K.M. Matthew* 10386 (RHT); Berijam slope, 06.08.1984, *K.M. Matthew* 2150 (RHT); Perumal malai, St. Joseph's farm, 07.02.1985, *K.M. Matthew* 40953 (RHT); Moir point slope, 04.08.1985, *K.M. Matthew* 41688 (RHT); Kodaikanal, Pillar Rock, 11.06.1986, *C. Sundherson* 004 (CAL); *ibid.*, 14.09.1968, *D.B. Deb* 30847 (MH); Kodaikanal hills, 18.10.1919, *C.K. Jacob* 21171 (MH). Kanyakumari Dist., Mahendragiri R.F., 25.02.1983, *A.N. Henry & R. Gopalan* 77157 (CAL); Upper Kothayar, 02.02.1978, *A.N. Henry* 53370 (MH); Sengamalai estate to Mahendragiri, 06.12.1969, *B.V. Shetty* 33058 (MH); Kandakki estate, Panagudi, 03.12.1969, *B.V. Shetty* 33015 (MH). Madurai Dist., Varayattu mottai, Pachakamatchi, 16.08.1990, *V. Lakshmanan* 91197 (MH). Nilgiris Dist., Naduvattam, 18.01.1961, *B.V. Shetty* 11925, (MH); Kotagiri Avenue, 04.01.1957, *K. Subramanyam* 1888 (MH); Upper Tiger shola, 19.01.1957, *K.M. Sebastine* 2069 (MH); Mettupalayam–Kotagiri road, 07.03.1969, *D.B. Deb* 31481 (MH); Kotagiri, 31.07.1970, *E. Vajravellu* 35184 (MH); Lamb's rock, Coonoor, 28.04.1971, *N.C. Rathakrishnan* 38105 (MH); Koil mattam, Elanad, 25.03.1972, *G.V. Subbaro* 40476 (MH); Nilgiri, Coonoor, 01.1883, *J.S. Gamble* 11925 (DD); 10.1886, *J.S. Gamble* 21155 (MH); *Ibid.*, 10.1889, *J.S. Gamble* 21437 (DD); Nilgiri, Sispara, 10.1889, *J.S. Gamble* 21155 (MH); Ooty, Kotagiri, 18.12.2014, *Prashob & Sibichen* 5577, 5578 (DEV). Tirunelveli Dist., Pachayar bund, Sengaltheri, 22.12.1980, *E. Vajravellu* 76430 (CAL). Theni Dist., Periakulam, Shembaganur-Periakulam, 21.11.1985, *K.M. Matthew, N. Rajendren & A. Usha* 42933 (RHT).

Osbeckia wynaadensis C.B. Clarke in Hook. f., Fl. Brit. India 2(6): 521. 1879; Gamble, Fl. Pres. Madras 1: 493(348). 1919; C. Hansen, Ginkgoana, 4: 62. 1977. Ramach. & V.J. Nair, Fl. Cannanore Dist. 188. 1988; M. Mohanan & Henry, Fl. Thiruvanthapuram 199. 1994; Sasidh. & Sivar., Fl. Pl. Thrissur For. 190. 1996; Sasidh., Fl. Periyar Tiger Reserve 145. 1998; Sasidh., Fl. Parambikulam WLS 129. 2002. **Lectotype** (designated by Hansen, 1977):—India, Tamil Nadu, Gudalur, Wayanad, 4000 ft. 29.03.1870, Clarke 11328A (K000890001 image!)

Figs. 37 & 38.

Perennial, erect shrubs, 1–2.5 m tall. Stems profusely branched, branches thinly covered with appressed shaggy hairs. Leaves petiolate; petioles 0.5–1.5 cm long; Lamina ovate to elliptic, 9–20 × 2.5–5 cm, 5-nerved, green, apex acute, base obtuse, upper side covered with ascending strong shaggy hairs, lower side with patent short hairs. Inflorescence terminal panicles, 9–15 flowered. Flowers pentamerous, bracteate, pedicellate; bracts ovate, 10–14 × 4–8 mm, green, appressed hairy along the dorsal side; pedicels 0.5–1.5 mm long. Hypanthium campanulate, 6–9 × 3–5 mm, with a few, large scale like emergences, simple hairs absent; intersepalar emergences strongly bristled scale like, caducous; other emergences similar to those on the hypanthium. Sepals 5, triangular, 7–12 mm long, acute, with indistinct nerves, margins finely ciliate, both sides glabrous, caducous. Petals 5, broadly obovate, 15–19 × 8–12 mm long, purple, with ciliate apex. Stamens 10; filaments 7–11 mm long, glabrous; anthers narrow, ovate, 6–10 mm long, yellow, attenuate, not twisted; pore oblique on ventral side; connective with a collar having dorsal and ventral lobes. Ovary united with hypanthium; anther pockets extending to the base of ovary; crown distinct with appressed short hairs; style 12–18 mm long. Capsules campanulate, 7–8 × 5–6 mm; seeds minute, numerous, muricate and curved.

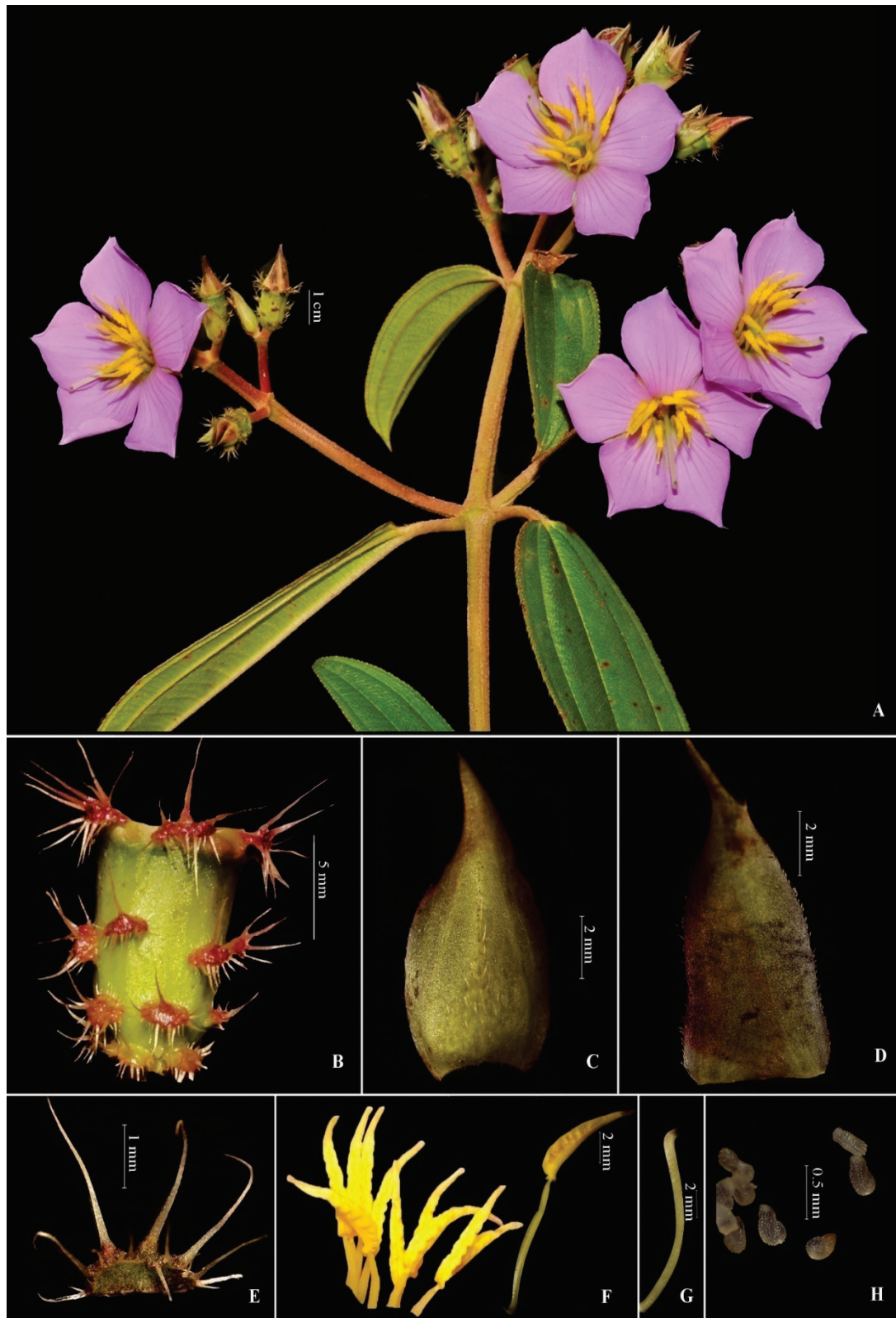


Figure 37. *Osbeckia wynaadensis* C.B. Clarke: **A.** Habit; **B.** Hypanthium; **C.** Bract; **D.** Sepal; **E.** Intersepal emergence; **F.** Stamens; **G.** Style; **H.** Seeds.



Figure 38. Lectotype of *Osbeckia wynaadensis* C.B. Clarke: [Clarke 11328A (K000890001)] © The Board of Trustees of Royal Botanic Gardens, Kew.

Chromosome number:— $n=12$
(Meenakumari & Kuriachan,
1990)

Flowering and Fruiting:—
September–December.

Ecology and Habitat:—Usually
found in large population, in
swampy areas along the forest
margins also occurs in open
grasslands.

Notes:—*Osbeckia wynaadensis*



closely resembles *O. nepalensis* both in vegetative and floral characters. Both of them occur in altitudes above 700 m. The allopatric distribution (*O. wynaadensis* is restricted to South India whereas *O. nepalensis* found only in North East) and the length of the petioles are the two major differences by which the species can be segregated. In *O. wynaadensis* leaves are petiolate (petioles are 0.5–1.5 cm long) but in *O. nepalensis* leaves are sessile.

Distribution:—Kerala, Tamil Nadu.

Specimens examined:— **Kerala:** Idukki Dist., Munnar, 30.04.1937, *E. Barnes* s.n. (DD). Palakkad Dist., Parambikulam Submergible area, 20.11.1962, *K.M. Sebastine* 15049 (CAL, MH). Wayanad Dist., Tirunelli, 9.02.1978, *V.S. Ramachandran* 53819 (CAL, MH); SulthanBathery, 08.02.1964, *J.L. Ellis* 18623 (CAL, MH); Pookode lake, 27.01.15, *Prashob & Sibichen* 6011, 6012, 6013, 6014 (DEV); Meenmutty, 14.02.1982, *C. N. Mohann* 73252 (CAL); *ibid.*, 27.01.15, *Prashob & Sibichen* 6015, 6016, 6017 (DEV); *S.loc., S.die, E. Barnes* s.n. (MH).

Tamil Nadu: Dindigul Dist., Kodaikanal, *S.die.*, *S.call.* s.n. (RHT); Nilgiri Dist., Benne R.F., 10.04.1972, K. Vivekanandhan 79662 (MH); Gudalur, *S.die.*, C.B. Clarke s.n. (MH); Gudalur, *S.die.*, E. Barnes, s.n. (DD); Benne R.F., 20.01.1961, B.V. Shetty 11944 (MH). Tirunelveli Dist., Mahendragiri, 09.1903, C.E.C. Fischer s.n. (CAL).

The section *Ceramicalyx* was established by Triana (1871). He included 5 species and 3 varieties namely *O. stellata*, *O. hispidissima*, *O. crinita*, *O. gracilis* and three varieties of *O. rostrata* viz., var. *longicollis*, var. *pulchella* and var. *ternifolia* under this section. Clarke (1879) treated all the above species except *O. gracilis* and *O. rostrata* var. *ternifolia* under this section. Besides these, Clarke (*l.c.*) also included a new variety of *O. rostrata* viz., var. *marginulata* under this section. Later, Cogniaux (1891) adopted the section *Ceramicalyx* Triana, excluding *O. gracilis*. The exclusion of *O. gracilis* by subsequent authors is justifiable as the species is fairly distinct due to its pentamerous flowers and the anthers without beak. The members of the section *Ceramicalyx* are perennial shrubs with tetramerous flowers, urceolate hypanthium and "S" shaped anthers with long beak. At present in India, the section is represented by 3 species and 2 varieties.

Species belong to Sect. *Ceramicalyx*:— *O. nayarii* G.S. Giri, *O. rostrata* D. Don, *O. stellata* Buch.-Ham. ex D. Don, *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen and *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen

Osbeckia* Sect. *Ceramicalyx Triana, Trans. Linn. Soc, London 28: 53. 1871;

C.B. Clarke in Hook.f., Fl. Brit. India 2(6): 516. 1879; Cogn. in A.DC. &

C.DC., Monogr. Phan. 7: 322: 1891. **Type:**—*Ceramicalyx stellatus* Blume

Oxyrhinae sub sect. *Longicolles* Naudin, Ann. Sci. Nat. Bot. ser. 3. 14: 74. 1850.

Perennial, erect, branched shrubs. Flowers tetramerous; hypanthium urceolate with stellate emergences and hairs; anthers 'S' shaped with long beak.

Distribution:—Distributed mainly along wet tropical and subtropical Asia including Indo China, Nepal, and Bhutan.

Key to the species of Sect. *Ceramicalyx*

- 1a. Plant glabrous; branchlets distinctly winged; hypanthium without emergences and hairs; intersepal emergences absent..... *O. nayarii*
- 1b. Plant hairy; branchlets not distinctly winged; hypanthium with emergences and hairs; intersepal emergences present..... 2
- 2a. Intersepal emergences having terete stalk with lateral hairs and stellate head.....*O. stellata*
- 2b. Intersepal emergences linear without lateral hairs and stellate head *O. rostrata*

Osbeckia nayarii G.S. Giri, J. Econ. Taxon. Bot. 4(2): 609. 1983. **Type:**—India, Khasia, 2000 ft., 14.09.1886, C.B. Clarke 44776A (CAL0000015810!).

Osbeckia pulchella Benth. ex Wall., Numer. List Pl. 143, no. 4059. 1831 (*nom. nud.*) non Benth. ex Naudin, 1850. *Melastoma pulchellum* Roxb., Fl. Indica, ed. 2, 2: 403. 1832 **Type:**—India, *S.loc.*, 1814, Roxburgh *s.n.* (BM000944362 image!).

Ceramicalyx pulchellus Blume, Mus. Bot. 1(4) : 50. 1849. **Type:**—Bangladesh, Chittagong, *S.die.*, Wallich 4059B (K000639584 image!). **Figs. 39 & 40.**

Erect, perennial shrubs, 1–1.5 m tall, with straggling branches. Stems and branches strongly quadrangular, winged at angles: wings thick, more or less fleshy, glabrous throughout. Leaves petiolate, glabrous; petioles 5–10 mm long; lamina elliptic to lanceolate, 10–15 × 3–6 cm, 5–7-nerved, apex acute to acuminate, base cuneate, dark green. Inflorescence terminal condensed panicles, 5–12-flowered. Flowers tetramerous pedicellate, bracteate; pedicels



Figure 39. *Osbeckia nayarii* G.S. Giri: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Sepal; **F.** Stamens; **G.** Sepal without Intersepal emergence; **H.** Seeds.

3–7 mm long; bracts green, ovate, 8–13 × 2–6 mm long, glabrous on either side, caducous. Hypanthium urceolate, 12–14 × 4–6.5 mm, glabrous; intersepalar emergences absent. Sepals 4, narrowly ovate with prominent midrib, 10–13 × 2.5–3.5 mm, glabrous, not persistent in fruit. Petals 4, ovate to orbicular, 16–20 × 10–14 mm, pink to purple. Stamens 8, filaments 2–4 cm long, glabrous; anthers 'S' shaped, 2–4.5 cm long, attenuate into a narrow, tubular beak (4–8 mm long), yellow, glabrous, pore apical, connective prolonged in to a small, indistinctly lobed collar. Ovary 12–14 mm long, 4-locular, united with hypanthium; anther pockets and crown covered with appressed hairs; style 2.5–4 mm long, glabrous, curved; stigma slightly swollen. Capsules urceolate, 12–14 × 4–6.5 mm, glabrous with a long neck; seeds numerous, minute, 0.1–0.2 mm long, curved and muricate.

Chromosome number:—Not reported.

Flowering and Fruiting:— July – November.

Ecology and Habitat:—Found in open grasslands above 1000 m.

Distribution:—Assam, Meghalaya, Tamil Nadu.

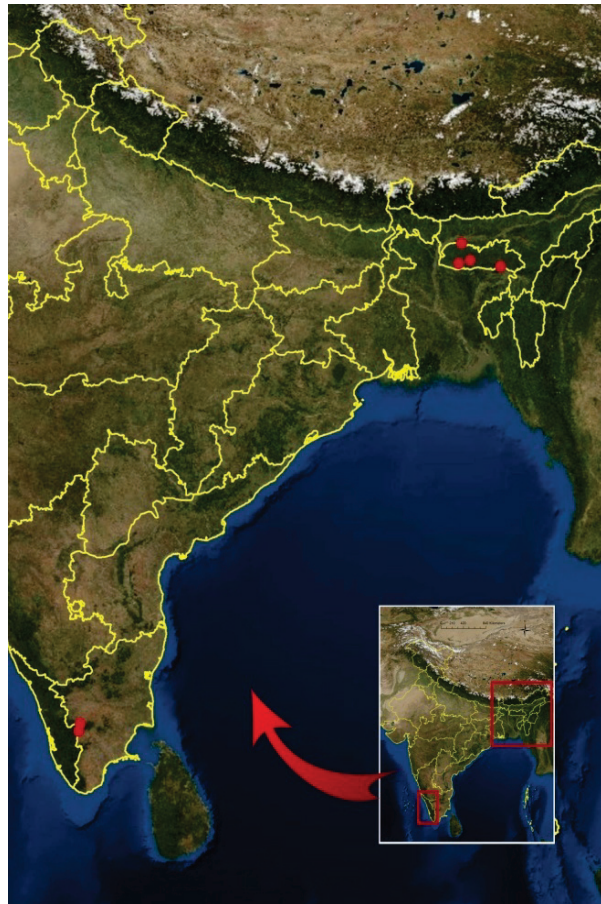




Figure 40. Holotype of *Osbeckia nayarii* G.S.Giri: [C.B. Clarke 44776A (CAL0000015810)] © Botanical Survey of India, Central National Herbarium.

Notes:— Roxburgh (1832) described *Melastoma pulchella* in his *Flora of India* based on specimens collected from Chittagong. Prior to the publication of Roxburgh, Wallich (1831) included this name in his catalogue as a species of *Osbeckia* viz., *O. pulchella* Benth., treating Roxburgh's name (*Melastoma pulchella*) as its basionym. However, Wallich's name is not valid as it is not accompanied by a description, diagnosis, or reference to any published diagnosis. Later Blume (1849) adopted Wallich's specific epithet and placed this taxon under the genus *Ceramicalyx* and validly published as *C. pulchellus*. The specific epithet "*pulchella*" cannot be validly combined with the genus *Osbeckia* as it was preoccupied for another taxon, *Osbeckia pulchella* Benth. ex Naudin, (= *Osbeckia rostrata* D. Don). Therefore, the present valid name for the taxon is *Osbeckia nayarii* G.S.Giri.

Specimens examined:—**Assam:** Golpara Dist., Golpara, 1914, *U.Kanjilal* 6914 (CAL). **Meghalaya:** East Khasia hills Dist., Pynursla, 1755 m, 15.09.2015, *Prashob & Sibichen* 6112 (DEV). Ri-Bhoi Dist., Nongpoh, 987 m, 06.08.2014, *K.M. Manudev & Prashob* 57412 (DEV). **Tamilnadu:** Coimbatore, Valparai, Sholayar dam, 1225 m, 03.10.2015, *Prashob & Sibichen* 6018 (DEV). **Kerala:** Kozhikode, St. Joseph's College Botanical garden (cultivated), 55 m, 06.10.2015, *Sibichen & Prashob* 1620 (DEV).

Osbeckia rostrata D. Don, Prodr. Fl. Nep. 221. 1825; N.P.Balakr, Fl. Jowai & Vicinity, 205. 141. 1983. *Osbeckia stellata* Buch.-Ham. ex D. Don var. *rostrata* (D. Don) C. Hansen, Ginkgoana 4. 28. 1977. (*syn. nov.*) **Type:**—Nepal, Narainhetty, 11.08.1802, *Hamilton s.n.* (BM000521786 image!).

Osbeckia recalva Bedd. ex Gamble, Fl. Pres. Madras 1: 494. 1919 (*pro syn.*).

Osbeckia ternifolia D. Don, Prodr. Fl. Nep. 221, 1825. *Ceramicalyx ternifolius* Blume, Mus. Bot. 1(4): 50. 1849. *Osbeckia rostrata* var. *ternifolia* (D. Don) Triana, Trans. Linn. Soc. London 28: 54. 1872. **Type**:— Nepal, *S.die*, *Hamilton s.n.*, (BM000521785 image!).

Osbeckia quaterna Buch.-Ham. ex D.Don Prodr. Fl. Nep. 221. 1825 (*pro syn.*).

Osbeckia campestris Buch.-Ham. In Wall. Numer. List 143, no. 4063. 1831 (*nom. nud.*). *Ceramicalyx calvus* Blume, Mus. Bot. 1(4): 50. 1849. **Type**:— *S.loc.*, *S.die.*, *Wallich s.n.* (G00310438 image!).

Osbeckia pulchella Benth. ex. Naudin, Ann. Sci. Nat. Bot., Ser. 3, 14: 73. 1850. *Osbeckia rostrata* var. *pulchella* Triana, Trans. Linn. Soc., London 29: 54. 1872 (*nom. nud.*). **Type**:— India, Khasia, *S.die*, *Griffith s.n.* (P02441144 image!).

Osbeckia longicollis Benth., In Wall. Numer. List 143, no. 4065. 1831 (*nom. nud.*). *Osbeckia rostrata* var. *longicollis* Triana, Trans. Linn. Soc, London 28: 54. 1872 (*nom. nud.*) Triana ex Kurz, J. Asiat. Soc. Bengal pt. 2. Nat. Rist. 46: 74. 1877. **Type**:— Not seen.

Osbeckia chinensis var. *lancifolia* Kuntze, Rev. Gen. Pl. 1: 247. 1891. **Type**:— China, *S. loc.*, *S. die.*, *Kuntze 7209* (NYBG00229578 image!).

Osbeckia rostrata var. *sexangulata* Haines, Bot. Bihar & Orissa 370. 1922. **Type**:— India, Chota Nagpur, wet places, 3000 ft, *S.call. s.n.* (CAL!).

Osbeckia arunkumarensis M.P.Nayar & G.S.Giri, J. Bombay Nat. Hist. Soc. 81(2): 436. 1984. (**Syn. Nov.**) **Type**:—India, Sikkim, East Himalaya, Griffith 2248 (CAL0000016807!). **Figs. 41 & 42.**

Erect, perennial shrubs, 0.5–2 m tall. Stems branched; young branches quadrangular, with short, rigid, appressed hairs, sometimes occurring only at nodes. Leaves petiolate; petioles 3–8 mm long, upper leaves often sessile; lamina ovate to lanceolate, 5–17 × 2–6 cm, 5-nerved, green, apex acute to attenuate, base obtuse, both sides densely clothed with patent hairs. Inflorescence a terminal panicle, 6–12-flowered. Flowers pedicellate, bracteate, tetramerous; pedicels 0.5–3 mm long; bracts ovate to broadly ovate, 4–8 mm long, glabrous, with a few to many appressed hairs dorsally. Hypanthium urceolate, 7–13 × 2.5–4 mm, usually longer than ovary, covered with emergences having a few to several patent hairs on the stalk; intersepal emergences linear without lateral hairs and stellate head, caducous; other emergences similar, smaller. Sepals 4-lanceolate, 6–12 × 1.5–3 mm long, ciliate and with few to many patent hairs dorsally, caducous. Petals obovate to broadly obovate, 13–18 × 10–15 mm, glabrous pink to purple. Stamens 8; filaments 7–10 mm long; anthers 7–13 mm, 'S' shaped, attenuate into a narrow long beak, yellow; pore oblique on ventral side; connective prolonged into a slightly undulating collar with large dorsal lobes. Ovary united with hypanthium for about two thirds of its length, anther pockets extending to the base of the ovary; remaining part glabrous or often thinly clothed with short appressed hairs, crown present; style 15–25 mm long, glabrous. Capsules urceolate, 7–11 × 2–6 mm, covered with emergences, neck widens towards rim, emergences fall off at maturity; seeds minute, 0.1–0.2 mm long, numerous, curved.

Chromosome Number:— $n=10$ (Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—August – October.



Figure 41. *Osbeckia rostrata* D. Don: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Sepal; **F.** Intersepalal emergence; **G.** Other emergence; **H.** Stamen; **I.** Seed.



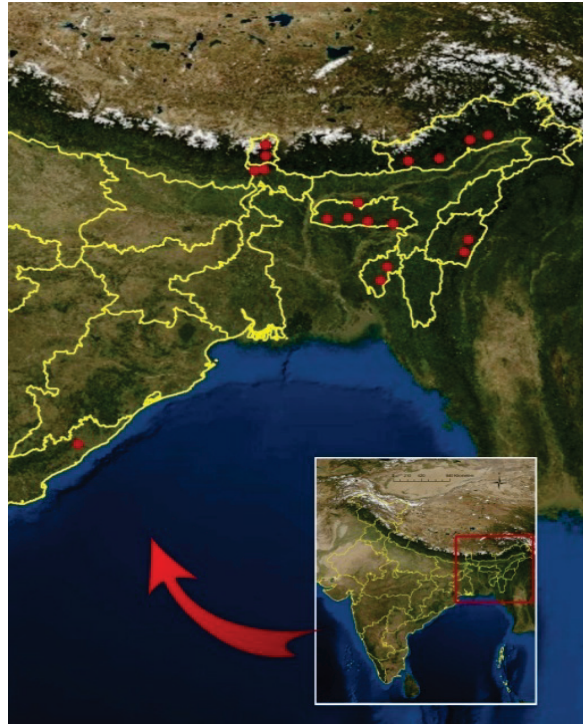
Figure 42. Holotype of *Osbeckia rostrata* D. Don: [Hamilton s.n., (BM000521786)]

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Ecology and Habitat:—Occurs in evergreen forest of North East Himalaya at an altitude above 500 m. The associated species is *O. stellata* var. *stellata*.

Distribution:— Andhra Pradesh, Assam, Manipur, Meghalaya, Mizoram, Sikkim, Tripura and West Bengal.

Notes:—Hansen (1977) treated *O. rostrata* as a variety of *O.*



stellata but it differs from the later by linear lanceolate to falcate intersepal emergences and fleshy stellate emergences on hypanthium hence it is treated here as a distinct species. Nayar and Giri (1984) described *O. arunkumarensis* from the herbarium collections of Griffith from Sikkim. They did not study the range of variation among the populations. The diagnostic characters of *O. arunkumarensis* such as winged branches, subsessile leaves, intersepal emergences terminated by a bristle are overlapping with *O. rostrata*, hence treated here as conspecific.

Specimen examined:—**Andhra Pradesh:** Visakhapatnam Dist., Visakhapatnam, Sunkerimetta. 21.09.1961, *N.P. Balakrishnan* 730 (CAL). **Assam:** East Karbi Anglong Dist., Phulai, 28.06.1963, *D.B. Deb* 35403, 35404 (ASSAM). Goalpara Dist., Dudhnai, Rangjuli East, 25.06.1964, *A.S. Rao* 39113 (ASSAM); *S.loc*, 31.07.1908, *W.G. Craib* 30 (CAL); Nowgong, Sonaikushi R.F., Tapatala, 20.08.1964, *N.P. Balakrishnan* 39300 (CAL). **Manipur:** Bishnupur Dist., Bishnupur, 11.1907, *A. Meebold* 171996 (CAL). Tamenglong Dist.,

Naga-Cachar hills, 05.1881, G. Watt 7278 (CAL); Mala naga-Cachar hills, 05.1882, G. Watt 171995 (CAL). Ukgrul Dist., Yhirighak, 11.1907, A. Meebold 5724 (CAL); *S.loc.*, 11.1907, Meebold 5980 (CAL). **Meghalaya:** East Khasi hills Dist., Mawlynnong, 12.09.2015, Prashob & Sibichen 6130 (DEV); Shillong, 24.06.1938, S.R. Sharma 18392 (ASSAM); Mawsmat, 21.09.1967, H. Deka 37719 (ASSAM). Garo hills Dist., *S.loc.*, *S.die*, N.E. Parrey 1929 (CAL). Jaintia Hills Dist., Jarain to Syndi, 17.08.1968, N.P. Balakrishnan 46164 (ASSAM); *S.loc.*, 09.08.1840, H.F. Mooney 1299 (ASSAM); *S.loc.*, 26.10.1956, P.O. Khant 5158 (ASSAM); Jarain garden, 19.09.2015, Prashob & Sibichen 6145 (DEV); Jowai, 19.09.2015, Prashob & Sibichen 6152 (DEV); Nongtalang village, 19.09.2015, Prashob & Sibichen 6148 (DEV). **Mizoram:** Aizwal Dist., Dampa Tiger reserve, Teirei, 21.09.2006, B.K. Sinha & N. Odyuo 112739 (ASSAM). **Tripura:** Bajapara, 29.08.1957, D. bfer, 1115 (CAL); Charilam, 04.06.1959, D. bfer 1763 (CAL). **West Bengal:** Darjeeling Dist., Darjeeling, 26.16.1876, J.S. Gamble 1730 (DD); Sukhia Pokhri, 26.10.1876, J.S. Gamble 1735 (DD).

Osbeckia stellata Buch.-Ham. ex D. Don. var. *stellata*, Bot. Reg. 8: t. 674. 1822; Osmaston, Fl. Kumaon 247. 1927; C. Hansen, Ginkgoana 4. 23. 1977; M.B. Raizada & H.O. Saxena, Fl. Mussoorie 247. 1978; N.P. Balakr. Fl. Jowai & Vicinity 206. 1983; R.K. Gupta, Fl. Nainitalensis 134. 1993; Hajra & Verma, Fl. Sikkim 1996; D.S. Dhaliwal & M. Sharma, Fl. Kullu Dist. 290. 1999; R.D. Gaur, Fl. Garhwal 317. 1999; T. Pullaiah, D.M. Rao & K.S. Ramamurthy, Fl. Eastern Ghats 57. 2002. **Lectotype** (designated by Hansen, 1977):—Nepal, Narainhetty; 10.08.1802, Hamilton s.n., (BM000944402 image!).

Ceramicalyx stellatus Blume, Mus. Bot. 1(4): 50. 1849. **Type:**—(Not seen)

Osbeckia marginulata Wall., Numer. List 143, no. 4064. 1831. (*nom. nud.*).

Osbeckia rostrata var. *marginulata* C.B.Clarke in Hook.f., Fl. Brit. India 2: 518. 1879. *Osbeckia stellata* Buch.-Ham. ex D.Don var. *marginulata* (C.B.Clarke) C.Hansen, Ginkgoana 4. 27. 1977. (**Syn. Nov.**) **Type:**— Myanmar, Tong Dong, *S. die.*, Wallich 4064 (K001038066 image!).

Osbeckia racemosa Craib, Bull. Misc. Inform. Kew 51. 1911. **Type:**— Thailand, Chiengami, Doi-Sootep, *S. die.*, Kerr 836 (K000867939 image!)

Osbeckia hildebrandii Stapf, Bull. Misc. Inform. Kew 6: 269. 1911. **Type:**— Myanmar, N. Shan States, Toungyi, Cult. Hort. Kew, 1901, Hildebrand 599-99 (K000890027 image!).

Osbeckia speciosa Naudin, Ann. Sci. Nat., Bot. Sér. 3, 14: 73. 1850. **Type:**— India, Missouri, *S. die.*, Jacquemont *s.n.* (P02441142 image!).

Osbeckia darjeelingensis G.S.Giri & M.P.Nayar, Bull. Bot. Surv. India 25(1-4): 241.1985. (**Syn. nov.**) **Type:**—India, West Bengal, Darjeeling, Jhenaikuri, 12.1879, Gamble 7597 (CAL0000016808!). **Figs. 43 & 44.**

Erect, branched, perennial shrubs, 0.50–2.5 m tall. Stems branched, young branches quadrangular, with appressed, short, crooked, rigid hairs. Leaves petiolate; petioles 4–10 mm long; lamina green, lanceolate, 6–20 × 2–9cm, 5–7-nerved; apex acuminate, base obtuse to attenuate, densely clothed with patent hairs on either side. Inflorescence terminal, paniced cyme, 5–9-flowered. Flowers pedicellate, bracteate, tetramerous; pedicels 0.5–3 mm long; bracts ovate to broadly ovate, 7 × 12 mm, ciliate, with few to many appressed hairs dorsally. Hypanthium urceolate, 9–20 × 3–7 mm, longer than ovary, covered with emergences and bristles inter mixed with patent or appressed hairs; intersepal ar emergences 5–9 mm long, with a terete stalk bearing lateral hairs and terminating in a head of stellate hairs, caducous;

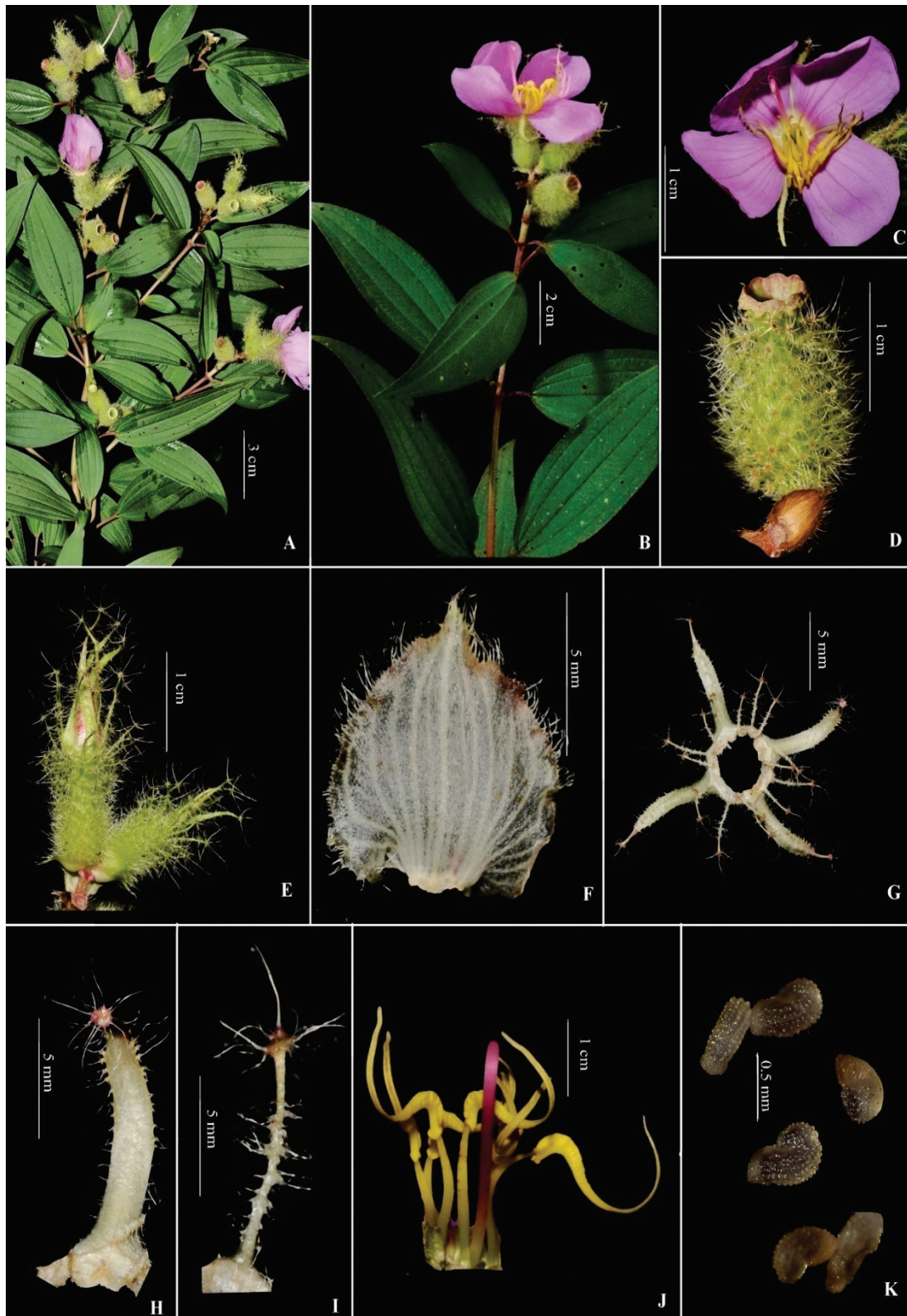


Figure 43. *Osbeckia stellata* Buch.-Ham. ex D.Don. var. *stellata*: **A&B** Habit; **C**. Flower; **D & E**. Hypanthium; **F**. Bract; **G**. Sepal with Intersepal emergence **H**. Sepal; **I**. Intersepal emergence; **J**. Stamen; **K**. Seed.



Figure 44. Lectotype of *Osbeckia stellata* Buch.-Ham. ex D.Don. var. *stellata*: [Hamilton s.n., (BM000944402)] © The Board of Trustees of Natural History Museum (BM).

other emergences smaller in lower portion of hypanthium. Sepals 4, triangular to lanceolate, 8–17 × 2–4 mm long, ciliate and with a few to many patent hairs dorsally, caducous. Petals 4, obovate to broadly obovate, 18–25 × 22–30 mm, glabrous, margin ciliate, pale pink to purple. Stamens 8; filaments 7–18 mm long; anthers 'S' shaped, yellow, 11–21 mm long, attenuate into a narrow, tubular beak (5–7 mm long), not twisted; pore oblique on ventral side; connective prolonged into slightly undulating collar with large dorsal lobe. Ovary united with hypanthium for about two third of its length, anther pockets extending to the base of the ovary; remaining part glabrous or thinly clothed with short appressed hairs: style 15–25 mm long, glabrous. Capsules urceolate, 11–19 × 4.5–10 mm, neck widens towards rim, densely covered with emergences and hairs which often fall off when mature; seeds minute, 0.1–0.2 mm long, numerous, curved, muricate.

Chromosome Number:— $n=10$ (Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—August – March.

Ecology and Habitat:—Seen in cluster on the margins of evergreen forests at an altitude above 500 m. The associated species are *Osbeckia Stellata* var. *crinita* and *O. stellata* var. *hispidissima*.

Distribution:—Arunachal Pradesh, Assam, Meghalaya, Himachal Pradesh, Manipur, Sikkim, Uttar Pradesh, Uttarakhand and West Bengal.



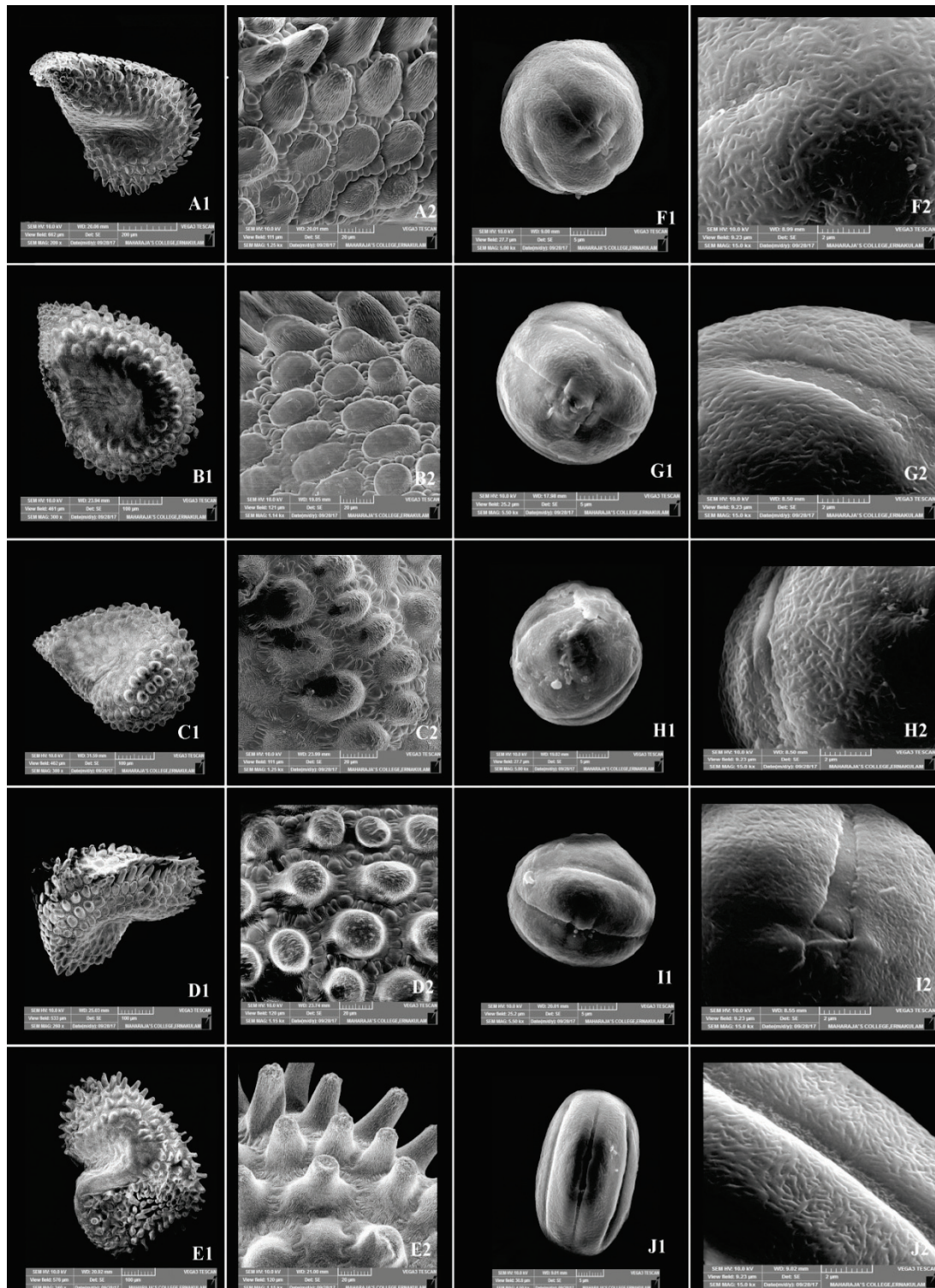


Figure 45. Comparison of seeds (A1-E1) and pollen (F1-J1) of *O. nayarii*, *O. rostrata*, *O. stellata* var. *stellata*, *O. stellata* var. *crinita* and *O. stellata* var. *hispidissima*: (A1, A2, F1, F2 - *O. stellata* var. *stellata*, B1, B2, G1, G2 - *O. stellata* var. *hispidissima*, C1, C2, H1, H2 - *O. stellata* var. *crinita*, D1, D2, I1, I2 - *O. rostrata*, E1, E2, J1, J2 - *O. nayarii*).

Table 4: Morphological characters of the seeds and pollen of members of section *Ceramicalyx*.

Sl. No.	Name	Seed				Pollen
		Shape	Colour of testa LM study	Ornamentation LM/SEM	Size	Shape
1	<i>O. nayarii</i> G.S. Giri	Curved	Dull black	Spiny Muricate	0.3– 0.5 x 0.2– 0.4 mm	Oblate
2	<i>O. rostrata</i> D. Don	Curved	Brown	Muricate with globose	0.2– 0.4 x 0.2– 0.3 mm	Elliptic
3	<i>O. stellata</i> Buch.-Ham. ex D. Don var. <i>stellata</i>	Curved	Dark brown	Muricate	0.4– 0.5 x 0.2– 0.4 mm	Globose
4	<i>O. stellata</i> Buch.-Ham. ex D. Don var. <i>hispidissima</i> (Wight) C. Hansen	Curved	Black-brown	Muricate	0.1– 0.4 x 0.1– 0.3 mm	Globose
5	<i>O. stellata</i> Buch.-Ham. ex D. Don var. <i>crinita</i> (Benth. ex Naudin) C. Hansen	Curved	Dark brown	Muricate	0.3– 0.4 x 0.2– 0.3 mm	Globose

Notes:— Ker-Gawler states that Hamilton, observed the specimens of *O. stellata* near Narainhetty in Nepal. Moreover, Wallich and Hamilton collected and deposited numerous samples of *O. stellata* in Lambert's Herbarium. From these collections Hansen designated *Hamilton s.n.*, (BM000944402) as its lectotype. *Osbeckia stellata* can be easily recognized by the more or less 'S' shaped large anthers with long beak, urceolate hypanthium with dense emergences and hairs. However, wide variations in vestiture created confusion in the delimitation of taxa and often resulted in the description of too many taxa which are not tenable. Presently two varieties have been recognized under *Osbeckia stellata* such as var. *crinita* and

var. *hispidissima*. var. *crinita* differs from the later by patent hairy stems and green emergences on the hypanthium. Similarly, var. *hispidissima* differs from var. *stellata* and var. *crinita* by its reddish brown emergences on the hypanthium. A comparison of SEM micrographs of the pollen and the seeds of members of section *Ceramicalyx* is given in Figure 45 & Table 4 to establish the distinctiveness.

Specimen examined:—**Arunachal Pradesh:** East Siang Dist., Yambung Camp, 07.01.1911, *I.H. Burkill s.n.* (CAL). Lohith Dist., Khamti village, 09.09.1969, *A.S. Rao* 47760 (CAL, ASSAM); Khopa village, 26.09.1969, *A.S. Rao* 48128 (CAL, ASSAM); Lohith, 24.11.1969, *J. Joseph* 48314 (CAL). Lohith- Payanava, 17.11.1957, *R.S. Rao* 10674 (CAL); Siang F.D., Tuting, 06.11.1958, *R.S. Rao* 17366 (CAL, ASSAM). *ibid.*, Tuting, 03.04.1958, *G.K. Murty* 13126 (CAL, ASSAM). Lower Subansiri Dist., Ziro, 01.10.1959, *G. Panigrahi* 19900 (CAL); Subansiri-Klerbari, 28.09.1954, *G. Panigrahi* 19732 (CAL); Subansiri F.D., Kherbavei, 28.09.1959, *G. Panigrahi* 19732 (CAL). **Himachal Pradesh:** Kangra Dist., Baslahar, 12.09.1969, *C.N. Nair* 30666 (CAL, BSD); *ibid.*, 07.10.1940, *H. F. Mooney* 87460 (DD); *ibid.*, 13.10.1950, *M.B. Raizada* 19962 (DD); *ibid.*, 13.06.1928, *R.N. Parker* 3013 (DD); *ibid.*, 26.06.1923, *R.N. Rarker s.n.* (DD); Upper Baslahar, 07.1950, *S.P. Selhi* 20360 (DD); Palampur, 26.09.1896, *G.A. Gammie* 18722 (DD). Kullu Dist., Shaman, 20.08.1977, *S.K. Murti & R. Prasad* 61917 (BSD). Shimla Dist., Fifth Water fall, Yamunotri, 20.06.1953, *S.N. Mitra* 9430 (CAL); North West Himalaya, 10.1891, *J. H. Lace s.n.* (DD). **Manipur:** Bishnupur Dist., Limatak, 27.08.1887, *George Watt* 7175 (CAL). **Sikkim:** East Sikkim Dist., Rangpo, 14.10.1949, *K. Biswas* 9848 (CAL); Singtam, 12.05.1967, *N.C. Mazudia & R. M Dutta* 210 (CAL); Machong, Chota pathing, 09.07.1991,

N.R. Mandal & P. Singh 13583 (BSHC); Rumtek, 06.08.1981, *B. Krishna* 1629 (BSHC). North Sikkim Dist., Mangan, Rang Rang bridge, 17.09.2016, *Prashob, Anilkumar & Sibichen* 6616 (DEV); Mangan, 15.11.1901, *Dr. Prain s.n.* (CAL); Near Tista bridge, 26.07.1986, *D.C.S. Raju & S. Singh* 6312 (BSHC); Chungthang to Lachen, 16.08.1989, *N.R. Mandal*, 10447 (BSHC). South Sikkim Dist., Rateypani Suntale, 11.09.1981, *B. Krishna* 1752 (CAL, BSHC); Namchi forest, 10.08.1992, *R.C. Srivastava* 10989 (BSHC); Mogipokri, *S.die.*, *R.C. Srivastava* 14530 (BSHC). West Sikkim Dist., Dentam, 29.08.1994, *P. Singh* 16340 (BSHC); Pelling to Yuksom, 16.08.1985, *D.C.S. Raju* 4304 (BSHC); Geyzing, 13.09.2016, *Prashob, Anilkumar & Sibichen* 6601 (DEV); Pelling, 13.09.2016, *Prashob, Anilkumar & Sibichen* 6602 (DEV); *ibid.*, 14.09.2016, *Prashob, Anilkumar & Sibichen* 6610 (DEV); Dherap, 14.09.2016, *Prashob, Anilkumar & Sibichen* 6608 (DEV). **Uttar Pradesh:** *S.loc.*, 04.05.1916, *R.S. Hole* 252 (CAL). Saharanpur Dist., Sharanpur, 09.1898, *Rao s.n.* (CAL). **Uttarakhand:** Almora Dist., Dinapani, 12.10.1975, *J.N. Vohra* 57813 (BSD); Dwarahat, 05.10.1975, *B.M. Wadhwa* 57392 (BSD); Debra, 13.10.1975, *B.M. Wadhwa* 57694 (BSD). Bageshwar Dist., Kapkot, 19.09.1957, *T.A. Rao* 4187 (BSD). Chamoli Dist., Sital, 09.1993, *S.call.* 77199 (BSD); Sital - Sital, 09.1993, *S.call.* 87956 (BSD); Narayan bagarah, 07.09.1985, *H.J. Chawdhary*, 78256 (BSD); Gopeswar to Mandal, 29.08.1978, *Panigrahi & Wadhwa*, 65596 (BSD); Dehradun Dist., Mussori, 08.1895, *P.W. Mackinnon s.n.* (CAL); Mussorie, 1859, *G. King s.n.* (CAL); Dehradun- Sahasradhara, 06.09.1963, *S.K. Malhothra* 29271 (CAL, BSD); Dehradun-Sahasradhara, 14.09.1962, *S.K. Malhothra* 23788 (CAL, BSD); Thangaon, *S.die.*, *Bipin Balodi & Megh Singh* 73076 (BSD); Mussorie, 06.09.1960, *Hari Om Saxena s.n.* (DD). Garhwal Dist., Garhwal,

10.09.1972, B.D. Naithani 3677 (DD). Garhwal Dist., Garhwal- Mondal,
 01.10.1970, B.D. Naithani 41974 (CAL, BSD); Garhwal -Gauri kund,
 14.08.1968, M.A. Rao 38752 (CAL, BSD); Garhwal- Dodital, 09.1995, Raj K.
 Gupta 933 (CAL); Rampur Garhwal, 20.10.1938, Kirt Ram 8969 (DD);
 Garhwal- Vishnuprayag-Govind Ghats, 14.08.1963, U.C. Bhattacharya 29324
 (CAL, BSD); Napainkoli, 22.09.1958, M.A. Rao 6468 (BSD); Tehri,
 Budhalcedar, 02.10.1974, M.V Viswanathan 55224 (BSD); Tehri, Ghuttu,
 18.08.1978, A.K. Goel 64588 (BSD); Ringalgarh, Tehri,-Garhwal, 26.09.1954,
 K.C. Sahni 21513 (DD); Puidar valley, 25.06.15, G.E. Osmaslon 679 (DD);
 Naitwar, Tehri,-Garhwal, 21.09.1955, K.C. Sahni 21513 (DD); Agar-
 Newalgaon, 21.09.200, B.P. Uniyal & M.S. Pundir 96832 (BSD, DD); Kumaon-
 Tavaghat, 10.06.1960, S.call, s.n. (CAL); Kumaon-Girgaon, 29.08.1969, Pant &
 Naithani 38565 (CAL, BSD); Kumaon-Munsiari, Pithoragarh, 05.05.1965, C.N.
 Nair 35674 (CAL, BSD, DD); *ibid.*, 12.06.1960, T.A. Rao 11788 (CAL, BSD, DD);
ibid., 10.06.1960, T.A. Rao 11672 (CAL, BSD); *ibid.*, 12.10.1962, Surendra Singh
 23622 (CAL, BSD); *ibid.*, 30.08.1900, Juayal 24438 (CAL, DD); *ibid.*, Askol,
 31.01.1971, C.M. Arora 45452 (BSD); Kumaon, Dalfia, 01.09.1973, C.M. Arora
 53231 (DD). Nainital Dist., Kathgodam, 10.1905, Meebold 716 (CAL). Pauri
 Dist., Khirsu road, 19.08.1978, G. Panigrahi 65000 (BSD, DD); *S.loc.*,
 15.05.1989, P.S. Karki 68633 (BSD); Khirsu, 18.09.1975, A.S. Rao 56332 (BSD);
 Balakhal, 09.08.1976, R.P. Srivastav 57078 (BSD). Pithoragarh Dist., Tawaghat,
 09.1986, Bipin Balidi 83210 (BSD); Lilam, 15.09.1983, Bipin Balodi 75241 (BSD);
 Maitli, 01.10.2001, M.S. Pundir 97034 (BSD); Dhanliganga, 10.09.1985, H.J.
 Chawdhary 76267 (BSD); Didihat, 01.10.1970, C.M. Arora 41366 (BSD);
 Didihat, Narayan nagar, 30.09.1975, C.M. Arora & P. Prasad 56631 (BSD);

Sobla, 08.08.2004, S.K. Srivastava 105907 (BSD); Bungling, 04.08.1998, B.P. Uniyal & Bipin Balodi 93811 (BSD, DD). Uttarkashi Dist., on way to Sangam, 07.1999, Bipin Balodi 95004 (BSD); Mori, 17.09.1995, Surendra Singh 89861 (BSD); On the way to Thalluka, 19.09.1995, Bipin Balodi 89349 (BSD); Govind Pashu Vihar National Park & Sanctuary, Thalluka, 24.09.2010, R. Manikandan 113706 (BSD). **West Bengal:** Darjeeling Dist., Kalimpong, 14.09.1914, Thornton Ripley s.n. (CAL); *ibid.*, 17.09.1914, Thornton Ripley s.n. (CAL); Rishyap, 23.10.1870, C.B. Clarke s.n. (CAL); Rimbik, 06.08.1981, B. Krishna 1629 (CAL); Sureil, 21.09.1908, W.W. Smith 006 (CAL).

Key to varieties

- 1a. Stalk of intersepalar emergences glabrous..... *O. stellata* var. *hispidissima*
 1b. Stalk of intersepalar emergences with lateral hairs2
 2a. Hypanthium large (>1.5 cm); sepals subulate*O. stellata* var. *stellata*
 2b. Hypanthium small (≤1 cm); sepals narrowly triangular.....
 *O. stellata* var. *crinita*

Osbeckia stellata Buch.-Ham. ex D.Don var. *crinita* (Benth. ex Naudin) C. Hansen, Ginkgoana 4: 31. 1977. *Osbeckia crinita* Benth. ex Naudin, Ann. Sci. Nat. Bot., Ser. 3, 14: 72. 1850; C.B. Clarke in Hook.f., Fl. Brit. India 2: 517. 1879; C. Hansen, Ginkgoana 4. 31. 1977; Kanjilal *et al.*, Fl. Assam. 2: 292. 1983; N.P. Balakr., Fl. Jowai & Vicinity 206. 141. 1983. *Osbeckia crinita* Benth. in Wall., Numer. List 143, no. 4066. 1831 (*nom. nud.*) **Lectotype** (designated by Hansen, 1977):— India, Assam, *S.die*, M. Walker s.n. (P02441145 image!).

Osbeckia cinerea Cogn. in A. DC. & C. DC., Monogr. Phan. 7: 1177. 1891.
Type:— Bangladesh, Sylhet, 1887, M. Balansa 4055 (P02441151 image!).

Osbeckia paludosa Craib, Bull. Misc. Inform., Kew. 262. 1916. **Type**:— Thailand, Siam, Chiangmai, 330 m, 21.10.12, A.F.G. Kerr 2740 (K000867937 image!).

Osbeckia garrettii Craib, Bull. Misc. Inform. Kew. 262. 1916. **Type**:— Thailand, Doi Kar Intanon, 18° 40' N, 98° 30' S, 1050 m, 16.09.1910, H.B.G. Garrett 51 (K000867935 image!).

Osbeckia robusta Craib, Notes Roy. Bot. Gard. Edinburgh 10: 54. 1917. **Type**:— China, Yunnan, *S.die. Forrest* 8561 (E00225554 image!).

Osbeckia mairei Craib, Notes Roy. Bot. Gard. Edinburgh 10: 54. 1917. *Melastoma mairei* H.Lév., Repert. Spec. Nov. Regni. Veg. 11: 300. 1912. **Type**:—China, Yunnan, alt. 690 m, *S.die. E.E. Maire s.n.* (E00225556 image!).

Osbeckia septemnervia Buch.-Ham. ex Craib, Notes Roy. Bot. Gard. Edinburgh 10: 55. 1917. *Osbeckia septemnervia* Buch.-Ham. in Wall., Numer. List. 4062 B. 1831 (*nom. nud.*). **Type**:—India, Himalaya, Goalpara, *S.die, Hamilton* 916 (E00225749 image!).

Osbeckia yunnanensis Franch. ex Craib, Notes Roy. Bot. Gard. Edinburgh 10: 57. 1917. **Type**:—China, Yunnan, 2500 m, altitude 26.09.1884, *Delavay* 191 (P 02441147 image!).

Osbeckia sikkimensis Craib, Notes Roy. Bot. Gard. Edinburgh 10: 56. 1917. **Type**:—India, Sikkim, Yoksom, 10.10.1875, C.B. Clarke 25207B (E00225751 image!).

Osbeckia wattii Craib, Notes Roy. Bot. Gard. Edinburgh 10: 57. 1917. **Type**:— India, Nagaland, Naga hills, 05.1882, *Watt* 7280 (K000890023 image!).

Osbeckia pulchra E.T.Geddes, Bull. Misc. Inform., Kew 1930(4): 171. 1930. **Type**:—Thailand, Doi Sootep, 1600 m, 24.11.1912, *Kerr s.n.*, (ABD!).

Osbeckia pulchra var. *rubra* Craib, Fl. Siam. Enum. 1: 677. 1931 **Type**:—
Thailand, Siam., Doi Sootep, 1200 m, 17.11.1922, Kerr s.n.
(BM000944334 image!).

Melastoma crinitum Roxb. Fl. Ind., ed. 2, 2: 402. 1832, non Vahl, 1807. **Type**:—
India, S.loc., 05.1811, Roxburgh 347 (BM000944403 image!).

Melastoma crinitum Vahl, Eclog. Amer. 3: 28. 1807. **Type**:—Not seen.

Melastoma crinitum Naudin, Ann. Sci. Nat., Bot. Ser. 3, 13: 280. 1850. **Type**:—
Not seen. **Figs. 46 & 47.**

Erect, branched, perennial shrubs, 0.50–2 m tall. Stems branched, young branches quadrangular, with patent, slightly reflexed brown hairs. Leaves petiolate; petioles 4–8 mm long; lamina ovate to broadly ovate, 4–13 × 2–4 cm, 5-nerved, green, apex acute to attenuate, base acute to rounded, both sides densely clothed with patent hairs. Inflorescence terminal, paniced cyme, 6–12-flowered; bracts ovate to broadly ovate, 4–8 mm long, ciliate, with few to many appressed hairs dorsally. Flowers tetramerous, pedicels 0.5–3 mm long. Hypanthium urceolate, 7–12 × 2.5–6 mm, covered with emergences, bristles and inter mixed with patent or appressed hairs; intersepalmer emergences 4–7 mm long, with a terete stalk bearing a few to many patent hairs and terminating in a stellate head, caducous; other emergences differ from intersepalmer emergences, smaller. Sepals 4, narrowly triangular, 7–13 × 1.5–3 mm long, ciliate with a few to many patent hairs dorsally, caducous. Petals 4, obovate to broadly obovate, 13–18 × 10–15 mm long, glabrous, margin ciliate, pale pink to purple. Stamens 8; filaments 7–14 mm long; anthers 'S' shaped, 11–15 mm long, yellow, narrowly ovate, with long beak; pore oblique on ventral side; connective prolonged into a slightly undulating collar with large dorsal lobe. Ovary united with hypanthium for about two thirds of its length, anther pockets extending to the base of the ovary; free part sometimes glabrous, but more often thinly clothed with



Figure 46. *Osbeckia stellata* Buch.-Ham. ex D.Don var. *crinita* (Benth. ex Naudin) C. Hansen: **A&B** Habit; **C**. Inflorescence; **D**. Bract; **E**. Hypanthium; **F**. Sepal; **G**. Intersepal emergence; **H**. Stamens; **I**. Seeds.

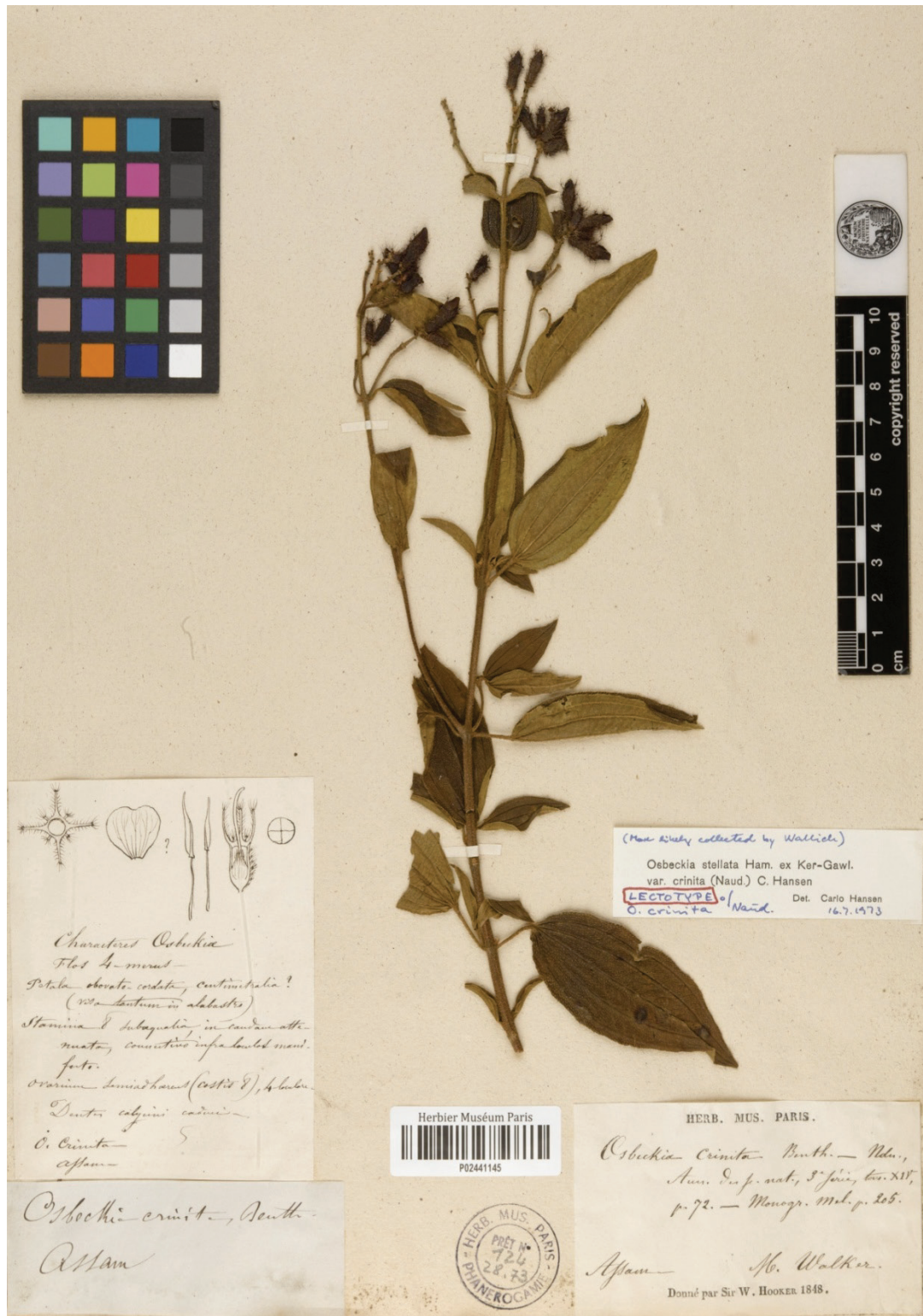


Figure 47. Lectotype of *Osbeckia stellata* Buch.-Ham. ex D.Don var. *crinita* (Benth. ex Naudin) C. Hansen: [M. Walker s.n. (P 02441145)] © The Board of Trustees of Muséum national d'Histoire naturelle (MNHN - Paris, France).

short appressed hairs; style 15–25 mm long, glabrous. Capsules urceolate, 7–11 × 2–6 mm, neck often widening towards rim, densely hairy below, more or less glabrous above; hypanthium exceeds ovary and crown; seeds numerous, 0.1–0.2 mm long, minute, curved.

Chromosome Number:— $n=10$
(Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—July–January.

Ecology and Habitat:—In evergreen forests at an altitude above 500 m. The associated species are *O. stellata* var. *stellata* and *O. capitata*.



Distribution:—Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal.

Notes:—*Osbeckia stellata* var. *crinita* differs from var. *stellata* and var. *hispidissima* by its patent hairy stem, shape, colour and size of the hypanthium.

The first available name for the taxon was *Melastoma crinitum* Roxb. (1832). However, it is illegitimate being a later homonym of *M. crinitum* Vahl. (1807). Prior to the publication of Roxburgh, Wallich (1831) included *Osbeckia crinita* Benth. in his catalogue. However, Wallich's name is not valid as it is not accompanied by a description, diagnosis, or a reference to a

published diagnosis. Later Naudin (1850) described the taxon as *Osbeckia crinita* Naudin, instead of *O. crinita* Benth. ex Naudin., without mentioning Bentham. Being a variety of *O. stellata* Buch.-Ham. ex D.Don. and the first legitimate specific epithet in the genus *Osbeckia*, i.e. *crinita* Benth. ex Naudin, the correct name becomes *O. stellata* var. *crinita* (Benth. ex Naudin) C. Hansen.

Specimen examined:—**Arunachal Pradesh:** Lohith Dist., Nansai township, 09.09.1969, A.S. Rao 47716 (CAL, ASSAM); Chowkham, 24.11.1969, J. Joseph 48314 (ASSAM); Paya nava, 17.11.1957, R.S. Rao 10674 (ASSAM). Lower Subansiri Dist., Subansiri, 14.11.1946, A.R.K. Sastry 40609 (ASSAM); Khorbar, 28.09.1959, G. Panigrahi 19732 (ASSAM). Tirap Dist., Deomali, West of Khonsa, 21.06.1961, F.B. Dub 25886 (ASSAM). West Siang Dist., Kiak, 25.11.1958, R.S. Rao 18022 (ASSAM); Dirang, 17.09.1964, J. Joseph 40058 (ASSAM); Lumla, 24.08.1976, P.K.Hajra 68481 (ASSAM); Sepa, 29.10.1970, A.S. Rao 49425 (ASSAM); Klaktang, 08.08.1973, P.K.Hajra 54019 (ASSAM); Klaktang, 14.10.1973, P.K. Hajra 54113 (ASSAM). **Assam:** Dima Hasao Dist., Garodong, 17.09.2010, C. Deori & D.K. Ray 119122 (ASSAM); Bhutan border, 18.09.2010, C. Deori & D.K. Ray 119022 (ASSAM). East Karbi Anglong Dist., Phulai, 26.06.1963, D.B. Deb 35378 (ASSAM); Doboka, 28.06.1963, D.B. Deb 35403, 35404 (ASSAM). Golaghat Dist., Kaziranga N.P., 14.08.1975, P.K. Hajra 52887 (ASSAM). Jorhat Dist., Borbheta, Phutuka, 11.03.1959, S.N. Bora 33643 (ASSAM); Orang Barseola Bank of Bihari River, 22.07.1958, G. Panigrahi, 14220 (CAL, ASSAM); Makum, 21.11.1911, I.H. Burkill 35746 (CAL); Khatangpani R.F, 09.07.1959, G. Panigrahi 18905, (CAL). Kamrup Dist., 24.10.1935, G.K. Deka 12848 (ASSAM). Lakhimpur Dist., near NEFA I.B., 12.05.1966, D.M. Verma 41724 (ASSAM). Nagaon Dist., Sonaibuchi R.F., 20.08.1964, N.P. Balakrishnan 39300 (ASSAM). **Manipur:** Imphal Dist.,

Chingmairong, 01.08.1952, *D.B. Deb* 777 (CAL); Chingmairang, 27.10.1952, *D.B. Deb* 546 (CAL); Pipihma, 02.1906, *Meebold* 5605 (CAL); Myanglihing, 20.05.1882, *George Watt* 7157 (CAL). Senapati Dist., Chingmei Hills, 22.12.1976, *Barin Gherh* 11602 (CAL). **Meghalaya:** East Khasi hills Dist., Cherrapunji, 27.09.1955, *G. Panigrahi* 3488 (CAL, ASSAM); Cherrapunji, 18.10.1932, *H.K. Nandi s.n.* (CAL); Cherrapunji, 31.10.1972, *R.S. Rao* 47279 (CAL); Chenglang, Khela, 19.08.1958, *G. Panigrahi* 14415 (CAL, ASSAM); Khasi hills, old Barapani Road, 11.09.1970, *A.S. Rao* 38637 (CAL); Barapani, 11.09.1970, *B.K. Sinha* 112013 (ASSAM); Khasia & Jaintia Hills, Shillong, 24.08.1938, *S.R. Sharma* 18162 (ASSAM); Khasia & Jaintia Hills, Shillong, 14.06.1958, *G. Panigrahi* 16115 (ASSAM); Khasia & Jaintia Hills, Shillong, 20.09.1930, *P.C. Kanjilal* 8489 (ASSAM); Khasia Hills, Shillong, 04.04.1894, *G.A. Gammie s.n.* (CAL); Khasia & Jaintia Hills, Shillong, 26.10.1915, *Upendranath Kanjilal* 6134 (ASSAM); Pynursula, 04.12.1943, *N.L. Bor* 18079 (DD); Sohra, 27.06.2014, *Prashob & Sibichen* 6106 (DEV); Sohra, 20.09.1939, *S.R. Sharma* 9411 (ASSAM); Laithkor, 28.06.2014, *Prashob & Sibichen* 6113 (DEV); *ibid.*, 11.09.2015, *Prashob & Sibichen* 6123 (DEV); Mahadavkala, 21.11.1962, *S.Choudary* 25157 (CAL); Mawphlang sacred forest, 17.09.2015, *Prashob & Sibichen* 6139 (DEV); Mawsynram, 25.02.1960, *G. Panigrahi* 21264 (ASSAM); Mahadevakala forest, Shillong, 21.11.1962, *C. Choudhary* 25157 (ASSAM); Mawphlang, Law-Hyngowh, 20.11.1972, *P.K. Hajra* 51922 (CAL, ASSAM); Mawphlang Sacred forest, 09.09.1972, *P.K. Hajra* 51948 (CAL, ASSAM); Khasia & Jaintia Hills, 26.05.1956, *R.S. Rao* 2571 (CAL); Shillong peak forest, 26.10.1960, *D.C.S. Raju* 22015 (ASSAM); Shillong peak, 24.08.1958, *R.S. Rao* 14050 (CAL, ASSAM); Shillong, Mulki village, 19.11.1962, *S.K. Kar* 29486 (ASSAM); Shillong, 10.12.1962, *R.M. Dutta* 25436 (ASSAM); *ibid.*, Behind Bishop falls, 24.12.1962, *R.M. Datta* 25533 (ASSAM);

ibid., 20.06.1958, G. Panigrahi 16497 (ASSAM); *ibid.*, 13.09.1960, G.K. Deka 21762 (ASSAM); *ibid.*, 02.09.1960, G.K. Deka 21761 (ASSAM); *ibid.*, 09.08.1962, G.K. Deka 17090 (ASSAM); *ibid.*, 26.11.1962, S. Choudhary, 25227, (CAL, ASSAM); *ibid.*, 24.12.1962, S. Choudary 25234 (CAL); *ibid.*, 24.12.1962, R.D. Ulla 25534 (CAL); *ibid.*, 02.10.1945, N.L. Bor 18436 (DD); *ibid.*, 02.10.1945, N.L. Bor 18445 (DD); *ibid.*, 12.09.1913, Upendranath Kanjilal 2628 (ASSAM); *ibid.*, 22.06.1913, Upendranath Kanjilal 2218 (ASSAM); *ibid.*, 28.12.1962, S.K. Kotari 29613 (ASSAM); *ibid.*, 12.12.1962, S.K. Kotari 27944 (ASSAM); *ibid.*, 23.09.1913, Upendranath Kanjilal 2618 (ASSAM); *ibid.*, 12.10.1931, S.R. Sharma 9547 (ASSAM); *ibid.*, 30.08.1956, G. Panigrahi 3199 (CAL, ASSAM); *ibid.*, 26.11.1952, S. Choudary 25263 (CAL, ASSAM); *ibid.*, 25.11.1949, B.B. Syam 22908 (ASSAM); *ibid.*, R.S. Rao 1693 (CAL, ASSAM); *ibid.*, 26.05.1911, I.H. Burkill & S.C. Banerjee 28 (CAL); *ibid.*, 29.09.1915, H.G. Carter 41409 (CAL); *ibid.*, 25.10.1938, K. Biswas 3730 (CAL); *ibid.*, 25.09.1962, S.L. Kapoor 73449 (CAL); *ibid.*, 25.05.1911, I.H. Burkill & S.C. Banerjee s.n. (CAL); Upper Shillong, 29.09.1915, H.G. Carter 41409 (CAL); Ukhral, 22.09.1948, S.K. Mukerjee 3528 (CAL); *ibid.*, 28.07.1948, S.K. Mukerjee 3245 (CAL); Woodland, Shillong, 26.11.1962, S.call. 25234 (CAL, ASSAM); Woodlands Shillong, 10.09.1965, R.V. Kammathy 001 (CAL). Jaintia Hills Dist., Sutnga, 19.11.1969, N.P. Balakrishnan 49995 (ASSAM); Raliang to Garampani, 22.08.1968, N.P. Balakrishnan 46986 (ASSAM); Ummulong, 16.08.1968, N.P. Balakrishnan 42990 (ASSAM). Jowai Dist., Jowai, 26.05.1956, R.S. Rao 2571 (CAL, ASSAM). Ri-Bhoi Dist., Nongpoh, 14.11.1936, Nongpoh 23.07.1938, S.R. Sharma 17951 (ASSAM); G. Panigrahi 4348 (ASSAM); Nongpoh, 30.07.1964, J. Joseph 37475 (ASSAM); *ibid.*, 23.09.1935, S.R. Sharma 12397 (ASSAM); *ibid.*, 24.08.1938, S.R. Sharma 18167 (ASSAM); West Khasi Hills Dist., Nongstom, 01.04.1962, G.V. Subba Rao 28470 (ASSAM). **Mizoram:** Aizwal Dist., Dampa Tiger reserve,

Teirei, 21.09.2006, B.K. Sinha & N. Odyuo 112738 (ASSAM); Dampa Tiger reserve, Way to Chhautpier top, 28.05.2005, N. Odyuo 109747 (ASSAM). Buia Hmun Tlang, 11.11.1999, A.A. Mao 107153 (ASSAM). Lawngtlai Dist., Lawngtlai, Kawlkhul, 16.10.1989, K.P. Singh 92861 (ASSAM); Kolasib, Bhairawi road, 31.05.1988, K.P. Singh 93191 (ASSAM); Kawlkhul, 04.10.1989, K.P. Singh 94334 (ASSAM); Mizo hills, 12.07.1963, Thalthlone, R.M. Dutta 33925 (ASSAM); *ibid.*, Vawmbuk, 12.07.1963, R. Dutta 33929 (ASSAM). Zote, 10.10.1989, K.P. Singh 94574 (ASSAM); *S.loc*, 29.04.1998, S.L. Abbar 102615 (ASSAM). **Nagaland:** Kohima Dist., Jasma, 12.1955, B.F.O. s.n. (ASSAM); Naga hills, 06.1935, N.L. Bor 21002 (ASSAM); *ibid.*, 06.1935, N.L. Bor 21000 (ASSAM); *ibid.*, 06.1935, N.L. Bor 21009 (ASSAM); *ibid.*, 06.1936, N.L. Bor 10557 (ASSAM); *ibid.*, 30.11.1986, R.C. Gauri 773 (DD); *ibid.*, 12.1935, N.L. Bor 6213 (DD); *ibid.*, Lzulake valley, 09.1939, N.L. Bor 90574 (ASSAM); *ibid.*, 25.11.1942, N.L. Bor 17284 (ASSAM); Lower Japfu hill, 05.09.2003, A.A. Mao & R. Gogoi 112504 (ASSAM). **Sikkim:** East Sikkim Dist., North East of Gangtok, 08.11.1960, K. Jhothathri 9475 (CAL); Tashi view point, Gangtok, 26.08.1980, P.K. Hajra 866 (CAL); Gangtok, 26.08.1980, P.K. Hajra 865 (BSHC); Takchi, Luing, 16.07.1998, S.K. Rai 23404 (BSHC); Takchi, 18.07.1985, D.C.S. Raju 7727 (BSHC). North Sikkim Dist., 09.1879, J.S. Gamble s.n. (DD); North Sikkim, 11.1879, J.S. Gamble s.n. (DD). South Sikkim Dist., 18.09, S. Kurz 171902 (CAL). South Sikkim, *S.die*, S. Kurz s.n. (DD); Rabongla, 23.08.1986, A.K. Verma 12701 (BSHC). West Sikkim Dist., Damthang-Rawangla, 08.1991, R. Gopalan 97559 (BSHC); Rengu temple, J.D. Hooker 1867 (CAL); Sikkim, *S.loc.*, 14.08.1870, C.B. Clarke s.n. (CAL); Sikkim, *S.loc.*, *S.die.*, R.S. Rao 319 (CAL); Karchi researve forest, 15.12.1994, G.P. Sinha & S. Pradhan 10862 (BSHC); Ribdi, 07.09.1995, R. Nath & S.K. Jana 31548 (BSHC). **West Bengal:** Darjeeling Dist., Chungtang, 26.04.1965, H. Santapau & S.K. Mukerjee 107

(CAL); Darjeeling, 01.10.1902, *J.H. Lacek* 2382 (CAL); Sureil, 04.1908, *C. Calder s.n.* (CAL); Darjeeling, 09. 1879, *J.S. Gamble* 7068 (DD); Darjeeling, 09.1880, *J.S. Gamble* 8361 (DD); Birchi hills, Darjeeling, 12.11.1944, *M.B. Raizada* 18939 (DD); Darjeeling, 01.10.1902, *J.H. Lace* 2382 (DD); Darjeeling, 22.09.1962, *B. Sahni* 1802 (CAL); Ghoong, 07.1996, *Sanjoy Ghara* 006 (CAL); Jorbangla, 16.04.1961, *S.call.* 111 (CAL); Birch hill Darjeeling, 22.11.1962, *J.K. Maheshwari* 5018 (CAL); Singalila National park, Meghma, 15.09.2002, *A.K. Ghosh* 30621 (CAL).

Osbeckia stellata Buch.-Ham. ex D.Don var. *hispidissima* (Wight) C. Hansen, *Ginkgoana* 4: 37. 1977. *Osbeckia hispidissima* Wight, *Icon. Pl. Ind. Orient.* t. 1612. 1850; Gamble, *Fl. Pres. Madras* 1: 493. 1919; T. Pullaiah, D.M. Rao & K.S. Ramamurthy, *Fl. Eastern Ghats* 57. 2002; G.V.S. Rao & G.R. Kumari, *Fl. Visakhapatnam Dist. Andhra Pradesh*, 340. 2003. *Type*:—India, *S. loc.* 25.11.45, *Cleghorn* D-46 (K000890022 image!). **Figs. 48 & 49.**

Erect, perennial shrubs, branched, 0.5–3.5 m tall. Stems quadrangular; hairs long and stiff, patent at the base, curved upwards. Leaves petiolate; petioles 5–11 mm long; lamina narrowly to broadly ovate, 8.2 × 3.1 cm, 5-nerved, apex acute to attenuate, base acute, indumentum thin to dense, hairs ascending to patent on both sides. Inflorescence paniced cymes, 5–10-flowered; bracts green, small, 4 mm long, hairy. Flowers tetramerous; pedicels 0.5–3 mm long. Hypanthium urceolate, 9–11 × 2.5–3 mm, covered with patent emergences and few bristles at the base; intersepal emergences 5–7 mm long, with a terete glabrous stalk, terminating in a stellate head; other emergences similar but smaller, restricted to uppermost part of

hypanthium mixed with appressed hairs. Sepals 4, lanceolate to ovate, margin ciliate or hairy, both sides glabrous, apex stellate. Petals 4, obovate to broadly obovate, 16–28 mm long, pink to purple, glabrous, apex ciliate. Stamens 8; filaments 8–12 mm long, glabrous; anthers narrowly ovate, S-shaped, yellow, 10–15 mm long, beak narrow 2–3 mm long, not twisted; pore oblique; connective with undulating collar having large dorsal lobes. Ovary united with hypanthium for about two thirds of its length, anther pockets extending to the base of the ovary, crown with appressed hairs; style 13–18 mm long, glabrous. Capsules urceolate, 8–10 × 2.5–3 mm, neck widens towards rim, densely covered with emergences and hairs which often fall off when mature; seeds 0.1–0.2 mm long, numerous, curved, muricate.

Chromosome Number:—

Not reported

Ecology and Habitat:—In evergreen forests at an altitude above 500 m. The associated species is *O. stellata* var. *stellata*.



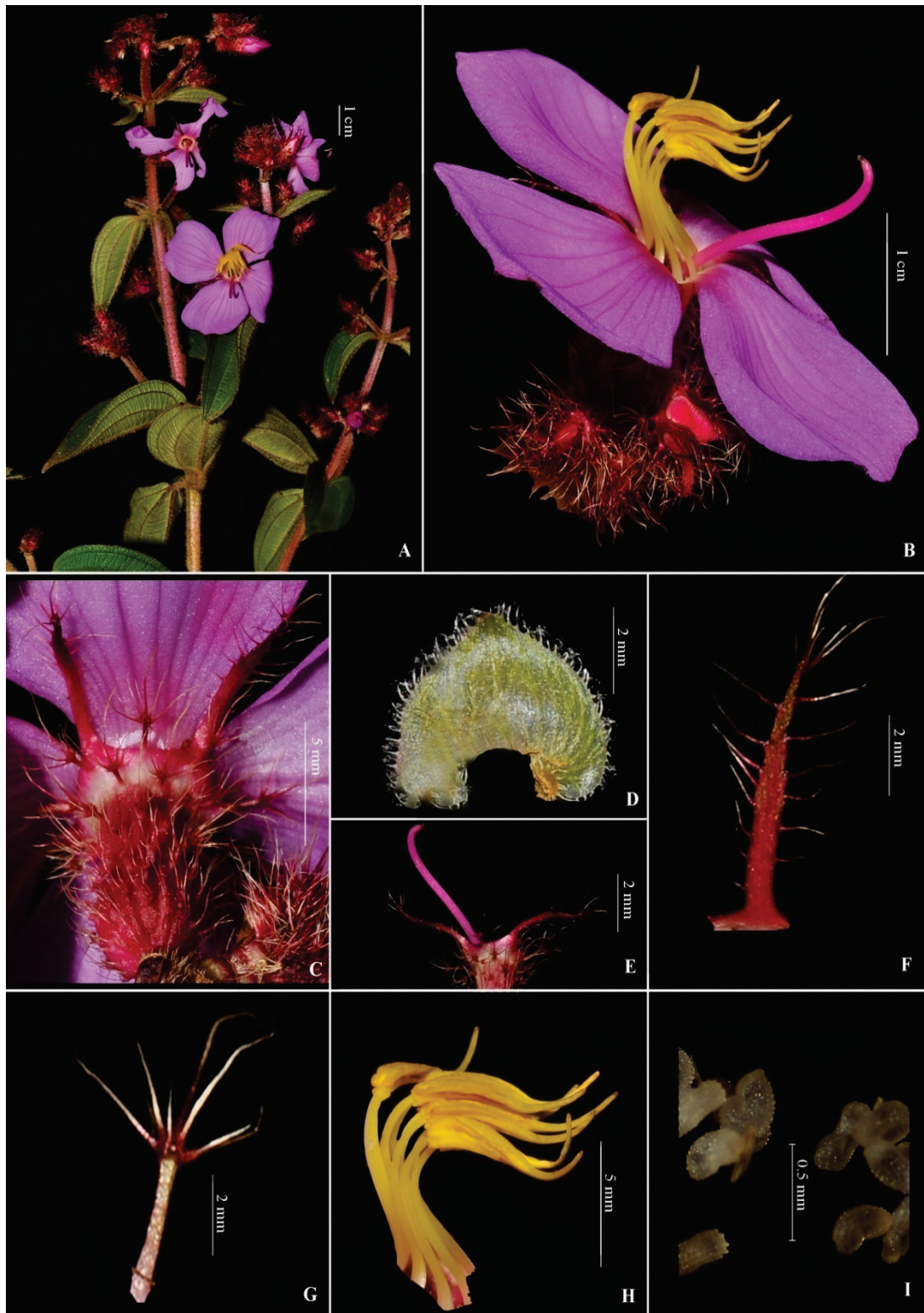


Figure 48. *Osbeckia stellata* Buch.-Ham. ex D.Don var. *hispidissima* (Wight) C. Hansen: **A.** Habit; **B.** Flower; **C.** Hypanthium; **D.** Bract; **E.** Style; **F.** Sepal; **G.** Intersepal emergence; **H.** Stamens; **I.** Seeds.



Figure 49. Holotype of *Osbeckia stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen: [Cleghorn, D-46 (K000890022)] © The Board of Trustees of Royal Botanic Gardens, Kew.

Flowering and Fruiting:—August–February.

Distribution:—Karnataka, Meghalaya.

Notes:—This variety is closely related to *O. rostrata* and *O. stellata* var. *crinita*, resembling the former by the hypanthium and the latter by the patent hairy stem. The reddish brown colour of the hypanthium, intersepal emergences with glabrous stalk and inflexed bristles on the stem justifies its varietal status.

Specimens examined:—**Karnataka:** Chikmagalur Dist., Bababoodan Hills, 25.11.1845, *Meebold* 10464 (CAL); Aglatti, Mysore, 11.1908, *S.call. s.n.* (JCB). Hassan Dist., Bisle Ghat, 25.4.1970, *Saldanha* 16879 (JCB); Vanagw, 15.05.1968, *Saldanha* 11718 (JCB). **Meghalaya:** East Khasia Hills Dist., Shillong, 27.10.15, *Prashob & Sibichen* 6622 (DEV); Air force campus, Shillong, 27.10.15, *Prashob & Sibichen* 6623 (DEV).

The section comprises annual herbs having tetra merous flowers and anthers with long beak. Triana (1871) included 4 species *viz.*, *Osbeckia chinensis*, *O. capitata*, *O. zeylanica* and *O. perottetii* under the section *Genuinae*. Clarke (1879) also included the first 3 species under the same section. Cogniaux (1891) followed Triana and included 4 species in the section *Genuinae* in “*Monographie Phanerogamarum*”. However the sectional name *Genuinae* is inadmissible as it is contrary to Art. No. 22.1, 22.2 of ICN (Turland *et al.*, 2018), hence the sectional name “*Osbeckia*”, is used in the present treatment instead of “*Genuinae*”. In India the section *Osbeckia* consists of three species and one variety.

Species belong to Sect. *Osbeckia*:—*O. capitata* Benth., *O. chinensis* L., *O. chinensis* L. var. *pusilla* (Zoll.) Triana and *O. zeylanica* L.f.

***Osbeckia* Sect. *Osbeckia* Type:**—*Osbeckia chinensis* L.

Genuinae Triana, Trans. Linn. Soc., London 28: 53. 1871; C.B. Clarke in Hook. f., Fl. Brit. India 2(6): 515. 1879; Cogn., in A.DC. & C.DC., Monogr. Phan. 7: 325: 1891.

Annual herbs. Flowers tetramerous; anthers with long beak.

Distribution:—Distributed mainly along wet tropical and subtropical Asia including Indo China, Nepal, Bhutan, and Sri Lanka.

Key to the species of Sect. *Osbeckia*

- 1a. Hypanthium campanulate with emergences and hairs 2
 1b. Hypanthium urceolate, glabrous, occasionally hairy *O. capitata*

- 2a. Intersepalal emergences persistent, with prominent stalk and stellate head margin not ciliate *O. zeylanica*
- 2b. Intersepalal emergences caducous, not stalked, margin ciliate.....
 *O. chinensis*

Osbeckia capitata D.Don ex Wight & Arn., Prodr. Fl. Ind. Orient. 1: 323. 1834; Benth. in Wall., Numer. List 144, 4072. 1831 (*nom. nud.*); Walp., Nov. Actorum Acad. Caesp. Leop.-Carol. Nat. Cur. 19. Suppl. 1: 331. 1843; Naudin, Ann. Sc. Nat. Ser. 3. 14. 1850; C.B. Clarke in Hook. f. Fl. Brit. India 2: 517. 1879; C. Hansen, Ginkgoana 4. 47. 1977; N.P. Balakr., Fl. Jowai & Vicinity, 206. 141. 1983. **Lectotype** (designated by Hansen, 1977):— Bangladesh, Sillhet, *S.die.*, Wallich 4072 (K000890015, image!)

Osbeckia glauca Benth. ex Naudin, Ann. Sci. Nat. Bot. ser. 3, 14: 68. 1850, *non* Benth. ex Triana, 1871. **Type**:— Bangladesh, Sillhet, *S.die.*, Wallich *s.n.* (P02441104, image!). **Figs. 50 & 51.**

Annual herbs, main stem prostrate with erect branches, 7–50 cm tall. Stems quadrangular, branched or unbranched, covered with appressed, ciliate hairs. Leaves sub-sessile; petioles 0.2–1.2 mm long; lamina ovate to broadly ovate, 1–3 × 0.5–2.3 cm, apex acute, base obtuse to subcordate, 3–5-nerved, both sides clothed with ascending short hairs. Inflorescence terminal, cluster of 2–3 flowers or solitary, subtended by 1–2 pairs of leaves. Flowers tetramerous, pedicellate and bracteolate; pedicels to 1 mm long. Bracts ovate to elliptic, 3.5–6 mm long, margins ciliate, appressed-hairy dorsally. Hypanthium urceolate, 6–8 × 3–5 mm, glabrous, occasionally hairy, with emergences; intersepalal emergences scale-like, 1–2.5 × 0.5–1 mm, caducous,



Figure 50. *Osbeckia capitata* D.Don ex Wight & Arn.: **A.** Habit; **B.** Hypanthium with stamens; **C.** Sepal; **D.** Intersepal emergence; **E.** Bract; **F.** Seeds.



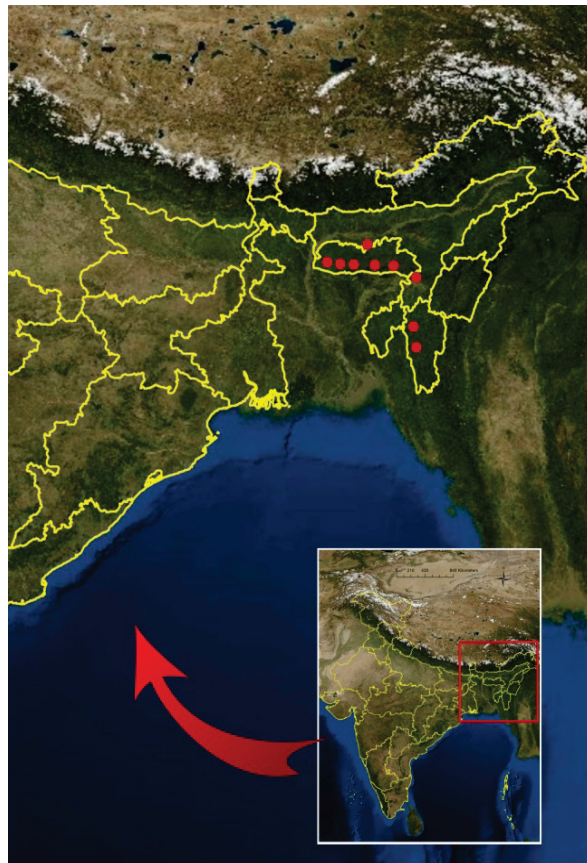
Figure 51. Lectotype of *Osbeckia capitata* D. Don ex Wight & Arn. [Wallich 4072 (K000890015)] © The Board of Trustees of Royal Botanic Gardens, Kew.

rounded at apex, without a distinct head, length of hairs on margin increases towards the tip, dorsal side clothed with appressed hairs. Sepals 4, triangular or ovate, 6–10 mm long, caducous, dark brown to green in color with indistinct nerves, margins ciliate, dorsal side clothed with appressed-hairs. Petals 4, pink, obovate, 10–17 × 6–11 mm, 10–12-nerved, apical margins ciliate. Stamens 8; filaments 5–11 mm long, dark pink; anthers ovate, 5–8 mm long, yellow, narrowed into a slender, tubular beak 2–4.5 mm long, not twisted, pore oblique on the ventral side of tip, narrow, connective prolonged into a collar. Ovary united with hypanthium for about half of its length; anther pocket extending to the base of ovary; free part glabrous, crown distinct; style 14–17 mm long. Capsules urceolate, 7–9 × 3.5–5 mm, not ribbed; seeds 0.2–0.4 mm long, numerous, curved.

Chromosome Number:— $n=10$
(Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—
August–October.

Ecology and Habitat:—This species thrives best in altitudes varying from 500–1500 m., commonly seen in borders of evergreen forests as well as grasslands, occurs in massive number in association with *O. stellata* var. *stellata* and *O. stellata* var. *crinita*.



Distribution:— Assam, Meghalaya and Mizoram.

Notes:— *Osbeckia capitata* resembles *O. chinensis* having tetramerous, pink, flowers with caducous sepals but the latter can be readily distinguished by its sub-sessile ovate leaves, as opposed to the petiolate, linear-lanceolate leaves of the former.

Specimens examined:—**Assam:** Dima Hasao Dist., Umrangso, N.C. Hills, 12.01.2007, R.S. Baruah 115222 (ASSAM). **Meghalaya:** East Khasi Hills Dist., Mawphlanag, Hill slope, 29.10.1972, P.K. Hajra 51907 (CAL); Shillong, 20.09.1956, G. Panigrahi 3297 (CAL); Upper Shillong, 24.08.1958, R.S. Rao 14034 (CAL, ASSAM); Laitkor Shillong, 28.06.2015, Prashob & Sibichen 6112 (DEV); *ibid.*, 26.09.2016, Prashob & Sibichen 6627 (DEV); *ibid.*, 28.06.1963, S.K. Kar 18072 (ASSAM); *ibid.*, 11.09.2015, Prashob & Sibichen 6122 (DEV); Mawsynram, 16.09.2015, Prashob & Sibichen 6138 (DEV); Mawphlang sacred forest, 17.09.2015, Prashob & Sibichen 6140 (DEV); Sohra, 26.09.2016, Prashob & Sibichen 6628 (DEV); *ibid.*, 06.09.1962, G.K. Deka 23376 (ASSAM); Shillong, Laitkor, 28.06.1963, S.K. Kar 18073 (CAL); Shillong, 09.07.1943, N.L. Bor 17965 (DD); Shillong, 24.07.1971, Ramesh Bedi 434 (DD); Pynursula, way to Sohra, 27.06.2015, Prashob & Sibichen 6110 (DEV); Pynursula, 25.08.1956, G. Panigrahi 2982 (ASSAM); Shillong, Woodland, 16.07.1964, H. Deka 36912 (ASSAM); Shillong, 26.05.1911, I.H. Burkill & S.C. Banerjee 42 (CAL); Shillong, 29.05.1911, I.H. Burkill & S.C. Banerjee 82 (CAL); Shillong, 24.09.1885, C.B. Clarke 40517 (CAL); Shillong, 29.09.1915, H.G. Carter 41408 (CAL); Khasia & Jaintia Hills, 22.08.1935, G.K. Deka 13082 (ASSAM); Khasia & Jaintia Hills, 13.07.1913, Ranjilal 2365 (ASSAM); Cherrapunji, 27.09.1956, G. Panigrahi 3480 (CAL); Cherrapunji, way to Nokthlang, 30.07.1913, Upendranath Kanjilal 2365 (ASSAM); Nongthymai, 20.09.1956, G. Panigrahi 3297 (ASSAM); Shillong peak, 26.10.1960, D.C.S. Raju 22023 (ASSAM); Sohra, 11.09.1940, R.N. Desai

2044 (ASSAM). West Khasi hills Dist., Markasa village, 18.06.1958, G. Panigrahi 16389 (CAL, ASSAM). Jaintia hills Dist., Dawki, 12.09.2015, Prashob & Sibichen 6134 (DEV); Jowai, 03.06.1952, A. Das 39288 (ASSAM); Jarain pitcher plant lake, 19.09.2015, Prashob & Sibichen 6143 (DEV); Nongtalang village, 19.09.2015, Prashob & Sibichen 6146 (DEV); Jowai, 19.09.2015, Prashob & Sibichen 6149 (DEV); Ummulong to Jowai, 16.08.1968, N.P. Balakrishnan 46105 (ASSAM). **Mizoram:** Lunglei Dist., Mizo hills, Darzo to Leite, 18.07.1963, R.Dutta 34102 (ASSAM).

Osbeckia chinensis L. var. *chinensis*, Sp. Pl. 345. 1753; C.B. Clarke in Hook.f., Fl. Brit. India 2(6): 515. 1879; C. Hansen, Ginkgoana 4. 49. 1977; T. Pullaiah & Ramam., Fl. East. Ghats, India. 56. 2001; N.P. Balakr. Fl. Jowai & Vicinity, 206. 141. 1983; R.S. Rao, Fl. East Godavari Dist. 366. 1999; T. Pullaiah, D.M. Rao & K.S. Ramam., Fl. East. Ghats 56. 2002; G.V.S. Rao & G.R. Kumari, Fl. Visakhapatnam Dist. Andhra Pradesh, 339. 2003. **Lectotype** (designated by Hansen, 1977):— *S.loc, S.die., P. Osbeck s.n.* (LINN image!).

Osbeckia sessilifolia Stokes, Bot. Mat. Med. 2: 348. 1812. **Type:**— Not seen.

Osbeckia chinensis L. var. *gerzuina* Kurz. J. Asiat. Soc. Bengal. 2. Nat. Hist. 46: 74. 1877. (*nom. illeg.*). **Type:**— Not seen.

Osbeckia chinensis L. var. *typica* Hochr., Candollea 2: 469. 1925. (*nom. illeg.*). **Type:**— Not seen.

Osbeckia angustifolia D. Don, Prodr. Fl. Nepal. 221. 1825. *Osbeckia chinensis* var. *angustifolia* (D.Don) C.Y.Wu & C.Chen, Fl. Yunnan. 2: 80. 1979. *Rhexia napaulensis* Ser. ex DC., Prodr. 3 : 142. 1828 (*pro syn.*) **Type:**— Wallich *s.n.* (Not seen).

Tristemma angustifolium Blume, Bijdr. Fl. Ned. Ind. 17: 1079. 1826. **Type:**—

Not seen.

Osbeckia linearis Blume, Flora 14: 473. 1831. *Melastoma linearis* Reinw. ex Blume, Flora 14: 474. 1831. (*pro. syn.*). *Osbeckia chinensis* var. *linearis* (Blume) Kurz, J. Asiat. Soc. Bengal pt. 2. Nat. Hist. 48: 74. 1877. *Osbeckia linearis* var. *moluccana* Blume, Mus. Bot. Lugduno-Batavum 1: 51. 1849. **Lectotype** (designated here):— Indonesia, *S.die.*, *S.coll.* s. n. (K000867922 image!).

Osbeckia ciliaris Ser. ex DC., Prodr. 3: 132. 1828. **Type:**— Not seen.

Osbeckia ciliata Ham. in Wall., Numer List. 143, 4067 C, *pro parte*. 1831. (*nom. nud.*)

Osbeckia ciliaris Buch.-Ham. ex G.Don, Gen. Hist. 2, 760, *in syn.* 1832. **Type:**— Not seen.

Osbeckia tenuis Buch.-Ham. ex G.Don, Gen. Hist. 2: 760, 1831. *pro parte*. (*nom. nud.*) **Type:**— Not seen.

Osbeckia decora Wall., Numer. List 144, 4070. 1831 (*nom. nud.*). **Type:**— Not seen.

Osbeckia glabrata Benth. in Wall., Numer. List 144, 4071. 1837 (*nom. nud.*). **Type:**— Not seen.

Osbeckia multiflora Blanco, Fl. Filipinas 293, 1837. **Type:**— Not seen.

Osbeckia myrtifolia Blume, Mus. Bot. 1(4): 51. 1849. **Type:**—Nepal, 1831, Wallich 4067A (K000890012 image!).

Osbeckia japonica Naudin, Ann. Sci. Nat. Bot. Ser. 3, 14: 70. 1850. **Type**:—
Japan, *S.loc.*, *S.die.*, *Textor (Blume) s.n.* (P02441110 image!).

Osbeckia perrotteti DC. ex Naudin., Ann. sci. Nat. Bot. Ser. 3, 14: 71. 1850.
Lectotype (designated here):— Philippines, Manille, Prape, *S.die.*,
Perrette s.n. (BR0000005208692 image!).

Osbeckia chinensis L. var. *linearifolia* Kuntze, Rev. Gen. Pl. 1: 247. 1891. **Type**:—
—India, Silligori-Terrai, *S.die.*, *C.E.O.Kuntze 6548* (NY00229579 image!).

Osbeckia ridleyana Hosseus., Bot. Jahrb. Syst. 45: (3) 371. 1911. (*nom.nud.*).

Osbeckia chinensis L. var. *parasnathensis* Haines, Bot. Bihar & Orissa 370. 1922.
Type:— India, *S.loc.*, *S.die.*, *Clarke 34727* (K000890005 image!).

Osbeckia watanae Craib, Bull. Misc. Inform. Kew. 4: 171. 1930. **Type**:—
Thailand, Watana, 14.10.1928, *Put 1909* (K000867933 image!).

Osbeckia chinensis L. var. *attenuata* Bakh.f., Meded Bot. Mus. Herb. Rijks
Univ. Utrecht 91: 50. 1943. **Type**:—China, *S.die.*, *Elbert 987* (L image!).

Figs. 52 & 53.

Annual, erect, branched herbs, up to 70 cm tall. Stems branched, branches clothed with appressed hairs. Leaves petiolate; petioles 0.5–2.5 mm long; lamina ovate to lanceolate, 1.5–4.5 × 0.8–2.4 cm, 3–5-nerved, apex acute, base acute to rounded, both sides thinly clothed with short to long, ascending to patent hairs. Inflorescence a dense terminal cluster of 5–10 flowers, subtended by 1–2 pairs of leaves. Bracts ovate, minute, 1–4 × 6–8 mm, margin ciliate, appressed-hairy along the midline dorsally or sometimes glabrous. Flowers tetramerous, pedicellate; pedicels to 3 mm long. Hypanthium campanulate, 3–7 × 2–4 mm, with few emergences, hairs

simple; intersepal emergences not stalked, flat, 0.3–1 × 0.3–11.5 mm, margins ciliate, caducous; other emergences appressed, but smaller, sometimes much reduced in size. Sepals 4, triangular, 6–7 × 2–5 mm, apex acute, base obtuse, with few distinct nerves, margin ciliate, few appressed hairs dorsally, caducous, or very rarely persistent. Petals 4, pink, ovate, 12–17 × 5–7 mm, ciliate at apex. Stamens 8; filaments 5–6.5 mm long; anthers 1.1–3.7 mm long beak narrowed 0.5–1.5 mm, connective prolonged into a small collar. Ovary united with hypanthium for about half its length, anther pockets extending to base of ovary; the rim of hypanthium extending beyond the crown is glabrous or very rarely with a few bristles, crown very distinct; style 9–14 mm long. Capsules campanulate to urceolate, 4.5–8 × 3–4 mm; seeds minute, 0.1–0.2 mm long, minute, curved.



Figure 52. *Osbeckia chinensis* L. var. *chinensis*: **A.** Habit; **B.** Flower (Images by Prasad Kumar Dash, Odisha Biodiversity Board).



Figure 53. Lectotype of *Osbeckia chinensis* L. var. *chinensis*: [P. Osbeck, s.n., (LINN image)] © The Board of Trustees of Linnean Society of London.

Chromosome Number:— $n=10$ (Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:— September–May.

Ecology and Habitat:—This species thrives best in altitudes varying from 300–500 m., commonly seen in borders of evergreen forests as well as grasslands.

Distribution:—Assam, Bihar, Chhattisgarh, Himachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland, Orissa, Sikkim, Tamil Nadu, Tripura, Uttarakhand, West Bengal.

Notes:—Linnaeus (1753) placed *Osbeckia* as the second genus

under Octandria-Monogynia in *Species plantarum* and treated *Kadali maderaspatanum* and *Echinophora maderaspatana* as synonyms of *O. chinensis*.



Osbeckia chinensis is the most wide spread species of the genus in Asia. Hence it is very variable, and too many species have been published based on specimens falling within its variation. For example, two entities within *O. chinensis* have been recognized such as var. *attenuata* Bakh., var. *parasnathensis*, Hansen (1977) treated these variety are conspecific to *O. chinensis*. Hansen (*l.c.*) also described var. *procumbens* from Northern Thailand owing to its creeping habit. Hansen (*l.c.*) admitted var. *pusilla* and var. *procumbens* as varieties in his Asiatic Revision of *Osbeckia*.

Specimens examined:—**Assam:** Darrang Dist., Silburi range office, 30.11.1975, *P.K. Hajra* 65347, (ASSAM). Goalpara Dist., *S.loc.*, 15.09.1937, *G.K. Deka* 17855 (ASSAM); Kochugaum, 27.01.1933, *D. Nath* 13476 (ASSAM). Golaghat Dist., Seelampur, 11.10.1885, *C.B. Clarke* 171801 (CAL). Kamrup Dist., Garo hills, 01.1904, *J. Marten* 171804 (CAL). **Bihar:** Begusarai Dist., Bomiabuna, 18.11.1938, *N.L. Bor* 10833 (DD); Kadalilmd, 08.01.1960, *G.V. Subbarao* 22927 (ASSAM). **Chhattisgarh:** Bastar Dist., North Kanjeer valley, 26.08.1959, *K. Subramanyan* 8633 (CAL); Dandakaranya, Orkal, 10.11.1963, *D.C.S. Raju* 1072 (CAL). **Himachal Pradesh:** Kangra Dist., Palampur, 25.09.1896, *G.A. Gammie s.n.* (DD). **Jharkhand:** Giridih Dist., Parasnath hills, 15.10.1982, *G.N. Tribedi* 718 (CAL); *ibid.*, *S.die.*, *S. Kurz. s.n.* (DD); *ibid.*, 21.02.1923., *s. Kurz. s.n.* (DD); *ibid.*, 04.11.1868, *S.coll. S.n.*, (DD). **Madhya Pradesh:** Mandal Dist., Kanha National Park, 11.1970, *R.M. Singhal s.n.*, (DD). **Manipur:** Kakching Dist., Kakching, 14.11.1954, *D.B. Deb* 1200 (CAL). Imphal Dist., Chingmeirong, 03.09.1952, *D.B. Deb* 603 (CAL); Machahl, 04.1882, *George Watt* 171794, (CAL); Khuduk, 18.01.1952, *D.B. Deb* 233 (CAL). Thoubal Dist., Wang Jing, 13.09.1954, *D.B. Deb* 2699 (CAL); Shngnu, 12.09.53, *D.B. Deb* 2676 (CAL); Konprm, 11.1907, *Meebold* 5907 (CAL); Kangpokpi, Sadar hills, 03.10.1943, *N.L. Bor* 17703 (DD). **Meghalaya:** East Khasi Hills Dist., Barapani, 31.08.1950, *G.K. Deka s.n.* (ASSAM); Cherrapunji, 13.11.1910, *D. Hooper* 34689 (CAL); Cherrapunji, 13.11.1910, *D. Hooper* 34690 (CAL); Khasia Hills, 27.09.1956, *G. Panigrahi* 3480 (CAL); Khasia hills, 06.1876, *S.coll.* 274 (CAL); Khasia hills. Cherra, 18.10.1932, *N.K Nandi s.n.* (CAL); Khasi hills, 29.09.1915, *H.G. Carter s. n.* (CAL); Shillong, *Nongthymmai*, 20.09.1956, *G Panigrahi* 3297 (CAL); Shillong, 03.10.1898, *Dr. Prain* 171766 (CAL); *S.loc.*, 09.1878, *Gustavman s.n.* (ASSAM); *ibid.*, 12.1885, *S.coll.* 350 (CAL); Mawphlang, Lawhyrgdoh, 29.10.1972, *P.K Hajra* 51907 (CAL); *ibid.*,

20.09.1956, G. Panigrahi 3297 (CAL); *ibid.*, s. die, S.N. Bal 701 (CAL); *ibid.*, Laitkor, way to Woodland, 28.06.1963, S.K. Kar s.n. (CAL); *ibid.*, 09.1929, S.coll. s.n. (CAL); *ibid.*, 05.1911, I.H. Burkill s.n. (CAL); *ibid.*, 26. 05 .1911, I.H. Burkill & S.C. Banerjee s.n., (CAL); *ibid.*, 24.09.1885, C.B. Clarke s.n., (CAL); *ibid.*, 07.08.1885, C.B. Clarke s.n., (CAL); *ibid.*, S.die., J.D. Hooker s.n., (CAL); *ibid.*, 29.05.1911, I.H. Burkill & S.C. Banerjee 82 (CAL); *ibid.*, 07.1918, S.coll. 889 (CAL); *ibid.*, 09.1892, Dr. King's Collector s.n. (CAL). Upper Shillong, 14.08.1958, R.S. Rao 14034 (CAL); Upper Shillong, 24.08.1958, R.S. Rao 14036 (CAL); West Khasi Hills Dist., Markasa village, 18.06.1958, G. Panigrahi 16389 (CAL). Jaintia Hills Dist., Raling to Garampani Road, 22.08.1968, N.P. Balakrishnan 46953 (ASSAM). Ri Bhoi Dist., Barapani forest, 25.10.1931, Shritam Sharma 9498 (ASSAM); Barapani, 13.10.1954, G.K. Deka 11452 (ASSAM). **Mizoram:** Champhai Dist., Zote, 10.10.1989, K.P. Singh 94551 (ASSAM). **Nagaland:** Peren Dist., Naga Hills, Tushar 4.9.1948, S.K. Mukerjee 3429 (CAL). Naga hills, 10.1939, N.L. Bor 6673 (DD). Naga hills, 06.1985, N.L. Bor 21000 (DD). **Orissa:** Koraput Dist., Deomali, 06.12.1962, G.V. Subbarao 29916 (ASSAM). Mayurbhanj Dist., Similipal Biosphere, Noana vicinity, 26.11.1979, S.coll. 12297 (CAL); Similipal Biosphere, Barakamara, 30.11.1979, S.coll. 12400 (CAL). **Sikkim:** South Sikkim Dist., S.loc., S.die., G.King s.n. (CAL); S.loc., 09.12.1875, J.S. Gamble 323 (DD). West Sikkim Dist., S.loc., 05.10.1875, C.B. Clarke s.n. (CAL); S.loc., S.die., J.D. Hooker s.n. (CAL); Gassing to Ralong river, 02.10.1862, M.D. Anderson s.n. (CAL). **Tamil Nadu:** Selam Dist., Omallur, Shevaroy's temple, 19.03.1979, N. Venugopal & Jayaselin 22374 (RHT); Yercaud, Servarayan, 29.06.1979, K.M. Matthew 23296 (RHT); Yercaud, Servarayan, 10.01.1980, K.M. Matthew 25635 (RHT); Yercaud, Servarayan hills, 16.12.1980, K.M. Matthew, Britto & Rani 28030 (RHT). **Tripura:** Gomati Dist., Udaipur, 25.04.1965, D.B. Deb, 2885 (CAL).

Uttarakhand: Dehradun Dist., *S.loc.*, 10.1891, *J.S. Gamble* 23157 (CAL, DD); Lachhiwala, 10.1930, *A.H. Khan s.n.* (DD); Tehri Garhwal, 04.10.1979, *C. Supia* 1056 (CAL, DD); Tehri Garhwal, 09.1882, *T.F. Dathu s.n.* (CAL); *S.loc.*, 30.08.1704, *S.coll. s.n.* (CAL); *S.loc.*, 09.1869, *Griffith s.n.*, (CAL). Uttarkashi Dist., Khela, Kalivally, Kumaon, 18.09.1900, *Fuayal s.n.* (CAL); *ibid.*, 18.09.1900, *Juagal* 24437 (CAL); Kumaon, Didihat-Narayan nagar, 12.10.1967, *Arora* 36491 (BSD); Baramgaon, Gori valley, 27.08.1900, *J.Nagar* 24437 (DD); Sarayu valley, 28.09.1881, *Dutha*, 1607 (DD); *ibid.*, 19.08.1986, *Dutha* 5575 (DD). **West Bengal:** Darjeeling Dist., *S.loc.*, 10.03.1995, *Chandra Panday* 21597 (CAL); *S.loc., S.die.*, *Kurz* 171844 (CAL).

Key to the varieties

1a. Intersepalal emergences caducous..... var. *chinensis*

1b. Intersepalal emergences persistent..... var. *pusilla*

Osbeckia chinensis L. var. *pusilla* (Zoll.) Triana, Trans. Linn. Soc., London 28: 53. 1872. *Osbeckia pusilla* Zoll. & Moritzi, Natuur-Geneesk. Arch. Ned.-Indie 2: 586. 1845, non De Wild. 1921. **Lectotype** (designated by Hansen, 1977):—Indonesia, Java, *Zollinger*, 2225 (P02441165 image!).

Osbeckia truncate D.Don ex Wight & Arn. var. *strigosa* Kuntze, Rev. Gen. Pl. 1: 248. 1891. **Type**:—India, *S.loc.*, *S.die.*, *Kuntze* 6219 (NY229590 image!).

Osbeckia boissieuana Guillaumin, Notul. Syst. (Paris) 2: 302. 1912; & in Bull. Soc. Bot. France 365. 402. 1913. **Lectotype** (designated here):—Vietnam, Cochinchine, 1862, *Thorel* 914 (BM000944330 image!).

Osbeckia parva E.T. Geddes, Bull. Misc. Inform., Kew. 2: 70. 1928. **Type**:—Thailand, 3000 ft, 06.10.1912, *Kerr* 2719 (K000867932 image!). **Fig. 54.**

Perennial, erect, branched herbs up to 70 cm tall. Stems branched, branches clothed with appressed hairs. Leaves petiolate; petioles 0.5–2.5 mm long, Lamina lanceolate, usually more than 3 times as long as broad, 2–6 × 1–2.5 cm, 3–5-nerved, apex acute, base acute to rounded, both sides thinly clothed with short to long, ascending to patent hairs. Inflorescence a dense terminal cluster of 5–10 flowers subtended by 1–2 pairs of leaves; bracts minute, ovate, 1–3 × 3–4 mm, margins ciliate and appressed-hairy along the midline dorsally, sometimes glabrous. Flowers tetramerous; pedicels up to 3 mm long. Hypanthium campanulate, 4–6 × 3–4 mm, with a few emergences, simple hairs, intersepal emergences not stalked, flat, 0.3–1 × 0.3–1.5 mm, margins ciliate, persistent; other emergences, appressed, but smaller, sometimes much reduced in size. Sepals 4, triangular, 1–4 mm long, apex acute, base obtuse, margins ciliate, with a few appressed hairs dorsally, caducous, or very rarely persistent. Petals 4, pink, ovate, 7–10 × 5–7 mm, ciliate at apex. Stamens 8; filaments 2–4 mm long; anthers 2–4.5 mm long beak narrowed, 2–2.5 mm, connective prolonged into a small collar. Ovary united with hypanthium for about half its length, anther pockets extending to base of ovary; free part glabrous or very rarely with a few bristles, crown very distinct; style 5–12 mm long. Capsules campanulate, 4–6 × 3–4 mm; seeds 0.1–0.2 mm long, minute, curved.

Chromosome Number:— $n=10$ (Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—September – May.

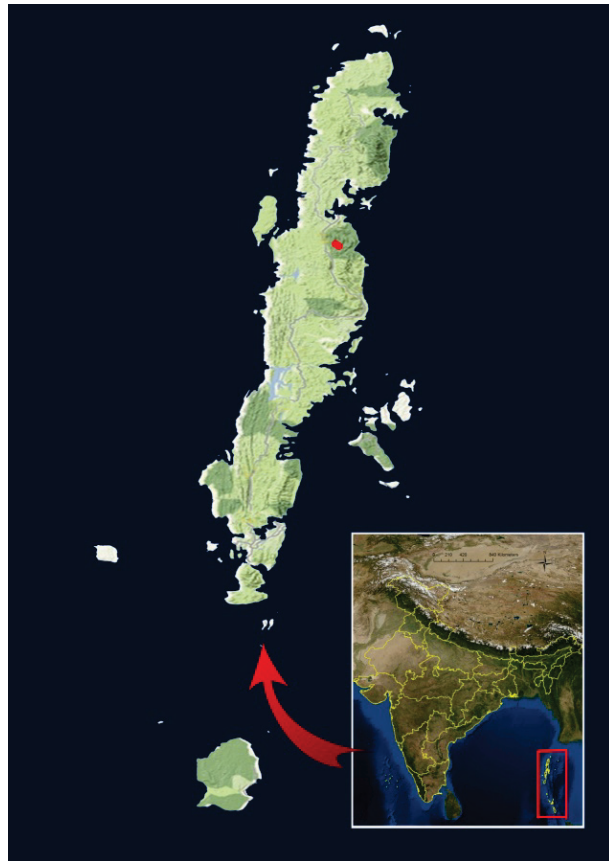


Figure 54. Lectotype of *Osbeckia chinensis* L. var. *pusilla* (Zoll.) Triana: [Zollinger 2225 (P02441165)] © The Board of Trustees of *Muséum national d'Histoire naturelle* (MNHN - Paris, France).

Ecology and Habitat:— Species thrives in massive population at altitudes varying from 300 – 1500 m., commonly seen in borders of evergreen forests as well as grasslands.

Distribution: — Andaman & Nicobar Islands. North Andaman.

Notes:—*Osbeckia chinensis* var. *pusilla* often grows in grassland wet soil. It has been collected at altitudes up to 1570 m.



Specimens examined:— **Andaman & Nicobar Islands.** North Andaman, 01.12.1976, *N.P. Balakrishnan & N.G. Nair* 4772 (PBL).

Osbeckia zeylanica L.f., *Suppl. Sp. Pl.* 215. 1782. C.B. Clarke in *Hook.f., Fl. Brit. India* 2: 516. 1879; J.S. Gamble, *Fl. Pres. Madras* 1: 494. 1919; C. Hansen, *Ginkgoana* 4. 43. 1977; J.L. Ellis, *Fl. Nallamalais* 186. 1987; Ramach. & V.J. Nair, *Fl. Cannanore Dist.* 188. 1988; Antony, *Syst. Stud. Fl. Kottayam Dist.* 168. 1989; Sasidh., *Fl. Periyar Tiger Reserve* 145. 1998; Sasidh., *Fl. Chinnar WLS* 132. 1999; B.D. Sharma, S. Karthikeyan & N.P. Singh, *Fl. Maharashtra, Dicot.* 28. 2000; J.M. Pallithanam & K.M. Matthew, *Fl. Sirumalai Hills, South India* 107. 2001; Mohanan & Sivad., *Fl. Agasthyamala* 281. 2002; T. Pullaiah, D.M. Rao & K.S. Ramamurthy, *Fl. Eastern Ghats* 60. 2002.

Type:— *S.loc.*, *S.die.*, *S.coll.* (Dahl a Linne P) (S.LINN S09-32833 image!).

Osbeckia debilis Naudin, Ann. Sci. Nat. Bot. ser. 3, 14: 65. 1850. **Type:**—*S.coll.* (ex herb. Guillemin) (P02441158 image!).

Osbeckia serialis Naudin, Ann. Sci. Nat. Bot. Ser. 3, 14: 67. 1850. **Type:**—India, Courtallum, Vandalore, 1836, *Wight* 1143 (P02441159 image!).

Osbeckia zeylanica L.f. var. *non-rostrata* Haines, Bot. Bihar & Orissa 369. 1922. **Lectotype** (designated here):— *S.loc.*, *s. die.*, *Haines* 4787 (K000890017 image!).

Echinophora maderaspatana Pluk. Alm. 132. t. 173. f. 4.

Echinophora maderaspatana Pluk. ex Bakh. f., Meded. Bot. Mus. Herb. Rijks Univ. Utrecht 91: 48, 1943 (*pro syn.*). **Figs. 55 & 56.**

Annual, erect herbs, 4–45 cm tall. Stems quadrangular, hispid, sparsely appressed-hairy, branched or unbranched. Leaves petiolate; petioles 1–4 mm long; lamina ovate, 1.5–4 × 0.6–1.5 cm, cuneate at base, acute at apex, densely hairy on both sides, hairs ascending, thin. Inflorescence a terminal cluster of 5–7 flowers or solitary, subtended by a pair of leaves. Flowers tetramerous, pedicellate, bracteate; pedicels to 3 mm long; bracts triangular, green, 1.5–3 × 1–2 mm, margin ciliate. Hypanthium campanulate, 3–5 × 1.5–2.5 mm, thinly clothed with patent emergences and hairs; intersepal emergences 1–2 mm long, stalk terete, with patent hairs, head with stellate hairs (1–2 mm long), persistent; other emergences similar, decreasing in size towards base of hypanthium. Sepals 4, triangular, 2.5–5.5 × 1–2 mm, prominently one nerved, margin ciliate, stellate hairs at apex, few patent hairs on nerves

dorsally, persistent in fruit. Petals 4, obovate, pink to purple, 8–12 × 3–10 mm, ciliate at apex. Stamens 8; filaments 3–5 mm long; anthers twisted, 2.5–6 mm long, yellow, attenuate into a narrow twisted beak of 1 mm, connective prolonged into a widened collar. Ovary united with hypanthium for about half its length; anther pockets extending to the base of the ovary; crown absent; style 7–12 mm long; stigma slightly widened. Capsules campanulate, 3–5 × 2–3 mm, ribbed, exceeds ovary; seeds minute 0.1–0.2 mm long, numerous, curved.

Chromosome Number:— $n=10$

(Meenakumari & Kuriachan, 1990)

Flowering and Fruiting:—

November – March.

Ecology and Habitat:—Occurs

abundantly in rock crevices in deciduous forests at an altitude above 500 m.



Distribution:—Andhra Pradesh, Karnataka, Kerala, Tamil Nadu.

Notes:— *Osbeckia zeylanica* is a distinct species differing from all other annual species by the twisted anthers, which gradually narrowing into a beak with a small bend near the tip pointing the pore towards the back. The consistent, but unfounded confusion of *O. zeylanica* with *O. chinensis* has been solved by Hansen (1972).

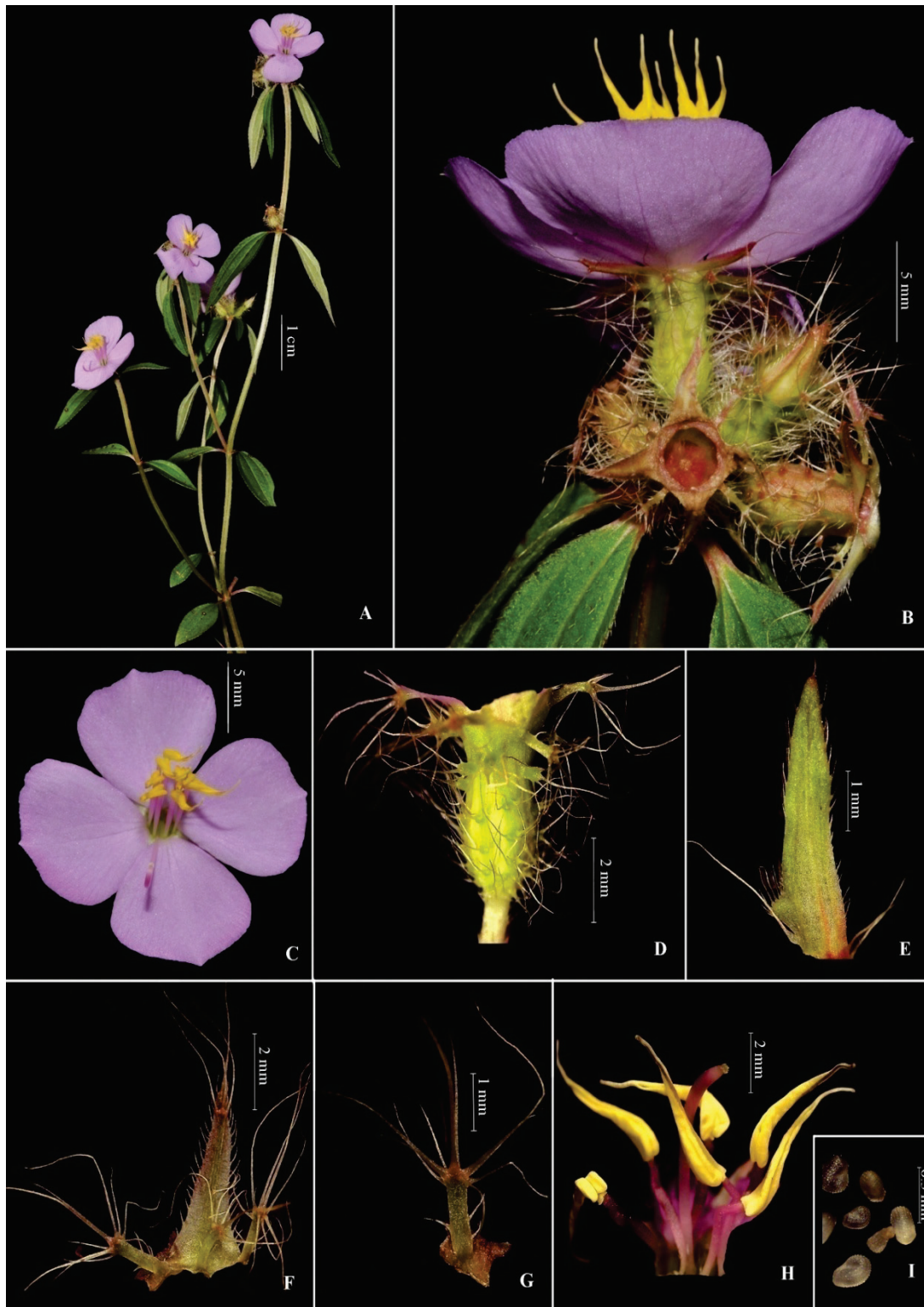


Figure 55. *Osbeckia zeylanica* L.f.: A. Habit; B. Inflorescence; C Flower; D. Hypanthium; E. Bract; F. Sepal & Intersepal emergences; G. Intersepal emergence; H. Stamens; I. Seeds.



Figure 56. Holotype of *Osbeckia zeylanica* L.f.: [Dahl a Linne P) (S.Lin S09-32833)] © The Board of Trustees of Linnen Herbarium Stockholm.

Specimens examined:—**Andhra Pradesh:** Chittoor Dist., Gyanayagundlu, 28.12.1975, G.V. Subbarao 46818 (CAL, MH); Chandragiri, 22.02.1914, *S.coll.* 9979 (MH); Chrudregira fort, 04.02.1089, *Ranga* 2267 (MH); Sunnipenta Nallamd, J.L. Ellis 23774 (CAL); Mamandar, 11.03.1918, C.E.C. Fischer 171873 (CAL). Cuddapah Dist., Balapalle, 23.02.1963, J.L. Ellis 15765 (CAL, MH). East Godavari Dist., Addateegala, 26.09.1980, G.V. Subbarao 68590 (MH). Karimnagar Dist., Aklaspur, 30.12.1964, G.V. Subbarao 22485 (CAL, MH). Nellore Dist., Tada, 03.03.1913, *S.coll.* 21242 (MH); Tada lake vicinity, 26.02.1971, *Sastry* 9748 (CAL). **Karnataka:** Chickmagalur Dist., Kadur, 14.01.1979, K.R. Keshava Murthy, B.R. Ramesh & P. Prakesh 5685 (CAL). **Kerala:** Kannur Dist., Iritty, 11.11.1978, V.S. Ramachandran 58660 (CAL, MH). Idukki Dist., Erattayar, 13.10.1982, V.S. Ramachandran & Mohanan 74611 (MH); Kozhikanam, 11.11.1975, *Vivekananthan* 46629 (MH). Travancore, 27.11.1913, M. Rama Rao 171872 (CAL). **Madhya Pradesh:** Indravati Tiger reserve-Bijapur Ghati, 11.10.1987, *Anand Kumar* 16150 (CAL); *S.loc.*, *S.die.*, *S.coll.* 21235 (MH). **Orissa:** Puri Dist., Puri coast, 02.12.1965, T.A. Rao 5698 (CAL); Orissa-Konark coast, 04.12.1965, T.A. Rao 5953 (CAL); Orissa coast, 09.03.1909, H.H. Haines 171725 (CAL); Ganjam, 01.1890, J.S. Gamble 21607 (CAL). **Tamil Nadu:** Coimbatore Dist., Atakathi, Anaimali hills, 26.12.1911, C.E.C. Fischer 771881 (CAL). Dharmapuri Dist., Harur, Chitteri hills, 12.01.1979, *Venugopal* 20851 (RHT); Kalachipodi Chitteri, 27.12.1990, *Ravishankar* 95555 (MH). Dindigul Dist., Kodaikanal, 02.05.1988, K.M. Matthew 52873 (RHT); *ibid.*, 20.02.1986, K.M. Matthew 44218 (RHT); Situmalai, 09.10.1959, *Pallithanam* 5172 (RHT); Madras, 02.1889, J.S. Gamble 20390 (CAL). Kanchipuram Dist., Chingleput Tirupporur, 01.02.1976, A.N. Henry 47145 (CAL); Tambaram, MCC Campus, 05.01.2001, *Livingston* 72077 (RHT); Chingleput, M.C.C. campus, 05.02.1986, *Narasimhan* 954 (MH);

Puzhuthivakkam, 31.01.2000, K.M. Matthew & Jayanthi 70982 (RHT); Thenpattinam, 06.03.2000, Augustine 61955 (RHT). Krishnagiri Dist., Denkanikottai, 14.11.1979, K.M. Matthew 24576 (RHT). Pudukkottai Dist., Kulathur, Bommadimalai, 09.03.1984, K.M. Matthew & Britto 29676 (RHT); Kulathur, Narathamalai, 07.02.1980, Diraviam 26354 (RHT); *ibid.*, 16.12.1982, K.M. Matthew & Rani 29336 (RHT); *ibid.*, 15.11.1975, K.M. Matthew 15073 (RHT); *ibid.*, 10.01.1971, K.M. Matthew 12981 (RHT); *ibid.*, 20.10.1970, K.M. Matthew 12857 (RHT); *ibid.*, 09.01.1969, K.M. Matthew 8268 (RHT); *ibid.*, *S.die*, Arulappan. *s.n.* (MH); Sathyamangalam, 23.12.1978, *S.coll.*, 16092 (RHT). Tirunelveli Dist., Mundanthurai, 22.02.1960, K.M. Sebastine 9909 (CAL). Mundanthurai, 19.02.1913, M.S Ramaswami, 39340 (CAL); Kannikketti, 20.02.1913, Ramaswami 39396 (CAL); Sivanapuri, 09.02.1916, C.E.C. Fischer 3876 (CAL); Tanimapatam, 02.1889, J.S. Gamble 20390 (CAL); Kalakkad, 22.01.1979, K.M. Matthew 16232 (RHT); Ambasamudram, Kannikketti, 02.01.1978, K.M. Matthew 15826 (RHT); Kalakkad, 12.02.2015, Prashob & Sibichen 5594 (DEV); Papanasam, 12.02.2015, Prashob & Sibichen 5595 (DEV); Agasthiyar falls, 12.02.2015, Prashob & Sibichen 5596 (DEV); *ibid.*, 08.01.2016, Prashob & Sibichen 5596 (DEV). Viluppuram Dist., Viluppuram, Tonnadu malai, 10.01.1999, K.M. Matthew & Augustine 71081 (RHT). Kallakurichi, 15.01.1979, Venugopal 21045 (RHT); Ulundurpet, South Arcot, 30.12.1981, K.M. Matthew, Britto & Rani 28741 (RHT); *ibid.*, 01.02.1980, K.M. Matthew, Britto & Rani 26264 (RHT).

Chapter 6 Discussion on Comparative morphology

Traditional taxonomic studies are primarily based on morphological variations among the taxa under study. The present chapter provides a comparative account of macro and micromorphological characters and its variations observed among the members of the genus *Osbeckia* L. in India. Morphological variations often encountered in this genus are often correlated with the climatic and edaphic conditions prevailing in the habitat.

Habitat

In India, the genus is fairly distributed in high altitude mountains (500–2700 m) of North East Himalayas, Western Himalayas and Western Ghats. The members are found to occur in a wide variety of habitats such as evergreen forests, sholas, forest margins, mountains, grasslands as well as rock crevices and marshy swamps in higher altitudes. For example, *O. aspera*, *O. travancorica*, *O. wightiana*, *O. gracilis*, *O. leschenaultiana*, *O. reticulata*, *O. brachystemon*, *O. mehrana*, *O. parvifolia*, *O. abrahami*, *O. stellata*, *O. stellata* var. *crinita*, *O. stellata* var. *hispidissima*, *O. rostrata*, *O. capitata*, *O. virgata*, *O. nayarii* and *O. saddlepeakensis* occur on forest margins, evergreen forests, sholas, mountains and grasslands in higher altitudes (1000–2500 m.) whereas *O. muralis*, *O. nutans*, *O. chinensis*, *O. chinensis* var. *pusilla* and *O. zeylanica* are seen on low lands. Species such as *O. wynaadensis*, *O. nepalensis* and *O. nepalensis* var. *albiflora* generally prefer swampy habitats.

Habit

Members are either annuals or perennials. Most of the Indian species are erect perennial shrubs. For example, *O. abrahami*, *O. aspera*, *O. travancorica*, *O. gracilis*, *O. leschenaultiana*, *O. mehrana*, *O. nutans*, *O. stellata*, *O.*

stellata var. *crinita*, *O. stellata* var. *hispidissima*, *O. rostrata* and *O. virgata* are small erect shrubs (Figs. 57 & 58A, B). Whereas *O. wynaadensis*, *O. nepalensis*, *O. nepalensis* var. *albiflora*, *O. wightiana*, *O. reticulata* and *O. nayarrii* are small to large shrubs become woody when old. (Figs. 58 C–G). *O. chinensis*, *O. chinensis* var. *pusilla*, *O. capitata*, *O. brachystemon*, *O. parvifolia*, *O. muralis*, *O. saddlepeakensis*, and *O. zeylanica* are annual herbs (Figs. 58 H–L). *O. brachystemon* (Fig. 58 H) is a prostrate herb. The smallest among the taxa is *O. saddlepeakensis* (Fig. 58 K) and the tallest (up to 7.5 m) is *O. reticulata* (Fig. 58 C). *O. nayarrii* (Fig. 58 D) is a straggling shrub.

Stems and branches

The nature of the stem and branches is an important character for identification. It may be quadrangular (*O. muralis*, *O. chinensis*, *O. brachystemon*, *O. parvifolia*, *O. virgata*, *O. wynaadensis*, *O. nepalensis*, *O. nepalensis* var. *albiflora*, *O. reticulata*, *O. mehrana*, *O. abrahami*, *O. stellata*, *O. stellata* var. *crinita*, *O. stellata* var. *hispidissima* and *O. rostrata*) to sub quadrangular (*O. aspera*, *O. wightiana*) or hexangular (*O. leschenaultiana*). In *O. nayarrii* and *O. gracilis* stems and branches are distinctly quadrangular and winged throughout. Young stems are succulent in *O. gracilis*. In many species the upper internodes are very short and one or a few pairs of leaves are seen crowded below the inflorescence (*O. leschenaultiana*, *O. brachystemon*, *O. muralis*, *O. zeylanica*, *O. wightiana*, *O. mehrana*). Inter nodes are swollen in *O. travancorica*.

Indumentum pattern of the stem varies from species to species. Complex trichomes are present in *O. reticulata*, *O. stellata* var. *stellata*, *O. stellata* var. *crinita* and *O. wynaadensis* whereas, hairs are simple in *O. parvifolia*, *O. muralis*, *O. virgata*, *O. brachystemon* and *O. zeylanica*. Peltate scales are seen in *O. wynaadensis*, *O. nepalensis* and *O. nepalensis* var. *albiflora*.

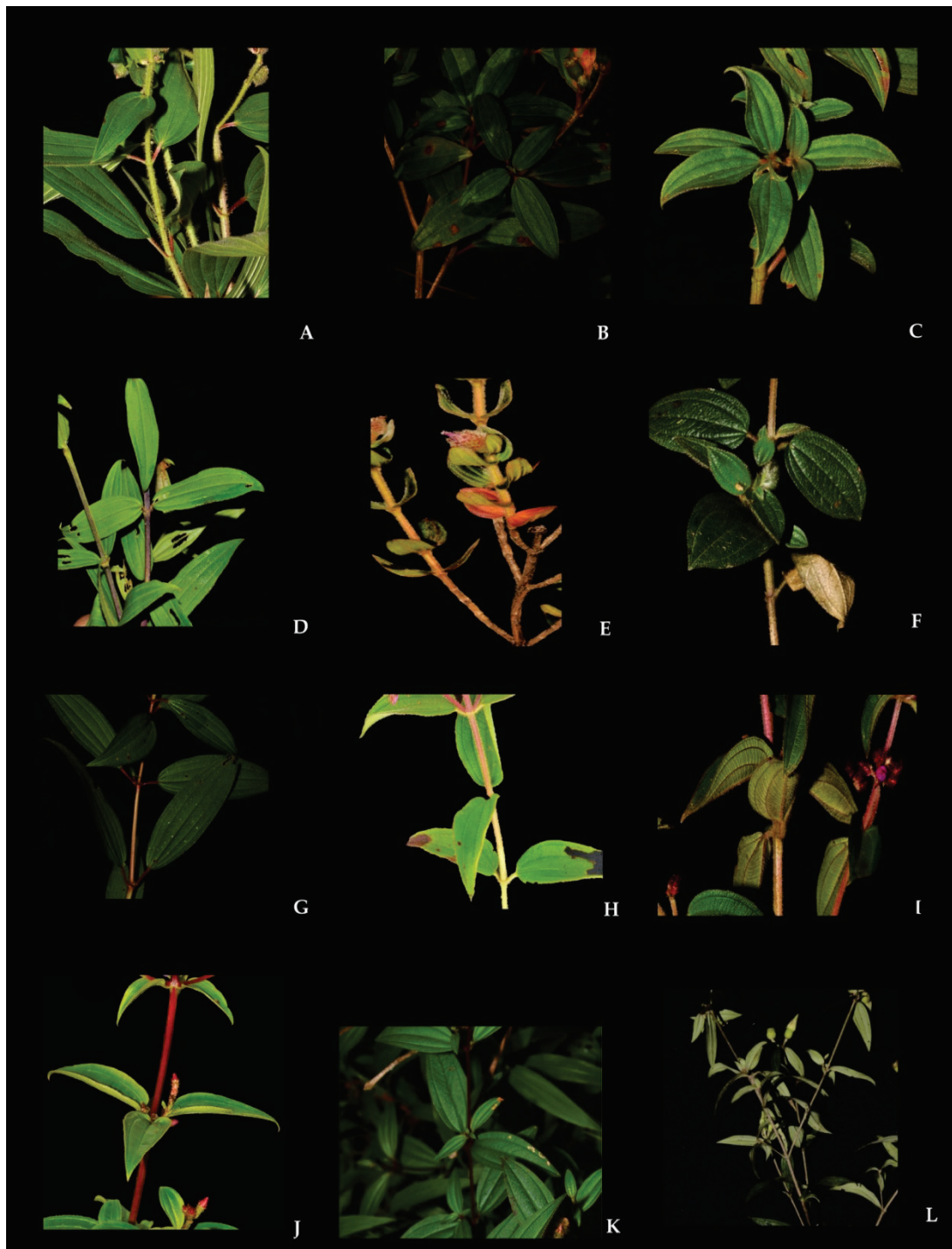


Figure 57. Stem and leaves in *Osbeckia* species: **A.** *Osbeckia abrahamii* G.S. Giri & M.P. Nayar; **B.** *O. aspera* (L.) Blume; **C.** *O. travancorica* Bedd. ex Gamble; **D.** *O. gracilis* Bedd.; **E.** *O. leschenaultiana* DC.; **F.** *O. mehrana* G. S. Giri & M.P. Nayar; **G.** *O. stellata* Buch.-Ham. ex D. Don var. *stellata*; **H.** *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen; **I.** *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen; **J.** *Osbeckia rostrata* D. Don; **K.** *O. virgata* D. Don ex Wight & Arn.; **L.** *O. nutans* Wall. ex C.B. Clarke.

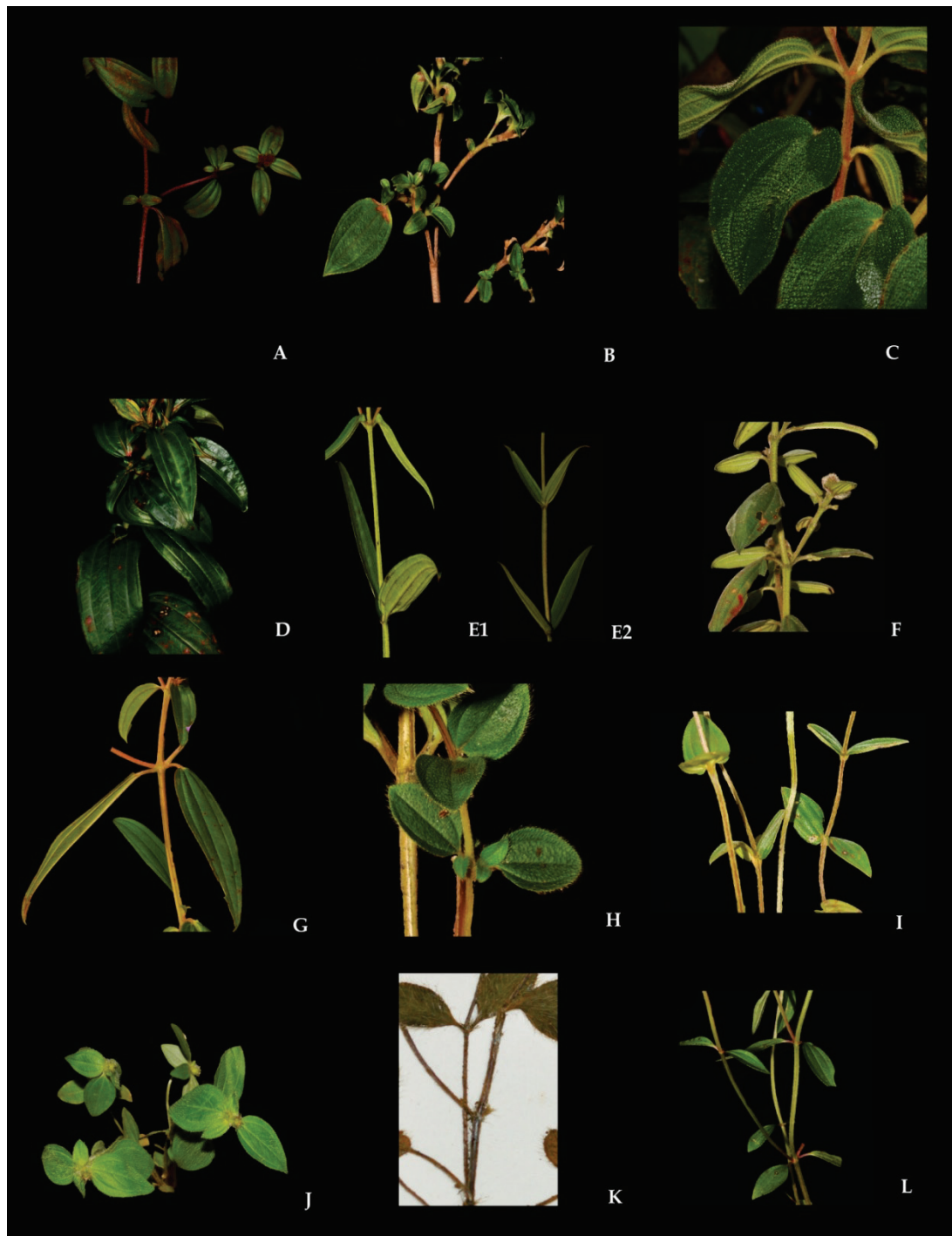


Figure 58. Stem and leaves in *Osbeckia* species: **A.** *O. parvifolia* Arn.; **B.** *O. tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.; **C.** *O. reticulata* Bedd.; **D.** *O. nayarii* G. S. Giri; **E1.** *O. nepalensis* Hook. var. *nepalensis*; **E2.** *O. nepalensis* Hook. var. *albiflora* Lindl.; **F.** *O. wightiana* (Benth.) Wight & Arn.; **G.** *O. wynaadensis* C.B. Clarke; **H.** *O. brachystemon* Naudin; **I.** *O. capitata* D.Don ex Wight & Arn.; **J.** *O. muralis* Naudin; **K.** *O. saddlepeakensis* Prashob *et al.*; **L.** *O. zeylanica* L.f.

Leaves

Simple, opposite, estipulate, petiolate sometimes sessile to sub-sessile; lamina isophyllous, acrodromous 3–5 or 5–7-nerved. Petioles are more than 1 cm long in *O. abrahamii*, *O. aspera*, *O. travancorica*, *O. wightiana*. *O. gracilis*, *O. reticulata*, *O. mehrana*, *O. abrahami*, *O. stellata*, *O. stellata* var. *crinita*, *O. stellata* var. *hispidissima*, *O. rostrata*, *O. virgata* whereas it is sessile to sub-sessile in *O. nepalensis* and *O. leschenaultiana*. Leaves are usually hairy but glabrous, leathery in *O. nayarii*. The surface of leaves are bullate in *O. reticulata*. Venation pattern and laminar indumentum are often species specific. Variation in leaf size, length of petiole and inter node are noticed among the members of the same species growing in different altitudes. For example, in species such as *O. aspera*, *O. travancorica* *O. wightiana*, *O. leschenaultiana*, *O. tirunelvelica* and *O. virgata* the size of leaf, length of petiole and internode decreases as altitude increases.

Laminar trichomes exhibit much diversity in *Osbeckia*. Complex trichomes are present in *O. reticulata*, *O. stellata* var. *stellata*, *O. stellata* var. *crinita* and *O. wynaadensis*. Trichomes are simple in *O. parvifolia*, *O. muralis*, *O. virgata*, *O. brachystemon* and *O. zeylanica*. Trichomes with bullate base are noticed in *O. reticulata*. Hairs are short and multiseriate (c. 250 μm) in most of the taxa but long hairs (c. 1300 μm) are also noticed in *O. abrahami*, *O. travancorica* and *O. muralis*.

Inflorescence

The flowers are primarily arranged in cymes of a few to many flowers. Cymes are 3–7-flowered in *O. mehrana*, *O. wynaadensis*, *O. nepalensis*, *O. nepalensis* var. *albiflora*, *O. reticulata* and *O. leschenaultiana*; 5–10-flowered -

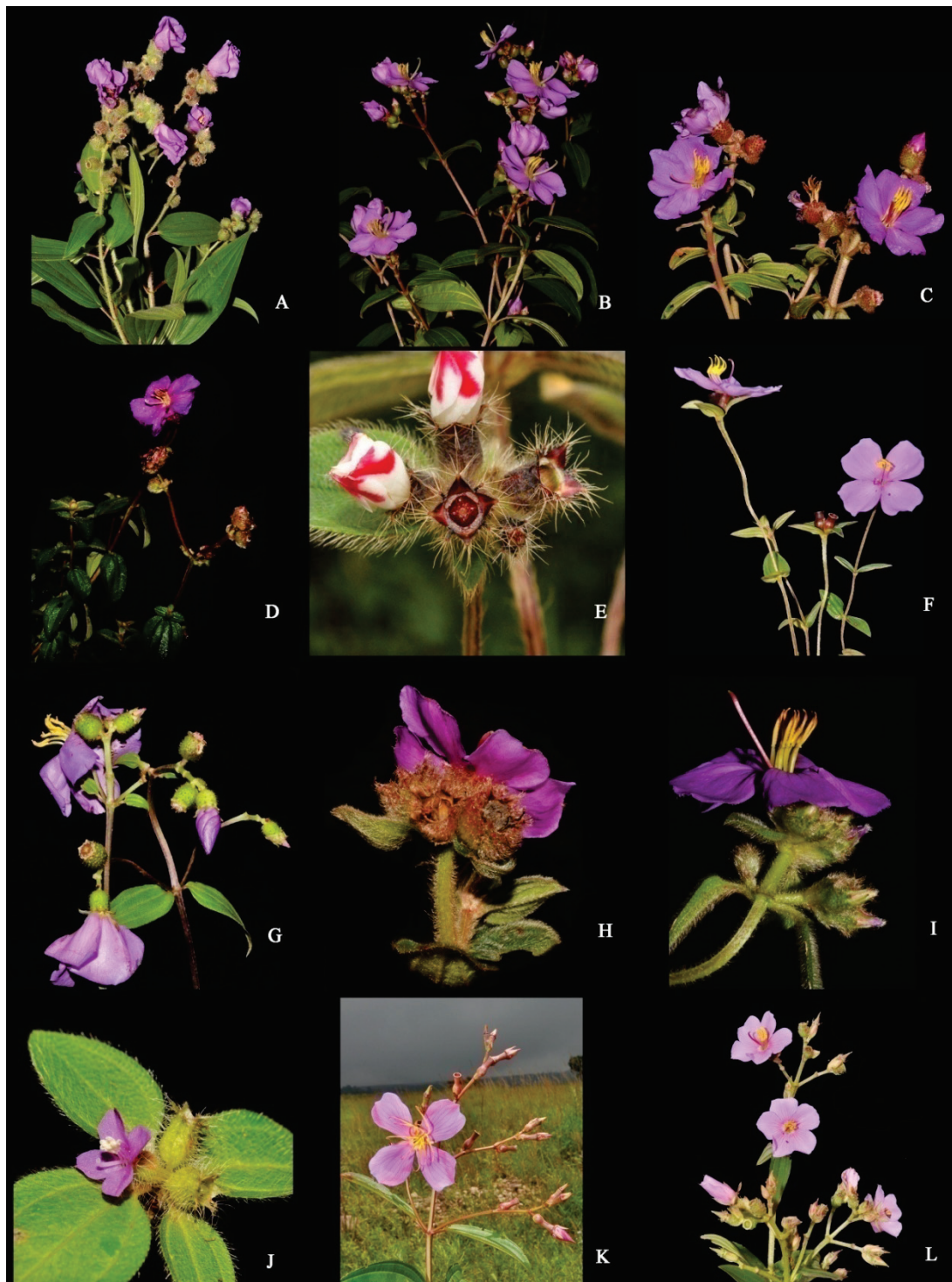


Figure 59. Inflorescence of *Osbeckia*: **A.** *Osbeckia abrahamii* G.S. Giri & M.P. Nayar; **B.** *O. aspera* (L) Blume; **C.** *O. travancorica* Bedd. ex Gamble; **D.** *O. wightiana* (Benth.) Wight & Arn.; **E.** *O. brachystemon* Naudin; **F.** *O. capitata* D.Don ex Wight & Arn.; **G.** *O. gracilis* Bedd.; **H.** *O. leschenaultiana* DC.; **I.** *O. mehrana* G. S. Giri & M.P. Nayar; **J.** *O. muralis* Naudin; **K.** *O. nayarii* G. S. Giri; **L.** *O. nepalensis* Hook. var. *nepalensis*.



Figure 60. Inflorescence of *Osbeckia*: **A.** *O. nepalensis* Hook. var. *albiflora* Lindl.; **B.** *O. nutans* Wall. ex C. B. Clarke; **C.** *O. parvifolia* Arn.; **D.** *O. reticulata* Bedd.; **E.** *O. stellata* Buch.-Ham. ex D. Don var. *stellata*.; **F.** *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen; **G.** *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen; **H.** *O. rostrata* D. Don; **I.** *O. tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.; **J.** *O. virgata* D. Don ex Wight & Arn. **K.** *O. wynaadensis* C. B. Clarke; **L.** *O. zeylanica* L.f.

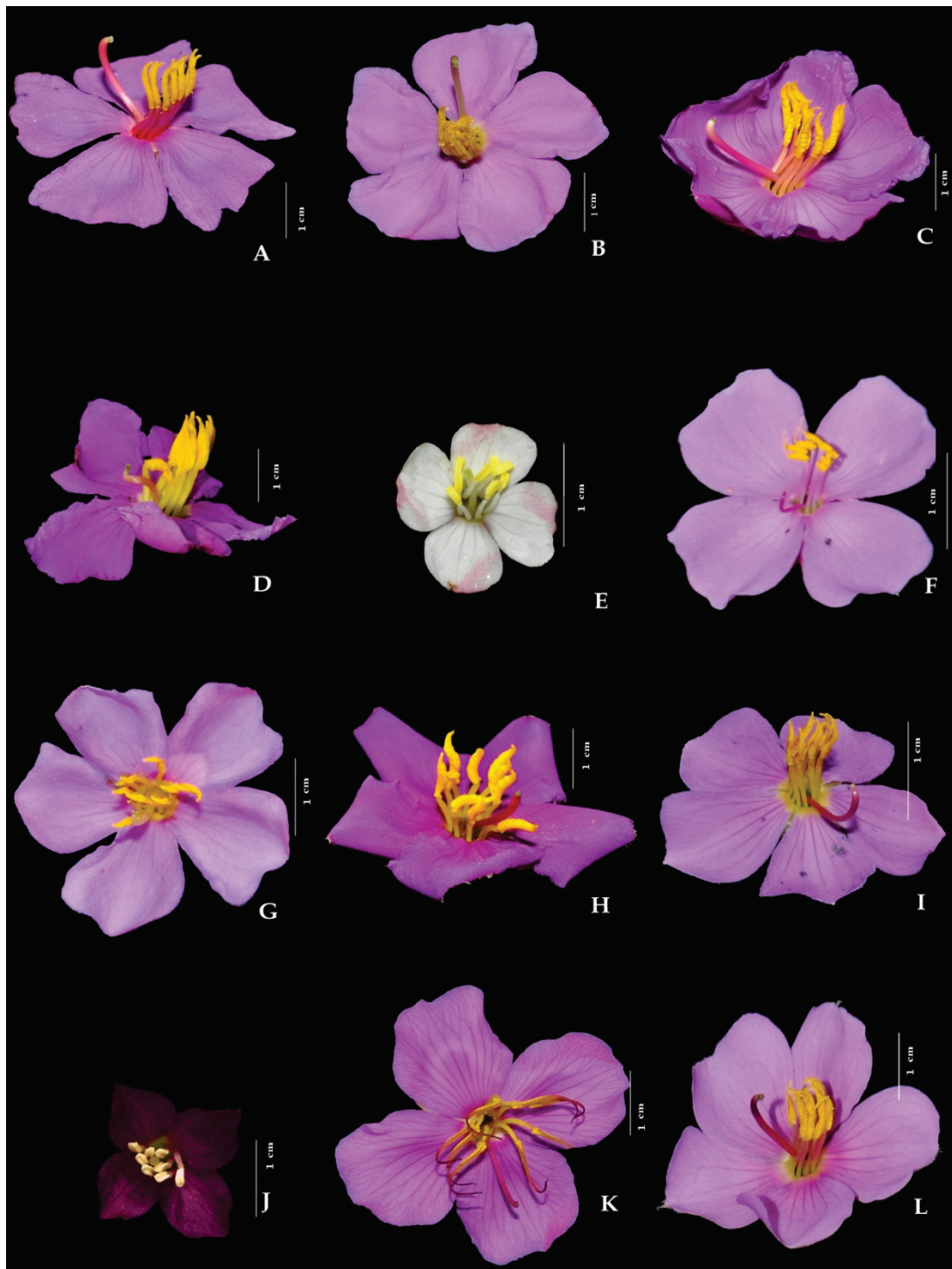


Figure 61. Diversity of flowers in *Osbeckia*: **A.** *Osbeckia abrahamii* G.S. Giri & M.P. Nayar; **B.** *O. aspera* (L) Blume; **C.** *O. travancorica* Bedd. ex Gamble; **D.** *O. wightiana* (Benth.) Wight & Arn.; **E.** *O. brachystemon* Naudin; **F.** *O. capitata* D.Don ex Wight & Arn.; **G.** *O. gracilis* Bedd.; **H.** *O. leschenaultiana* DC.; **I.** *O. mehrana* G. S. Giri & M.P. Nayar; **J.** *O. muralis* Naudin; **K.** *O. nayarii* G. S. Giri; **L.** *O. nepalensis* Hook. var. *nepalensis*.



Figure 62. Diversity of flowers in *Osbeckia*: **A.** *O. nepalensis* Hook. var. *albiflora* Lindl.; **B.** *O. nutans* Wall. ex C. B. Clarke; **C.** *O. parvifolia* Arn.; **D.** *O. reticulata* Bedd.; **E.** *O. stellata* Buch.-Ham. ex D. Don var. *stellata*.; **F.** *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen; **G.** *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen; **H.** *O. rostrata* D. Don; **I.** *O. tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.; **J.** *O. virgata* D. Don ex Wight & Arn. **K.** *O. wynaadensis* C. B. Clarke; **L.** *O. zeylanica* L.f.

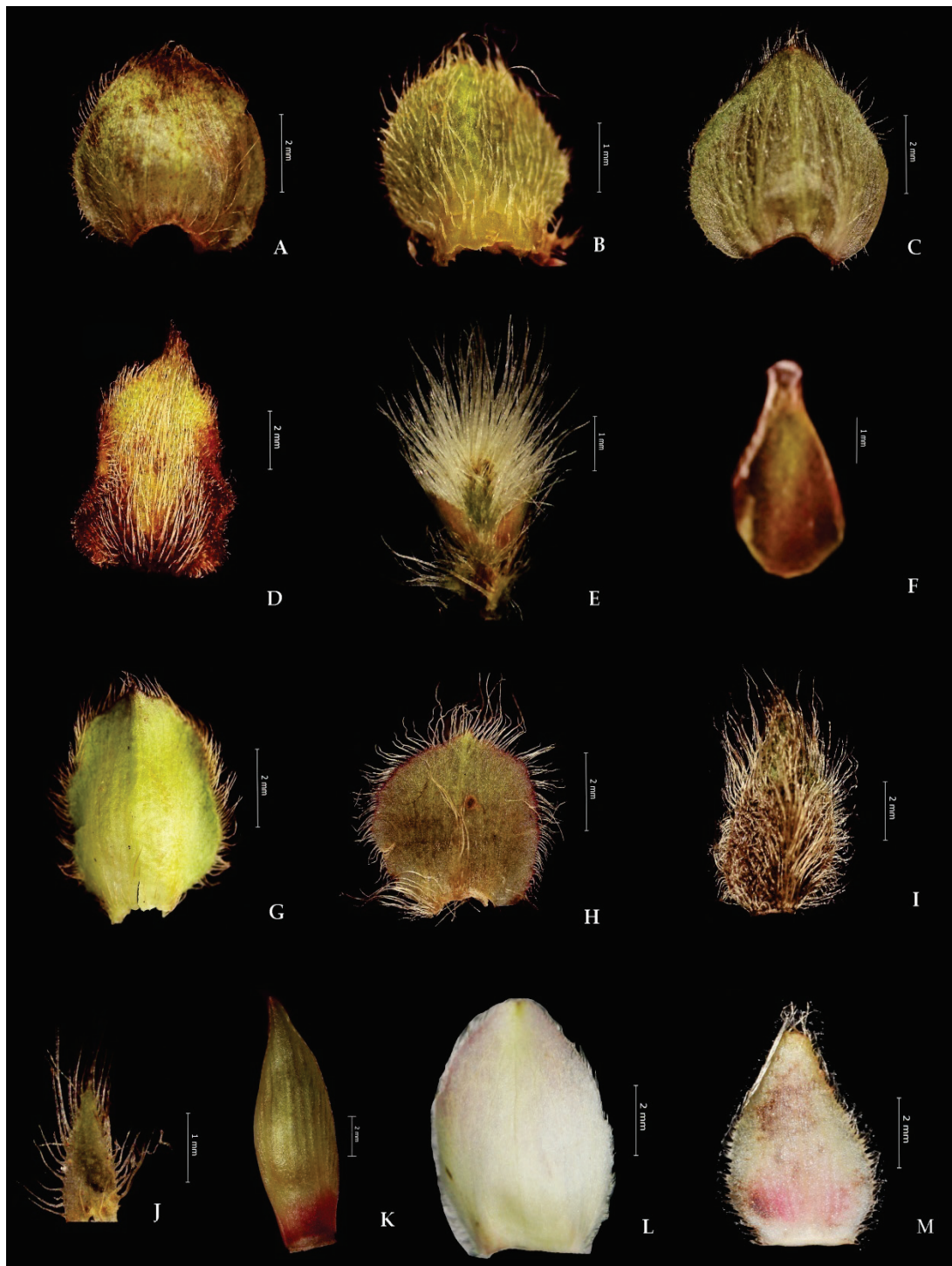


Figure 63. Diversity of Bracts in *Osbeckia*: **A.** *Osbeckia abrahamii* G.S. Giri & M.P. Nayar; **B.** *O. aspera* (L) Blume; **C.** *O. travancorica* Bedd. ex Gamble; **D.** *O. wightiana* (Benth.) Wight & Arn.; **E.** *O. brachystemon* Naudin; **F.** *O. capitata* D.Don ex Wight & Arn.; **G.** *O. gracilis* Bedd.; **H.** *O. leschenaultiana* DC.; **I.** *O. mehrana* G. S. Giri & M.P. Nayar; **J.** *O. muralis* Naudin; **K.** *O. nayarii* G. S. Giri; **L.** *O. nepalensis* Hook. var. *nepalensis*. **M.** *O. nepalensis* Hook. var. *albiflora* Lindl.

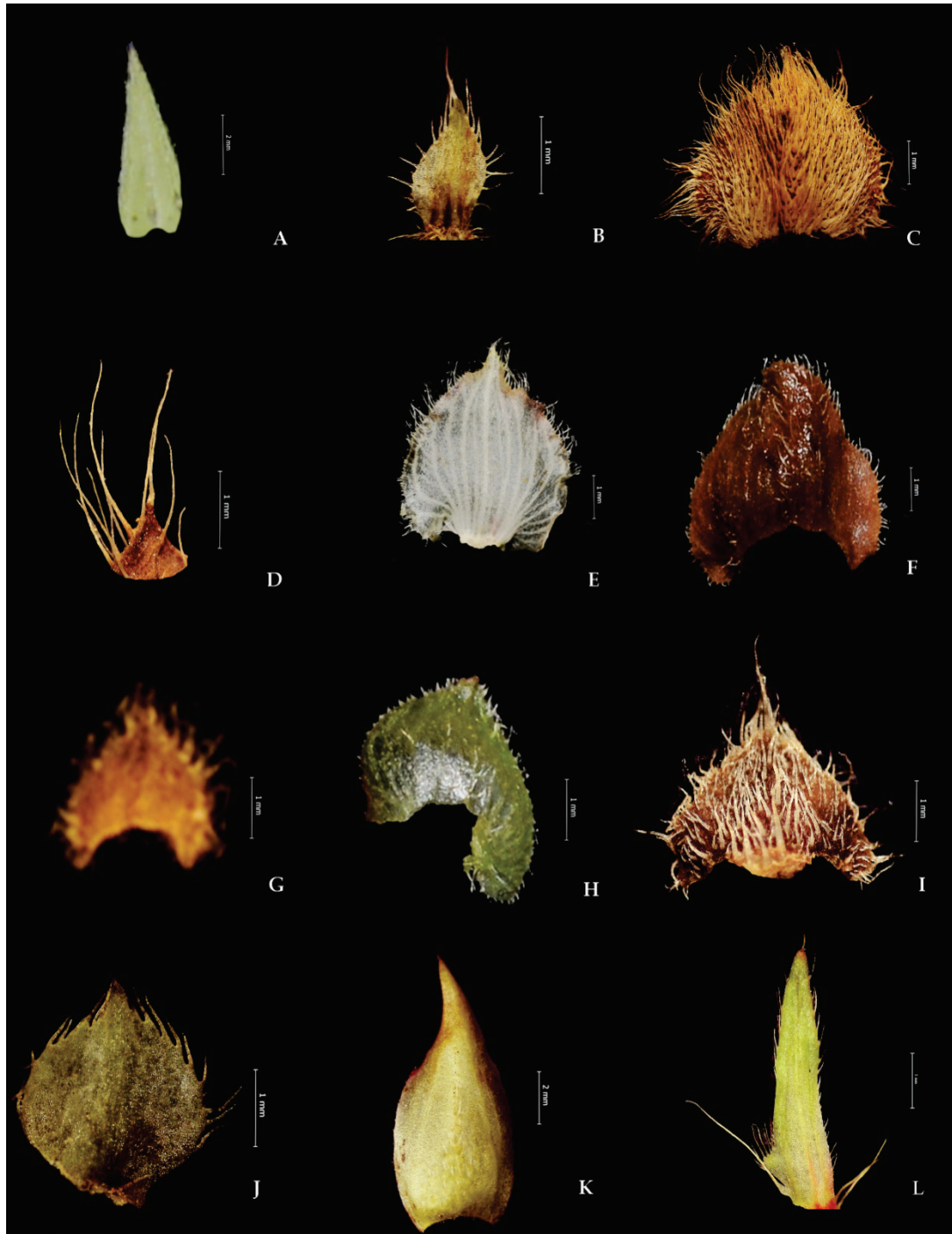


Figure 64. Diversity of Bracts in *Osbeckia*: **A.** *O. nutans* Wall. ex C. B. Clarke; **B.** *O. parvifolia* Arn.; **C.** *O. reticulata* Bedd.; **D.** *O. saddlepeakensis* Prashob *et.al.*; **E.** *O. stellata* Buch.-Ham. ex D. Don var. *stellata*; **F.** *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen; **G.** *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen; **H.** *O. rostrata* D. Don; **I.** *O. tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.; **J.** *O. virgata* D. Don ex Wight & Arn. **K.** *O. wynaadensis* C. B. Clarke; **L.** *O. zeylanica* L.f.

in *O. abrahami*, *O. stellata*, *O. stellata* var. *crinita*, *O. stellata* var. *hispidissima* and *O. rostrata* (Figs. 59 & 60). The cymes may be solitary in *O. zeylanica*, *O. capitata* and *O. chinensis*. Rarely the cymes are long, 15–20 cm (*O. rostrata*, *O. abrahamii*), often considerably condensed to a cluster of cymes (*O. virgata*, *O. muralis*, *O. brachystemon*, *O. saddlepeakensis*, *O. capitata*, *O. parvifolia*). Solitary flowers are rare as in *O. muralis*, *O. zeylanica* and *O. saddlepeakensis*. Inflorescence is a panicle in *O. nayarrii* (Figure 59-K).

Flowers

Flowers are more or less homogenous in appearance (Figs. 61 & 62) bracteate, actinomorphic, tetramerous or pentamerous. In *O. parvifolia* both tetramerous and pentamerous conditions occur. The flower size varies from 0.5–5 cm across. The smallest flower is noticed in *O. saddlepeakensis* (0.5–1.0 cm diam.) and the largest in *O. reticulata* (3–5 cm diam.). The flowers are usually pink, slightly varying from purple, pale red to deep purple. In *O. brachystemon* flowers are white with pink tinge. Flowers are white in *O. nepalensis* var. *albiflora*. In all species petals fall off after anthesis.

Bracts

Bracts are ovate in *O. brachystemon*, *O. capitata*, *O. chinensis*, *O. chinensis* var. *pusilla*, *O. mehrana*, *O. nepalensis*, *O. nepalensis* var. *albiflora*, *O. parvifolia*, *O. gracilis*, *O. tirunelvelica*, *O. wynaadensis*, *O. nayarrii* and *O. virgata*. Ovate to cordate bracts are noticed in *O. abrahamii*, *O. aspera*, *O. travancorica*, *O. nutans*, *O. reticulata*, *O. stellata* var. *crinita*, *O. stellata* var. *hispidissima*, *O. rostrata*. It is broadly ovate in *O. stellata* var. *stellata* and *O. wightiana*; orbicular in *O. leschenaultiana*; triangular in *O. muralis*, *O. saddlepeakensis* and *O. zeylanica*. Bracts are small (0.2– 0.7 mm) in *O. muralis* and *O.*

saddlepeakensis whereas it is large as in *O. wightiana* and *O. stellata* var. *stellata* (1–1.7cm), partially covering the buds. Bracts are hispid and ciliate at margin except in *O. nayarii* (Figs. 63 & 64). The bracts are usually caducous, often subtended by crowded ordinary leaves. The transition from ordinary leaves to bracts is usually abrupt.

Hypanthium

Four kinds of hypanthium are noticed in *Osbeckia*: campanulate, urceolate, obconic and globose. It is campanulate in *O. abrahamii*, *O. aspera*, *O. brachystemon*, *O. chinensis*, *O. chinensis* var. *pusilla*, *O. gracilis*, *O. leschenaultiana*, *O. mehrana*, *O. nepalensis*, *O. nepalensis* var. *albiflora*, *O. parvifolia*, *O. nutans*, *O. reticulata*, *O. tirunelvelica*, *O. travancorica*, *O. virgata*, *O. wynaadensis*, *O. wightiana* and *O. zeylanica* whereas, it is urceolate in *O. capitata*, *O. nayarii*, *O. stellata* var. *stellata*, *O. stellata* var. *crinita*, *O. stellata* var. *hispidissima* and *O. rostrata*. In *O. saddlepeakensis* the hypanthium is obconic and is globose in *O. parvifolia*. Hypanthium persists both in flowering and fruiting stage. The vestiture of the hypanthium is very variable and often extraordinary because of the presence of emergences, hairs, bristles and scales (Figs. 65 & 66). The apex of the hypanthium is often crowned with apical hairs. Sepals, petals and stamens are inserted on the rim of the hypanthium. Sepals and petals are convolute in young bud stage.

Emergences are the superficial outgrowths on the hypanthium. Based on its position on the hypanthium, emergences are classified as intersepalar and other emergences. In size, intersepalar emergences are larger and other emergences are smaller. Larger ones are usually seen towards the apex of the hypanthium and the smaller ones towards the base. The emergences are either distributed throughout the hypanthium or it may

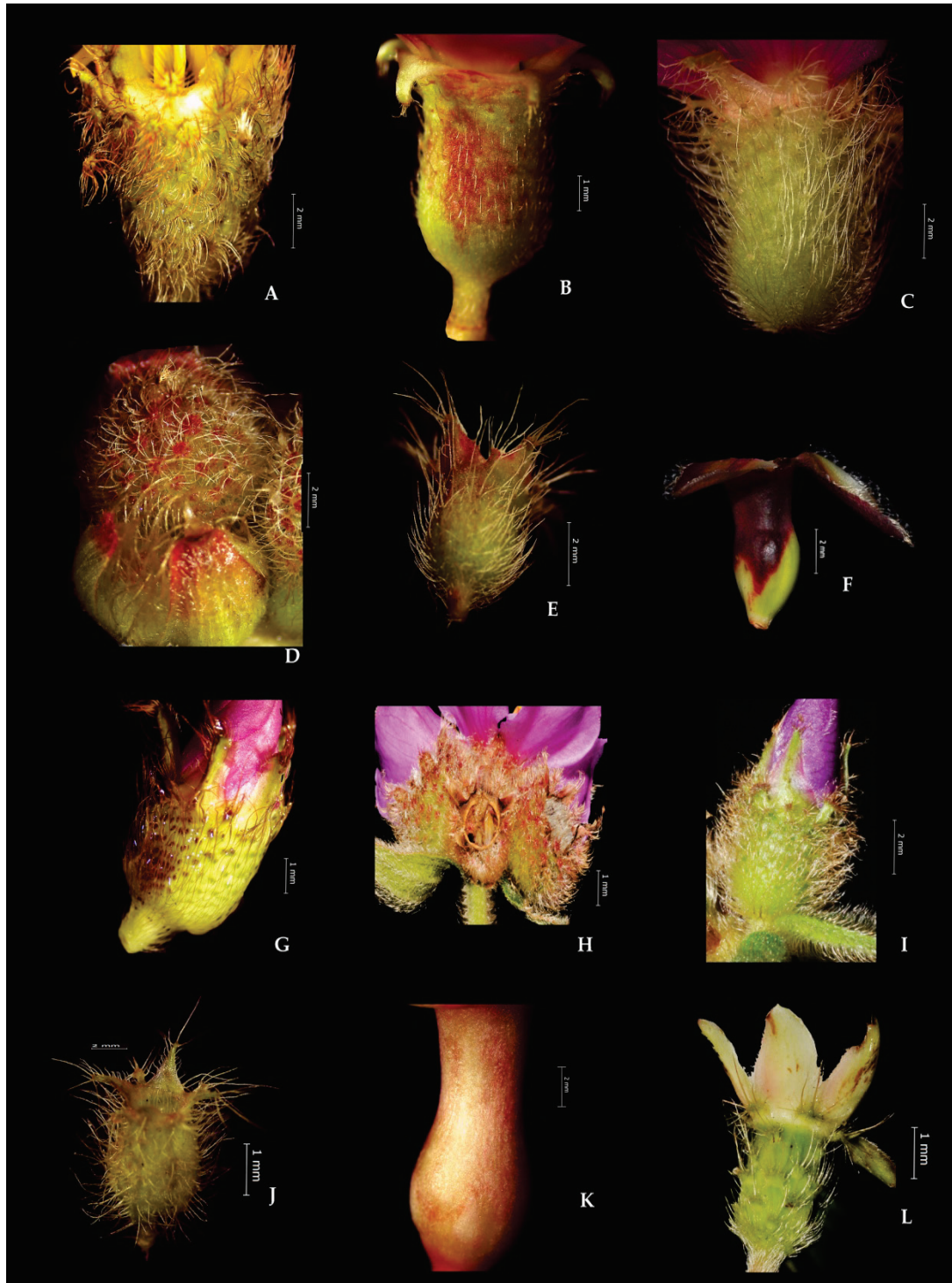


Figure 65. Diversity of Hypanthium in *Osbeckia*: **A.** *Osbeckia abrahamii* G.S. Giri & M.P. Nayar; **B.** *O. aspera* (L) Blume; **C.** *O. travancorica* Bedd. ex Gamble; **D.** *O. wightiana* (Benth.) Wight & Arn.; **E.** *O. brachystemon* Naudin; **F.** *O. capitata* D.Don ex Wight & Arn.; **G.** *O. gracilis* Bedd.; **H.** *O. leschenaultiana* DC.; **I.** *O. mehrana* G. S. Giri & M.P. Nayar; **J.** *O. muralis* Naudin; **K.** *O. nayarii* G. S. Giri; **L.** *O. nepalensis* Hook. var. *nepalensis*.

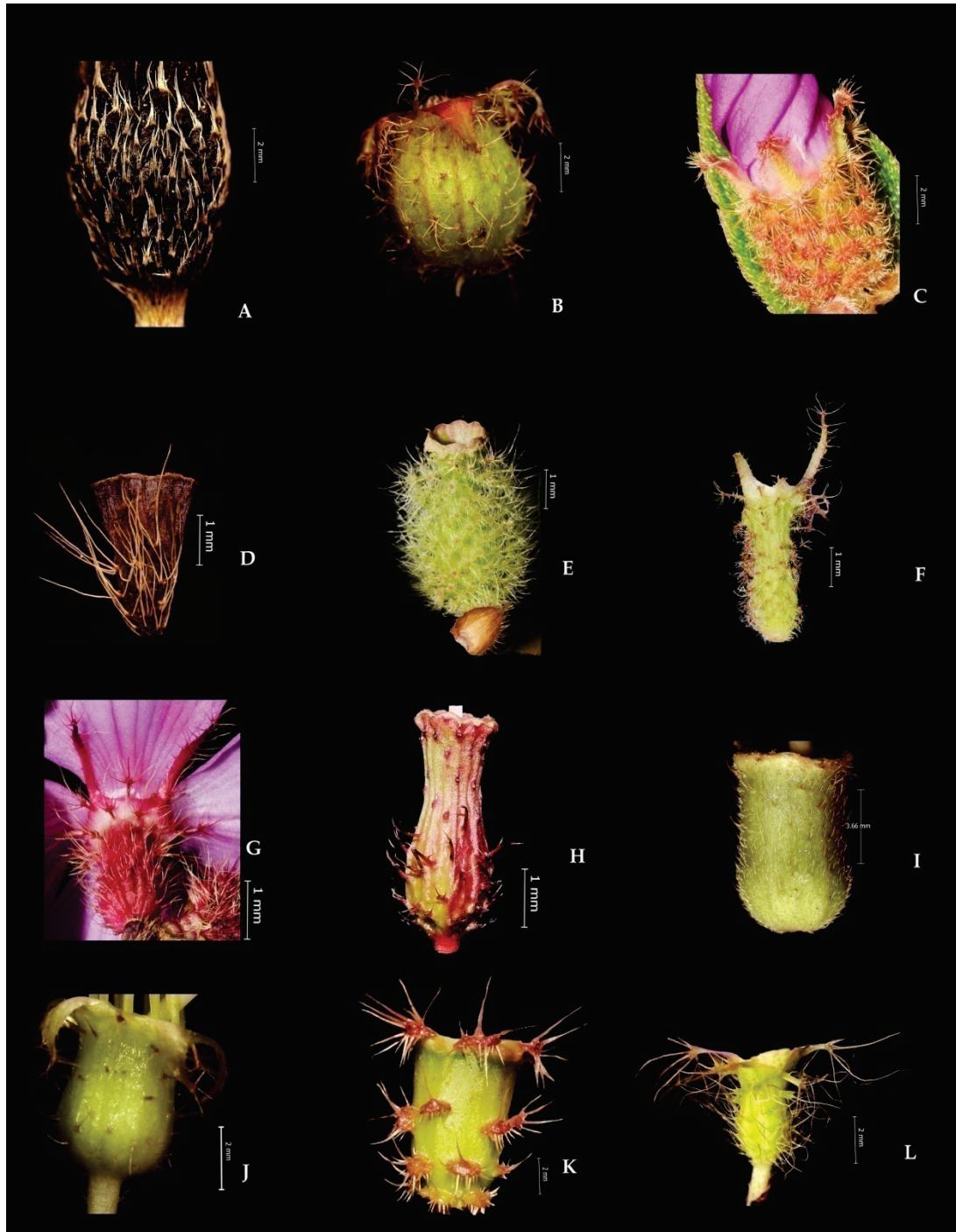


Figure 66. Diversity of Hypanthium in *Osbeckia*: **A.** *O. nutans* Wall. ex C. B. Clarke; **B.** *O. parvifolia* Arn.; **C.** *O. reticulata* Bedd.; **D.** *O. saddlepeakensis* Prashob *et.al.*; **E.** *O. stellata* Buch.-Ham. ex D. Don var. *stellata.*; **F.** *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen; **G.** *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen; **H.** *O. rostrata* D. Don; **I.** *O. tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.; **J.** *O. virgata* D. Don ex Wight & Arn.; **K.** *O. wynaadensis* C. B. Clarke; **L.** *O. zeylanica* L.f.

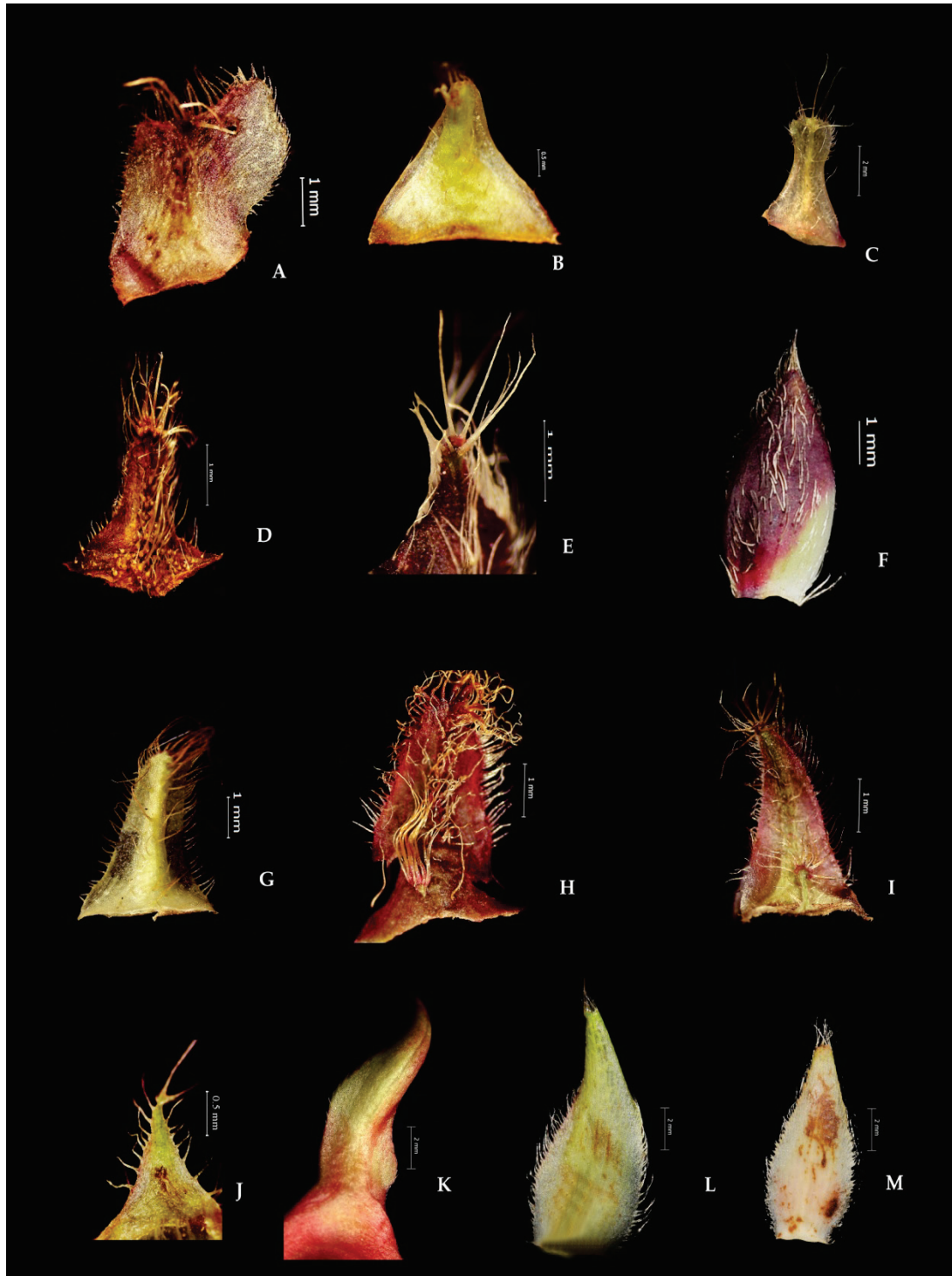


Figure 67. Diversity of Sepals in *Osbeckia*: **A.** *Osbeckia abrahamii* G.S. Giri & M.P. Nayar; **B.** *O. aspera* (L) Blume; **C.** *O. travancorica* Bedd. ex Gamble; **D.** *O. wightiana* (Benth.) Wight & Arn.; **E.** *O. brachystemon* Naudin; **F.** *O. capitata* D.Don ex Wight & Arn.; **G.** *O. gracilis* Bedd.; **H.** *O. leschenaultiana* DC.; **I.** *O. mehrana* G. S. Giri & M.P. Nayar; **J.** *O. muralis* Naudin; **K.** *O. nayarii* G. S. Giri; **L.** *O. nepalensis* Hook. var. *nepalensis*; **M.** *O. nepalensis* Hook. var. *albiflora* Lindl.

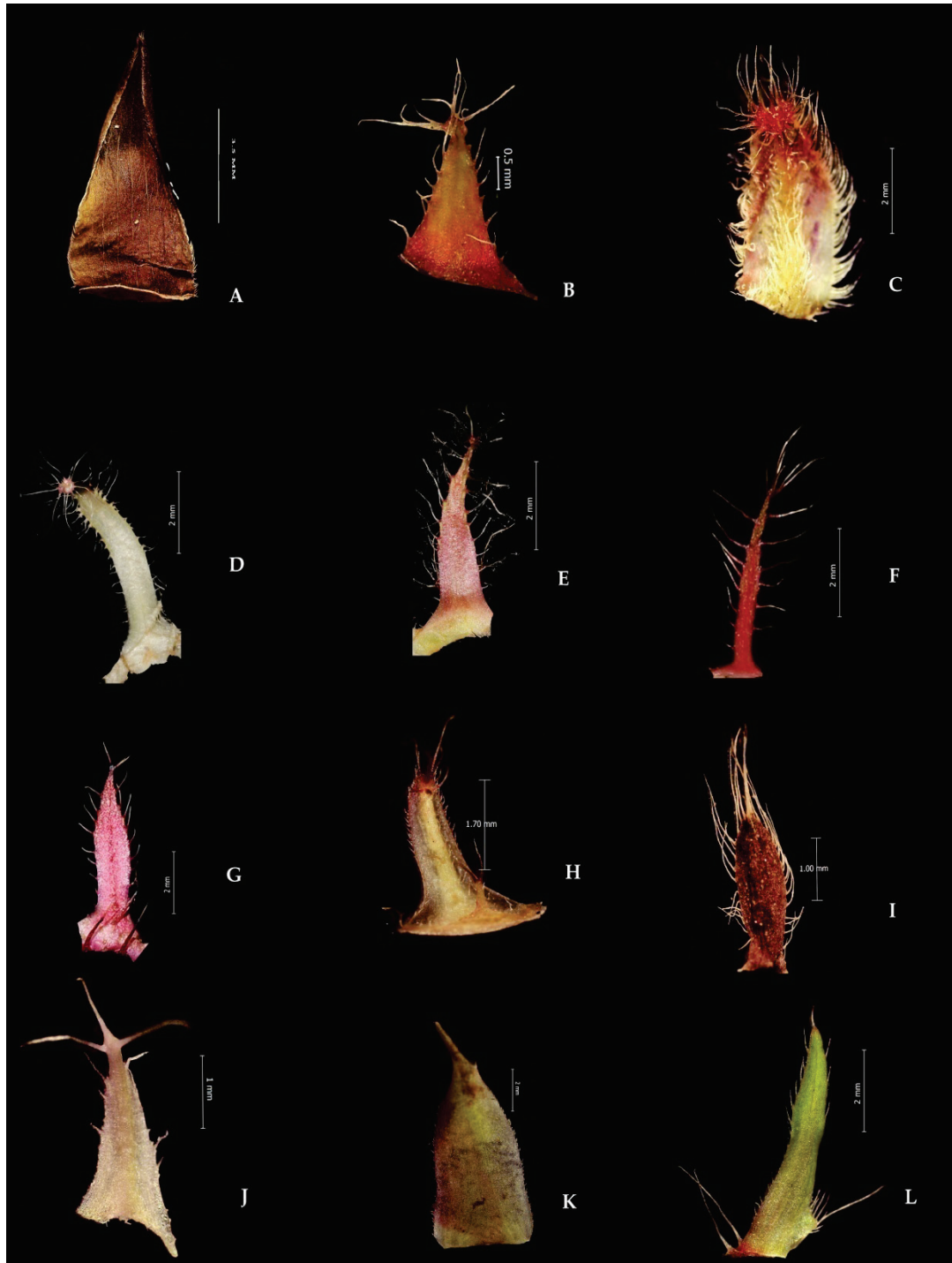


Figure 68. Diversity of Sepals in *Osbeckia*: **A.** *O. nutans* Wall. ex C. B. Clarke; **B.** *O. parvifolia* Arn.; **C.** *O. reticulata* Bedd.; **D.** *O. stellata* Buch.-Ham. ex D. Don var. *stellata*.; **E.** *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen; **F.** *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen; **G.** *O. rostrata* D. Don; **H.** *O. tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.; **I.** *O. saddlepeakensis* Prashob *et.al.*; **J.** *O. virgata* D. Don ex Wight & Arn.; **K.** *O. wynaadensis* C. B. Clarke; **L.** *O. zeylanica* L.f.

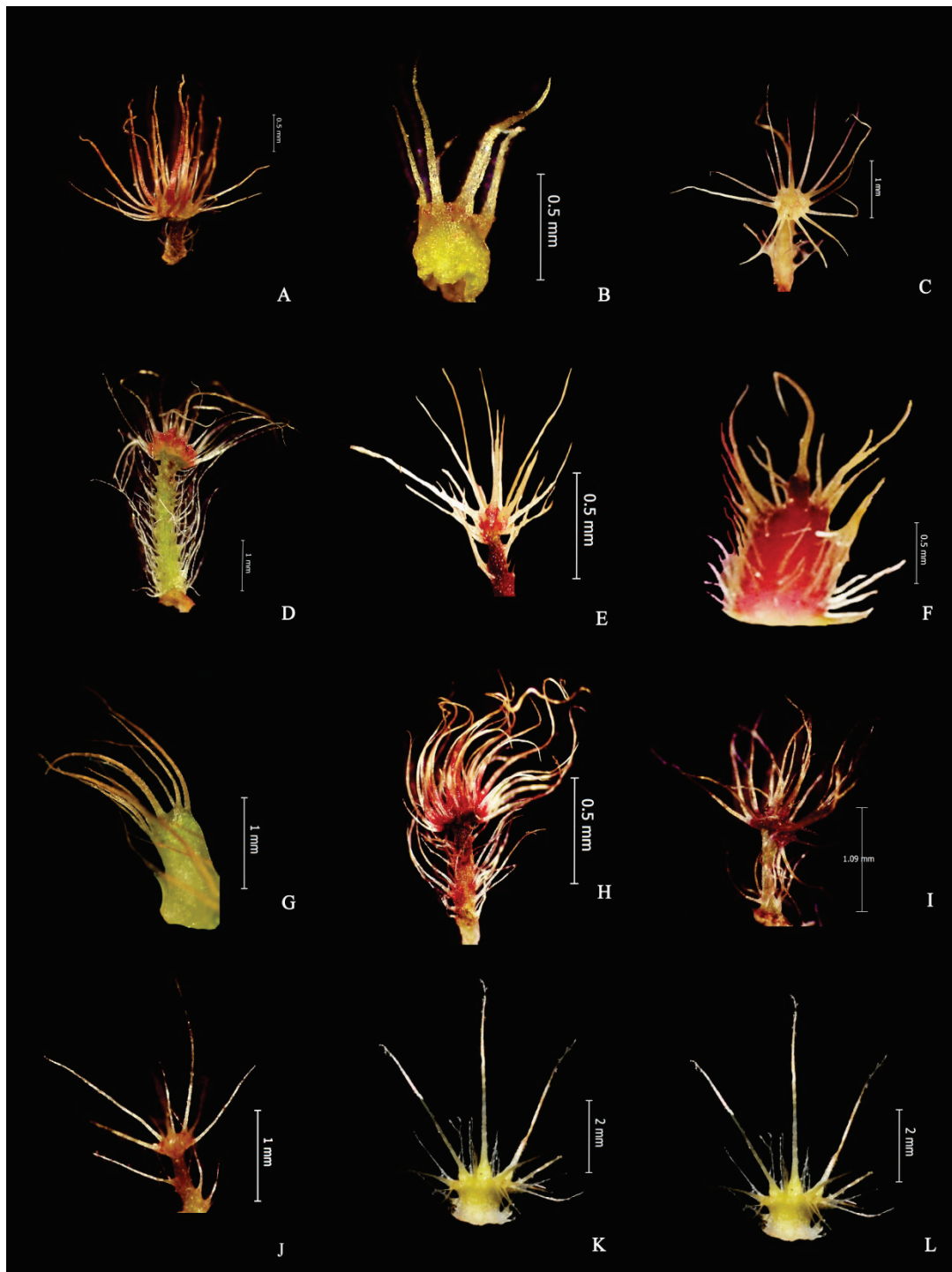


Figure 69. Diversity of Intersepal emergences in *Osbeckia*: **A.** *Osbeckia abrahamii* G.S. Giri & M.P. Nayar; **B.** *O. aspera* (L) Blume; **C.** *O. travancorica* Bedd. ex Gamble; **D.** *O. wightiana* (Benth.) Wight & Arn.; **E.** *O. brachystemon* Naudin; **F.** *O. capitata* D.Don ex Wight & Arn.; **G.** *O. gracilis* Bedd.; **H.** *O. leschenaultiana* DC.; **I.** *O. mehrana* G. S. Giri & M.P. Nayar; **J.** *O. muralis* Naudin; **K.** *O. nepalensis* Hook. var. *nepalensis*; **L.** *O. nepalensis* Hook. var. *albiflora* Lindl.

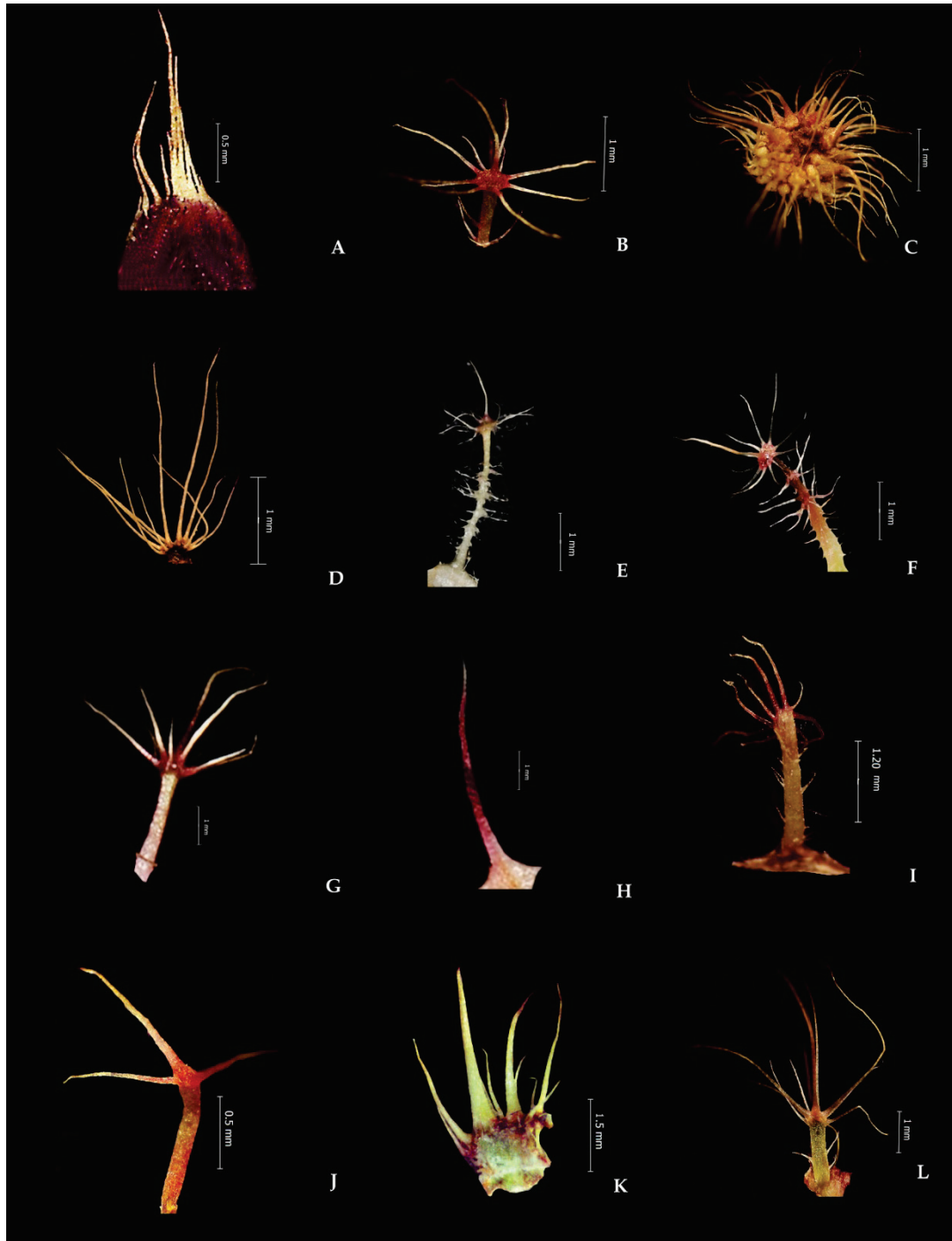


Figure 70. Diversity of Intersepal emergences in *Osbeckia*: **A.** *O. nutans* Wall. ex C.B. Clarke; **B.** *O. parvifolia* Arn.; **C.** *O. reticulata* Bedd.; **D.** *O. saddlepeakensis* Prashob *et.al.*; **E.** *O. stellata* Buch.-Ham. ex D. Don var. *stellata.*; **F.** *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen; **G.** *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen; **H.** *O. rostrata* D. Don; **I.** *O. tirunelvelica* Murugan & Manickam ex Kottaim. & Gnanasek.; **J.** *O. virgata* D. Don ex Wight & Arn. **K.** *O. wynaadensis* C. B. Clarke; **L.** *O. zeylanica* L.f.

be restricted to upper or lower part. Besides emergences, there are hairs on the hypanthium, constituting the third element of the hypanthial vestiture. In several species such as *O. aspera*, *O. tirunelvelica* and *O. gracilis* hairs are the only vestiture of hypanthium besides the intersepal emergences.

Extreme diversity is noticed in structure and size of emergences which forms an important character for species delimitation. For example, emergences are fleshy and stellate in *O. rostrata* (Figs. 66 H); scales and bristles are seen in *O. nepalensis*, *O. nepalensis* var. *albiflora* and *O. wynaadensis*. Both emergences and hairs are present in *O. muralis*, *O. virgata*, *O. travancorica*, *O. wightiana*, *O. leschenaultiana*, *O. brachystemon*, *O. parvifolia* and *O. zeylanica*. In species having persistent calyx, intersepal emergences persist even in fruit. Once the sepal falls off after flowering, the intersepal emergences may or may not persist. Hypanthium is glabrous in *O. nayarii* (Fig. 65 K).

Sepals

Sepals are four or five in *Osbeckia*, arise from the rim of hypanthium. The shape, venation and pattern of indumentum on sepals are of great taxonomic significance. Two types of sepals are found in *Osbeckia*. One is tapering from the base, while the other is widening from the base. The former is distinctly 1-nerved (*O. virgata*, *O. brachystemon*, *O. stellata*, *O. crinite* and *O. muralis*) (Figs. 67 & 68). The constriction is often abrupt in *O. reticulata* and *O. leschenaultiana* resulting in a comparatively long, narrow outer part with densely hairy midrib and ciliate margin. The hairs at the apex of such sepals are often stellate with long bristles resembling the heads of the emergences, often confused as large emergences as seen in *O. stellata*, *O.*

parvifolia, *O. brachystemon*, and *O. muralis*. Sepals of the latter type have several indistinct nerves (*O. nepalensis*, *O. nepalensis* var. *albifolia* and *O. wynaadensis*). Triangular shaped sepals are present in *O. aspera*; sepals are assymmetric in *O. abrahamii*. In many species the sepals fall off after flowering whereas, in few others sepals persist even in well-ripened fruits.

Intersepalar emergences

The intersepalar emergences are the largest among various emergences. It is present in between two adjacent sepals. Intersepalar emergences are present in all taxa except *O. nayarii*. Emergences with terete stalk and stellate head are present in varieties of *O. stellata*, *O. abrahamii*, *O. travancorica*, *O. wightiana*, *O. brachystemon*, *O. leschenaultiana*, *O. mehrana*, *O. muralis*, *O. parvifolia*, *O. tirunelvelica*, *O. virgata*, *O. zeylanica* (Figs. 69 & 70) intersepalar emergences are scale like in *O. wynaadensis*, *O. nepalensis* var. *nepalensis*, *O. nepalensis* var. *albiflora*, *O. nutans* and *O. capitata*. Intersepalar emergences are linear to lanceolate in *O. rostrata* with a bulbous base ending in a tuft of hairs in *O. aspera* and *O. gracilis*.

Corolla

Corolla consists of four or five free petals. The number of floral parts is usually a constant character though individuals with one or two extra lobes can rarely be found. In most species corolla possesses shades of pink varies from purple, pale red to deep purple whereas, petals are white in *O. nepalensis* var. *albiflora* and white with pinkish tinge in *O. brachystemon*. Usually the corolla sheds soon after anthesis. The shape of the petals is almost uniform (ovate to obovate) and has little taxonomic value. Large and showy corolla adds ornamental value to the taxon.

Androecium

Androecium constitutes an important identifying feature in *Osbeckia* (Figs. 71 & 72). Stamens are 8 or 10, isomorphic, fall off after anthesis. The space where the anthers accommodated in the bud stage is called extra-ovarian chambers or anther pockets (Bakhuizen, 1943). Anthers are embedded in anther pockets while in bud stage. The filaments are more or less flat, yellow, pink or purple in colour, except in *O. brachystemon*, where it is white in colour. Anthers vary in shape and size but yellow in colour. The connective is often deep yellow, slightly prolonged into a small but distinct collar surrounding the insertion of the filament immediately below the anther sacs.

Sectional classification of the genus is mainly based on the nature of anther. The anther cells mostly united at the apex into a single tube forming a short to very long beak. Sectional characteristics of anthers and underlying species are as follows: Sect. *Amblyanthera* (Figs. 71E & J, 72B & D)–Beaks absent, apex truncate (*O. muralis*, *O. brachystemon* and *O. parvifolia* and *O. saddlepeakensis*); Sect. *Osbeckia* (Figs. 71F, 72L) anthers beaked (*O. chinensis*, *Ochinensis* var. *pusilla*, *O. capitata* and *O. zeylanica*); Sect. *Ceramicalyx* (Figs. 71K, 72E-H)–Long beak and “S” shaped anthers (*O. nayarii*, *O. stellata* var. *stellata*, *O. stellata* var. *crinita*, *O. stellata* var. *hispidissima* and *O. rostrata*) Sect. *Asterostoma* (Figs. 71A-D, G-I, L, M, 72A, C, I-K)–anthers attenuate upwards, not beaked (*O. aspera*, *O. travancorica*, *O. wightiana*, *O. gracilis*, *O. leschenaultiana*, *O. reticulata*, *O. mehrana*, *O. abrahami*, *O. virgata*, *O. nutans*, *O. wynaadensis*, *O. nepalensis* and *O. nepalensis* var. *albiflora*). Anthers usually dehisce by an apical pore. The pore is usually tilted more or less to the ventral or dorsal side. *Osbeckia brachystemon* and *O. muralis* possess two apical pores, *i.e.*, each anther sac open by separate pores.

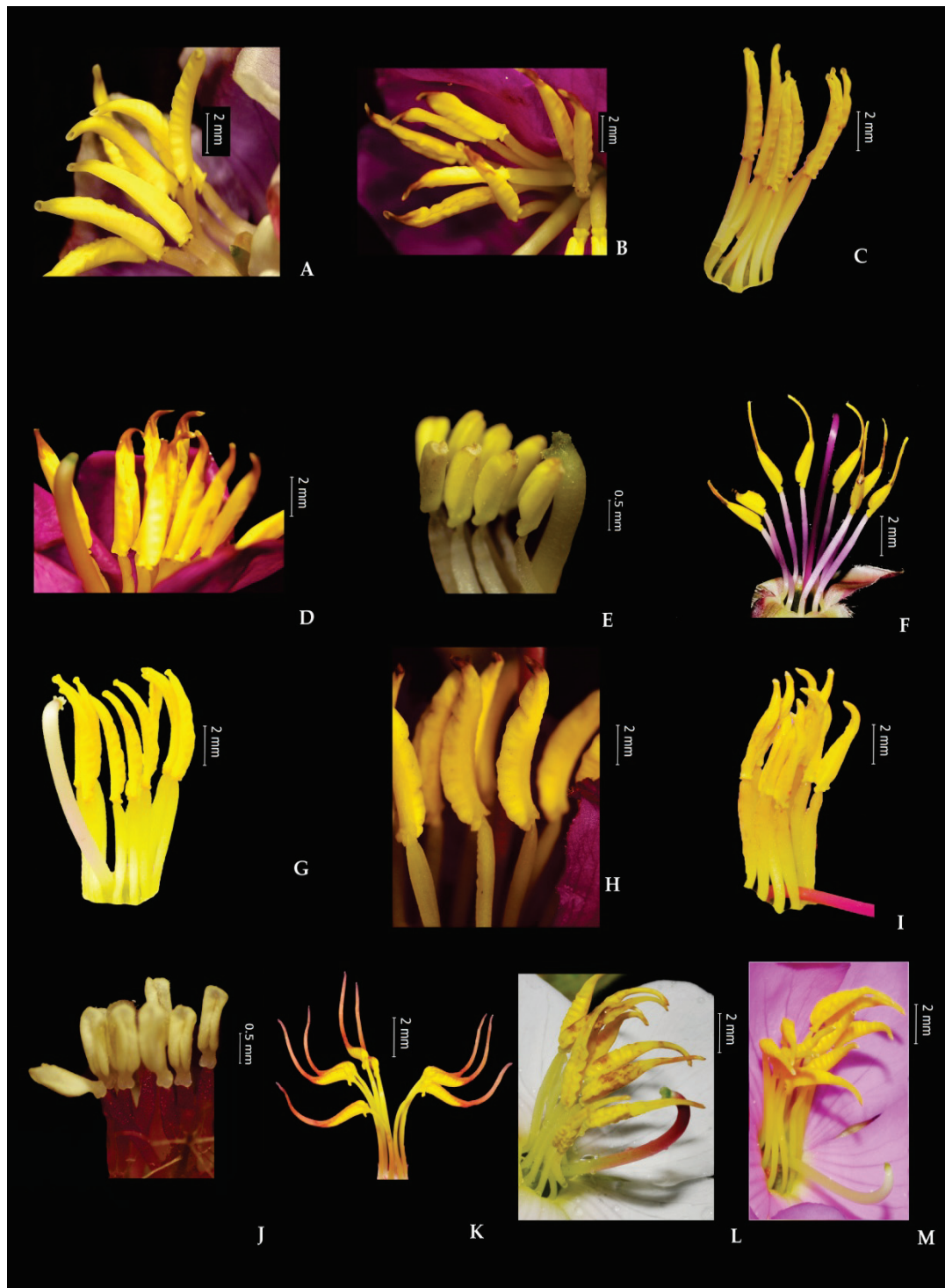


Figure 71. Diversity of Stamens in *Osbeckia*: **A.** *Osbeckia abrahamii* G.S. Giri & M.P. Nayar; **B.** *O. aspera* (L) Blume; **C.** *O. travancorica* Bedd. ex Gamble; **D.** *O. wightiana* (Benth.) Wight & Arn.; **E.** *O. brachystemon* Naudin; **F.** *O. capitata* D.Don ex Wight & Arn.; **G.** *O. gracilis* Bedd.; **H.** *O. leschenaultiana* DC.; **I.** *O. mehrana* G. S. Giri & M.P. Nayar; **J.** *O. muralis* Naudin; **K.** *O. nayarii* G.S. Giri; **L.** *O. nepalensis* Hook. var. *albiflora* Lindl.; **M.** *O. nepalensis* Hook. var. *nepalensis*.

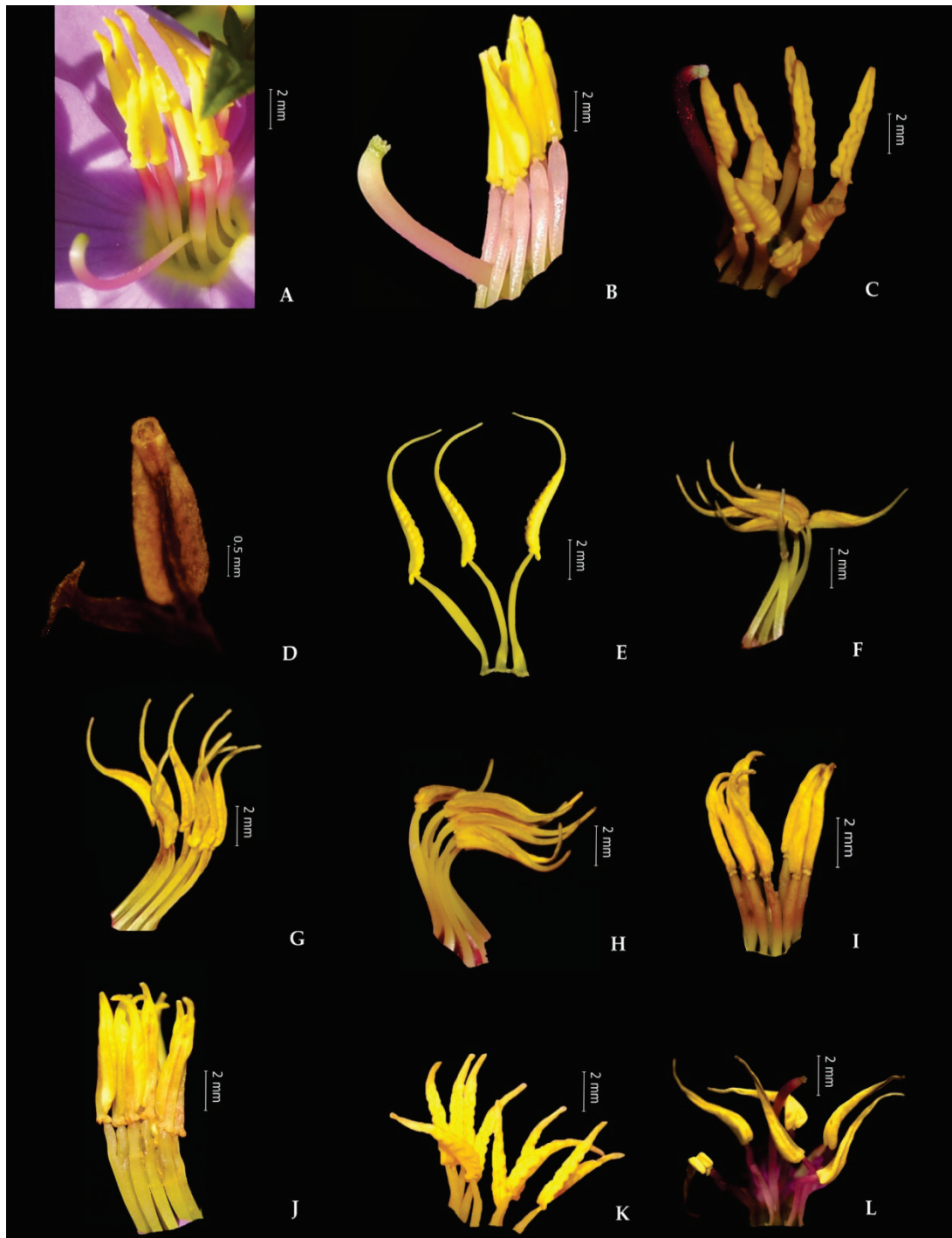


Figure 72. Diversity of Stamens in *Osbeckia*: **A.** *O. nutans* Wall. ex C. B. Clarke; **B.** *O. parvifolia* Arn.; **C.** *O. reticulata* Bedd.; **D.** *O. saddlepeakensis* Prashob *et.al.*; **E.** *O. stellata* Buch.-Ham. ex D. Don var. *stellata*.; **F.** *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen; **G.** *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen; **H.** *O. rostrata* D. Don; **I.** *O. tirunelvelica* Manickam & Murugan ex Kottaim. & Gnanasek.; **J.** *O. virgata* D. Don ex Wight & Arn; **K.** *O. wynaadensis* C. B. Clarke; **L.** *O. zeylanica* L.f.

Gynoecium.

The genus is characterized by a tetra or pentalocular ovary with axile placentation. The placenta protrude from the axils of the locules as compressed, longitudinally furrowed bars, carrying the ovules on the distal, widened part. The ovary is inferior, adnate to the hypanthium for about half of its length. The ovary has large ellipsoid placenta with numerous ovules on both sides.

The style is almost straight except for a slight bend below the tip where it may be slightly swollen. The stigma is capitate or pin headed and is often sparsely patent hairy basally or glabrous. The style may persist in the very young fruit.

Capsule

The capsular fruit consists of ovary and hypanthium. The capsule may be campanulate, urceolate, obconic or globose in shape. The capsules are campanulate in *O. abrahamii*, *O. aspera*, *O. brachystemon*, *O. chinensis*, *O. chinensis* var. *pusilla*, *O. gracilis*, *O. leschenaultiana*, *O. mehrana*, *O. nepalensis*, *O. nepalensis* var. *albiflora*, *O. nutans*, *O. reticulata*, *O. tirunelvelica*, *O. travancorica*, *O. virgata*, *O. wynaadensis*, *O. wightiana* and *O. zeylanica*; urceolate in *O. capitata*, *O. nayarii*, *O. stellata* var. *stellata*, *O. stellata* var. *crinita*, *O. stellata* var. *hispidissima* and *O. rostrata*; obconic in *O. saddlepeakensis*; and globose in *O. parvifolia*. In the fruiting stage the hypanthium exceeds the ovary. The dehiscence is loculicidal. Seeds are minute, curved and numerous.

Steussy (1990) defined Phenetics as the classification based on accurately delimited characters of equal weight and their comparison by an explicit method of grouping to compute overall similarity. In other words, it is the numerical evaluation of the affinity or similarity between taxonomic units and arranging on the basis of their affinity (Sokal & Sneath, 1963). The operation of numerical taxonomy involves the assortment of as many characters of Operational Taxonomic Units as possible. These characters are compared from one OTU to another using various statistical models (coefficients). Phenetic analysis is performed to classify all the species, as it is better in representing distances among similar species (Newmaster *et al.*, 2008).

The present morphometric study on *Osbeckia* is the first of its kind in India. The materials used for the study were freshly collected specimens and herbarium specimens deposited in various Indian herbaria. Twenty three species and four varieties of *Osbeckia* were selected as Operational Taxonomic Units (OTU's) and a total of 37 characters (both vegetative and reproductive characters) were selected for the cluster analysis. A data matrix of 37 morphological characters of 27 taxa was prepared (Appendix-V). All the computations were done using NTSYS software version 2.02i (Rohlf, 2000) and a cluster analysis for the qualitative morphological data was performed using simple matching coefficient. A dendrogram (Figure-73) is plotted from a distance matrix generated using an arithmetic average (UPGMA) clustering algorithm and standardized data based on the average

taxonomic distance subjected to the unweighted pair-group clustering method using NTSYS.

The similarity study conducted among the 27 taxa of *Osbeckia* using morphological characters indicates that there is considerable variation among the taxa. The dendrogram obtained clearly reveals that 27 taxa used in the morphometric analysis falls under 3 distinct clades.

Clade I is characterized by species having pentamerous flowers and campanulate hypanthium with emergences and hairs. All the members of the section *Asterostoma* Triana falls within this clade. Currently this section consists of 13 species and 1 variety in India. As per the phenogram there are 5 subclades under clade I. The first subclade (Ia) consists of 3 species *viz.* *O. abrahamii* G.S. Giri & M.P. Nayar, *O. nepalensis* Hook., *O. nepalensis* Hook. var. *albiflora* Lindl. Sharing 90 % similarity. The second subclade (Ib) consists of *O. nutans* Wall. ex C.B. Clarke only. It is characterized by small lanceolate leaves and large sepals exceeding the hypanthium. The third subclade (Ic) consists of 5 species *viz.* *O. travancorica* Bedd. ex Gamble, *O. leschenaultiana* DC., *O. tirunelvelica* Manickam & Murugan, *O. wightiana* (Benth.) Wight & Arn. and *O. virgata* D.Don ex Wight & Arn., shares about 94 % similarity. The fourth subclade (Id) comprises 2 species *O. mehrana* G.S. Giri & M.P. Nayar and *O. reticulata* Bedd. Fifth subclade (Ie) consists of 3 species *viz.* *O. aspera* (L) Blume and *O. gracilis* Bedd. and *O. wynaadensis* C.B. Clarke.

Clade II is represented by 3 species and 2 varieties of section *Ceramicalyx* Triana, characterized by erect perennial shrubs with tetramerous flowers, urceolate hypanthium and "S" shaped anthers with long beak. Clade II is

further divided into 3 subclades, *O. nayarii* G.S.Giri holds a distinct position which is alienated from all the other species. This species is featured by its quadrangular stem, winged at angles, glabrous throughout and absence of intersepal emergences. The second subclade (II b) holds *O. rostrata* D. Don, characterised by linear lanceolate to falcate intersepal emergences and fleshy stellate emergences on hypanthium. The third subclade (IIc) consists of *O. stellata* Buch.-Ham. ex D. Don var. *stellata*, *O. stellata* Buch.-Ham. ex D. Don var. *hispidissima* (Wight) C. Hansen and *O. stellata* Buch.-Ham. ex D. Don var. *crinita* (Benth. ex Naudin) C. Hansen

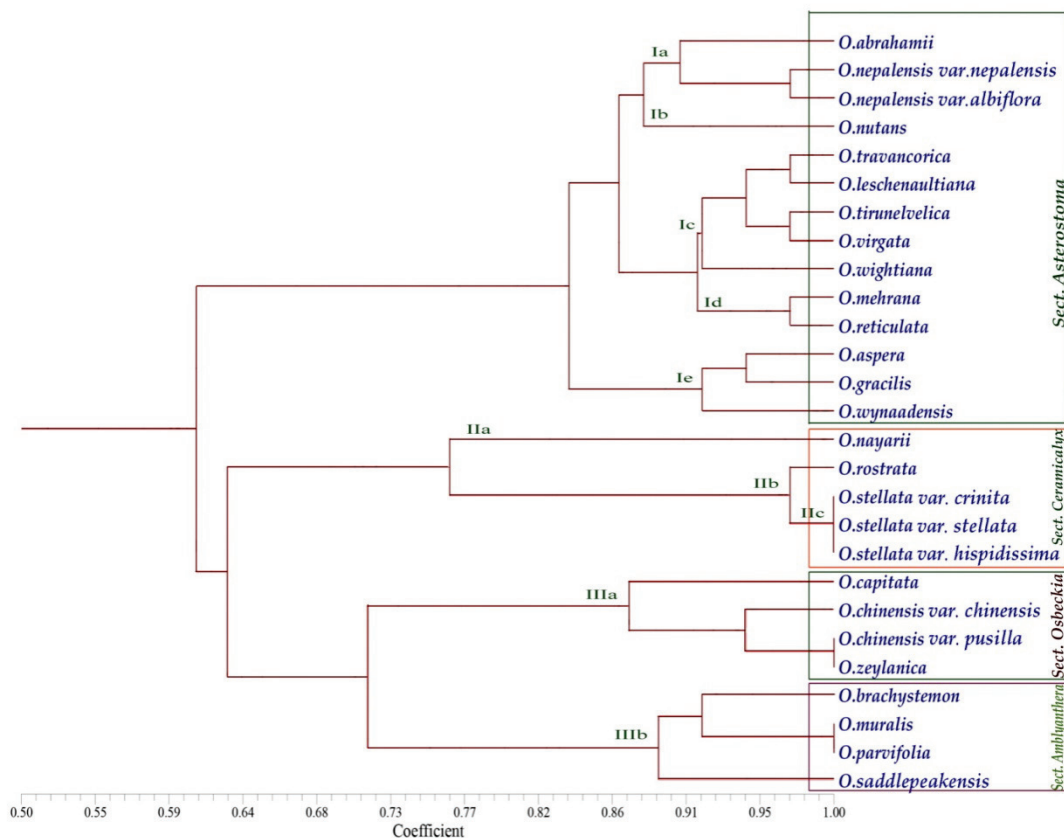


Fig. 73: Phenogram of divergence between the species of *Osbeckia* in India.

Clade III is represented by 8 taxa which falls under two sections of the genus *viz.* Sect. *Osbeckia* and Sect. *Amblyanthera* falls in two homogenous subclades (IIIa and IIIb respectively). The sub clade IIIa consists of 3 species

and 1 variety of Sect. *Osbeckia* viz. *O. capitata* Benth., *O. chinensis* L., *O. chinensis* L. var. *pusilla* (Zoll.) Triana and *O. zeylanica* L.f. The section is characterized by annual herbs, tetramerous flowers and anthers with long beak. The sub clade IIIb comprises 4 species which falls under the section *Amblyanthera* Triana. Members characterized by tetramerous flowers, beakless anthers, campanulate/obconic hypanthium with emergences and hairs. The subclade IIIb consist of recently described *O. saddlepeakensis* Prashob *et al.* also It is distinct from all other species of section *Amblyanthera* by its extreme small flowers (2–4.5 mm across), triangular bracts, obconic hypanthium with emergences on basal portion and anthers with single apical pore. Other members are *O. brachystemon* Naudin, *O. muralis* Naudin and *O. parvifolia* Arn.

Discussion

The phenogram generated through the phenetic analysis strongly supports the circumscription of infrageneric classifications of previous workers (Triana, 1871; Cogniaux, 1891 and Clarke 1879). Inclusion of Section *Amblyanthera* and *Osbeckia* under clade III indicates their close affinity. However, sect. *Asterostoma*, and sect. *Ceramicalyx* constitute distinct homogenous clades.

Taxonomic significance of anatomical characters of *Osbeckia* has been assessed in this chapter. Anatomy of stem, leaf and indumentum pattern of 24 taxa has been examined. Three taxa viz., *Osbeckia chinensis*, *O. chinensis* var. *pusilla* and *O. saddlepeakensis* have been excluded from the present study because of the non-availability of live specimens.

Materials and methods

The materials for the anatomical study were collected from the field as well as the germplasm maintained in St. Joseph's College Botanic garden. Specimens preserved in 4% formalin were also used for the study.

Epidermal peelings and transverse sections of leaves were taken from fresh as well as preserved specimens. Epidermal peelings of the abaxial and adaxial surface were taken from the basal, middle and apical part of the lamina with the help of sharp razor blade and fine tweezers. The peelings obtained were stained with toluidine blue and mounted in glycerin. Micro-preparations were observed under light microscope using 40x objective. The number and shape of subsidiary cells surrounding the stomata were noted to determine the type of stomata, stomatal index and density. The stomatal density was determined as the number of stomata per square millimeter of epidermal peeling and the stomatal index (SI) was calculated using the formula $SI = \frac{S}{S+E} \times 100$ where, S = number of stomata and E= mean epidermal cells within the particular area under investigation.

Photographs of transverse sections of both lamina and stem and surface view of epidermal peelings were captured using Leica DFC 290

Camera attached with Leica DM 100 Trinocular Research Microscope. The entire work was done at Department of Botany, St. Joseph's College, (Autonomous) Devagiri, Kozhikode.

The leaf anatomy

The lamina is dorsiventral in *Osbeckia*. Epidermis is single layered on abaxial and adaxial surface, consists of barrel shaped parenchyma cells without intercellular spaces covered with a thin layer of cuticle. Hairs are of various kinds: non glandular; mostly multicellular (*O. reticulata*), rarely unicellular (*O. gracilis*). Multicellular hairs are multiseriate, branched (*O. abrahamii*) or simple (*O. travancorica*). Hairs are complex in *O. nepalensis*, *O. nepalensis* var *albiflora*; peltate or stellate in *O. nutans*; clavate or often shaggy in *O. wynaadensis*. Beneath the epidermis there is hypodermis, consists of groups of sclerenchymatous cells just above the vascular bundles. Mesophyll is differentiated into palisade and spongy parenchyma (Figs. 74 A & B). Palisade parenchyma is single layered, elongated cells, arranged compactly, contains abundant chloroplasts whereas, spongy parenchyma consists of 4–5-layered chlorenchyma with intercellular spaces.

The upper surfaces of the leaves are with lines of cells containing crystals in many species. In such cases mesophyll consists of sclerenchymatous idioblasts containing crystals. The crystals are mostly druses rarely raphides. When epidermal hairs are present, the cells are accompanied by a bundle of sclereids which connects the hairs with the sclerenchyma in the subtending part of the leaf. Sometimes there are only a few crystalliferous cells at the very base of the hairs, but more often there are many cells arranged in 1- 3 rows which form lines. The lines may be short or

long; they may be branched or unbranched. Lines of crystalliferous cells occur on lower side of the leaves, but are mostly indistinct. Vascular bundles are conjoint, bicollateral, open and 'U' shaped (Fig. 74 A). Abaxial hypodermis is 1 or 2-layered, present only at midrib region, sclerenchymatous, crystalliferous cells present evenly. Abaxial epidermis consists of small cells arranged compactly without intercellular space.

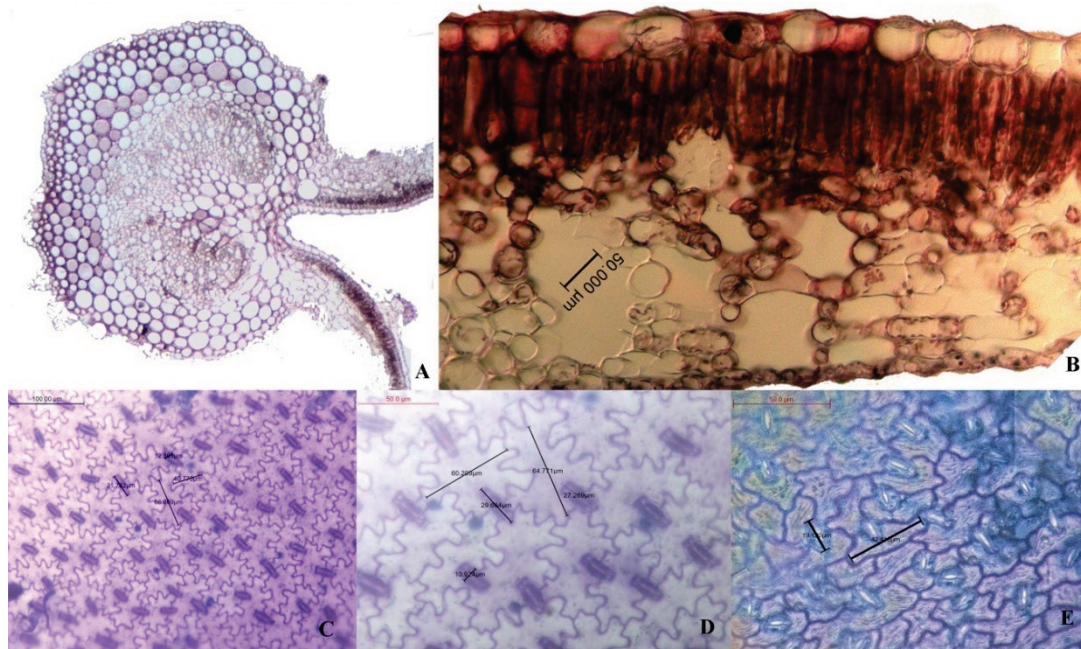


Figure 74: Leaf Anatomy of genus *Osbeckia*: **A.** C.S of midrib, **B.** C.S of lamina, **C-E.** Stomata.

Stomata

Osbeckia is hypostomatic; having stomata on the lower surface of the leaf only. In all species stomata are scattered without any regular arrangement. Two types of stomata are observed on the lower surface namely Anisocytic and Diacytic (Fig. 74 C, D, and E). Frequency of anisocytic stomata is much higher compared to diacytic. Diacytic stomata with two subsidiary cells are seen in species like *O. muralis*, *O. parvifolia* and *O. zeylanica*. In *O. wynaadensis* and *O. zeylanica*. In the case of *O. zeylanica*

both types of stomata are present. The highest stomatal index is found in *O. leschnaultiana* (47.97) and lowest in *O. aspera* (23.88). The length of the stomatal pore also varies from species to species. Longest stomatal pore is seen in *O. aspera* var. *wightiana* (46.22 μm) and the shortest in *O. wynaadensis* (11.879 μm). Stomatal characters are summarized in Table -5.

Table 5. The Type, frequency and index of stomata in *Osbeckia* species

No	Species	Stomatal type	Epidermal cells /sq.mm	Stomatal Frequency No./sq.mm	Stomatal Index
1	<i>O. abrahamii</i>	Anisocytic	116	53.5	31.56
2	<i>O. aspera</i>	Anisocytic	102	32	23.88
3	<i>O. travancorica</i>	Anisocytic	107	50	31.84
4	<i>O. wightiana</i>	Anisocytic	121	86	41.545
5	<i>O. brachystemon</i>	Anisocytic	108	61	36.094
6	<i>O. capitata</i>	Anisocytic	96	59	37.684
7	<i>O. gracilis</i>	Anisocytic	122.66	62	33.575
8	<i>O. leschenaultiana</i>	Anisocytic	90	83	47.97
9	<i>O. mehrana</i>	Anisocytic	116	47	28.834
10	<i>O. muralis</i>	Diacytic	83	72	46.451
11	<i>O. nayarii</i>	Anisocytic	118.6	64.6	35.27
12	<i>O. nepalensis</i>	Anisocytic	121	61	34.214
13	<i>O. nepalensis</i> var. <i>albiflora</i>	Anisocytic	124	63	34.584
14	<i>O. nutans</i>	Anisocytic	112	51	29.453
15	<i>O. parvifolia</i>	Diacytic	96	80	45.45
16	<i>O. reticulata</i>	Anisocytic	120	73	37.823
17	<i>O. rostrata</i>	Anisocytic	119	70	36.013
18	<i>O. stellata</i> var. <i>stellata</i>	Anisocytic	125	64	35.296
19	<i>O. stellata</i> var. <i>crinita</i>	Anisocytic	108	60	29.509
20	<i>O. stellata</i> var. <i>hispidissima</i>	Anisocytic	126.66	65.33	34.027
21	<i>O. tirunelvelica</i>	Anisocytic	117	56	32.24
22	<i>O. virgata</i>	Anisocytic	140.6	47.3	25.17
23	<i>O. wynaadensis</i>	Diacytic	90	39.5	30.501
24	<i>O. zeylanica</i>	Anisocytic, Diacytic	69.66	58.66	45.71

Stem anatomy

Young stems are often tetragonal in outline, externally bound by an epidermis composed of spherical shaped crystalliferous cells which are closely attached to form a compact layer devoid of intercellular space. Dendritic trichomes and multicellular setose trichomes are seen on the epidermis. Beneath the epidermis there is hypodermis, composed of 2–3 layers of sclerenchymatous cells. Cortical bundles are present in the wings of *O. nayarii* (Figs. 75B & C).

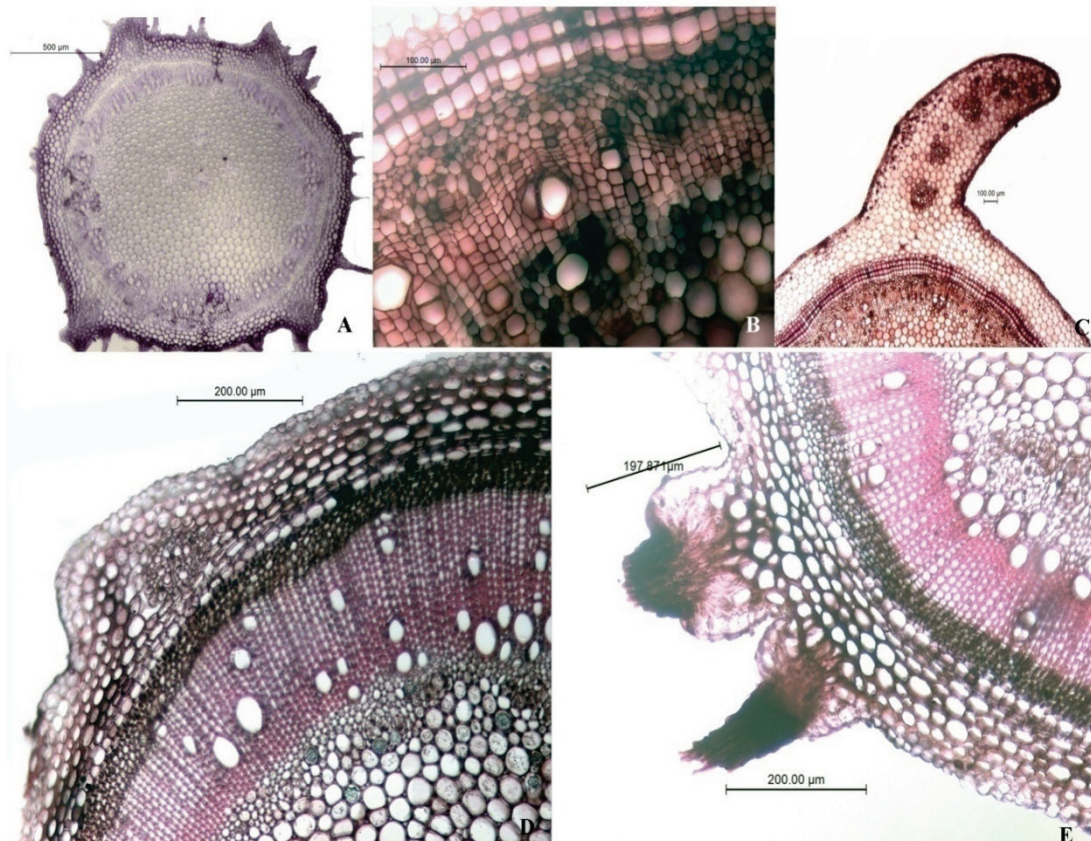


Figure 75: Stem Anatomy of genus *Osbeckia*: **A.** Stem T.S, **B-C.** Stem T.S showing wings and cortical vascular bundle (*O. nayarii*), **D-E,** Stem T.S (*O. stellata*).

The cortex may or may not be containing crystalliferous cells. Vascular bundles are conjoint, bicollateral and open. Internal phloem is present throughout the taxa. Secondary thickening develops from a conventional cambial ring or anomalous. Primary medullary rays are narrow. The vessels are usually found in numerous small radial multiples, and commonly as irregular clusters, occasionally tangential. The vessel end-walls are exclusively simple. The vessels with vestured pits are without spiral thickening. Pith composed of spherical parenchymatous cells.

Trichomes

An unusual diversity is noticed in the indumentum pattern of the genus *Osbeckia*, (Fig. 76 & Table 6) It varies from simple unicellular to very complex multicellular hairs. Hairs are mostly multiseriate, non-glandular and complex types. Complex trichomes are often branched. There are two types of non-glandular trichomes: simple unicellular, simple multicellular. Four types of multicellular trichomes present: setose, hirsute, paleaceous, strigose and dendritic. Simple unicellular hair consists of a large basal cell and one elongated cell having smooth surface whereas simple multicellular trichome consists of two to five cells. Dendritic trichomes are treelike with multiple lateral branches. The surface ornamentation of the trichome is echinate or adorned with micropapillae. The trichomes are found densely on the abaxial side of the epidermal surface, on the midribs and along the secondary and tertiary veins. Various types of trichomes met with the taxa is given in Table-6.

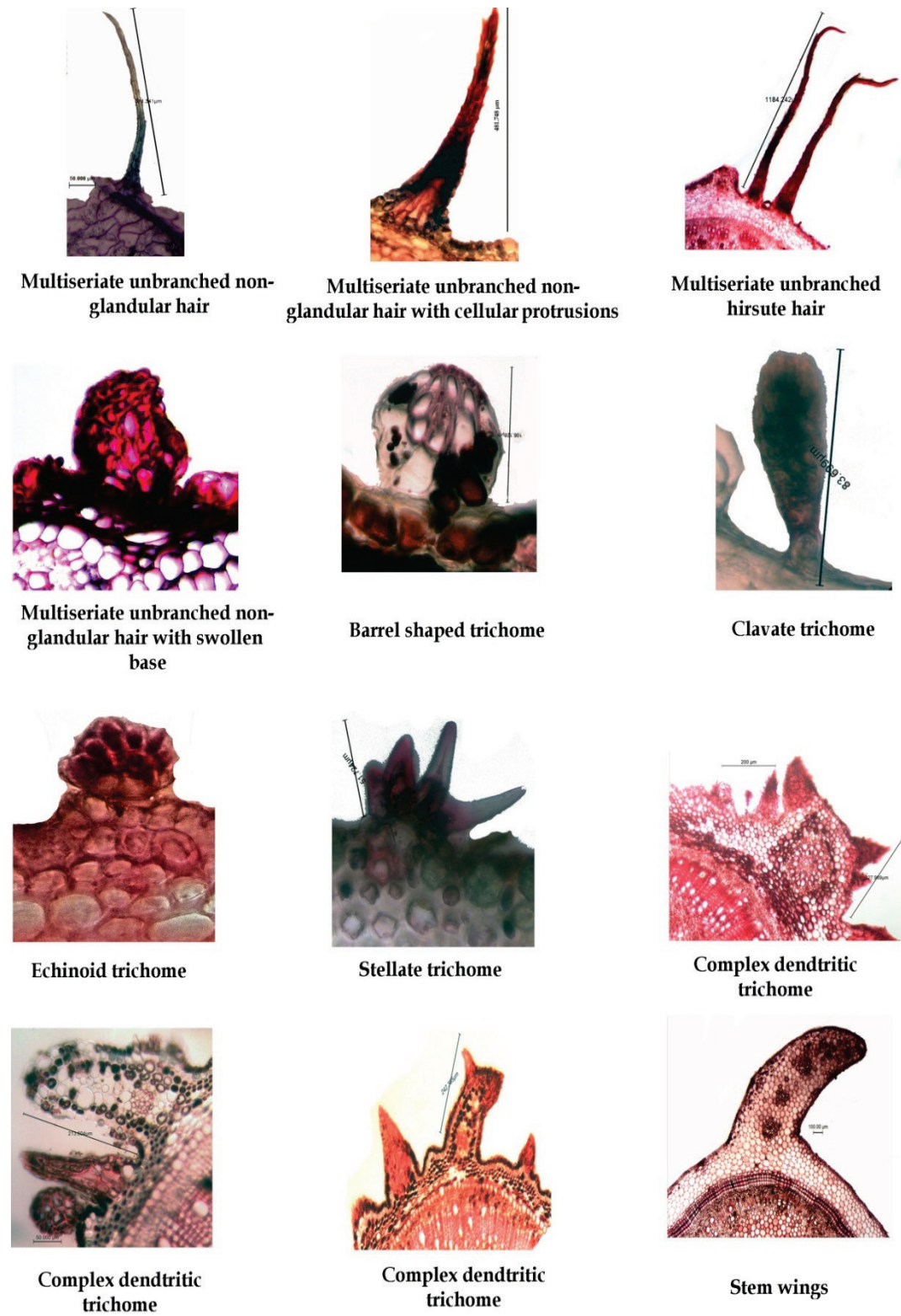


Figure 76: Diversity of trichomes in the genus *Osbeckia*

Table 6. Types of trichomes found in *Osbeckia* species

No.	Species	Type of trichomes
1	<i>O. abrahamii</i>	Multicellular trichome
		Strigose trichome
2	<i>O. aspera</i>	Setose trichome
		Multicellular trichome
3	<i>O. travancorica</i>	Setose trichome
4	<i>O. wightiana</i>	Multicellular trichome
5	<i>O. brachystemon</i>	Setose trichome
6	<i>O. capitata</i>	Shaggy
7	<i>O. gracilis</i>	Glandular trichome (Clavate shaped)
		Stellate glandular hairs
8	<i>O. leschenaultiana</i>	Multicellular dendritic trichome
		Glandular hair (Barrel shaped)
9	<i>O. mehrana</i>	Multicellular Strigose
10	<i>O. muralis</i>	Paleaceous trichome
11	<i>O. nayarii</i>	Absent
12	<i>O. nepalensis</i>	Multiseriate setose
		Stellate scales
13	<i>O. nepalensis</i> var. <i>albiflora</i>	Multiseriate setose
		Stellate scales
14	<i>O. nutans</i>	Echinate
15	<i>O. parvifolia</i>	Dendritic trichome
		Multicellular trichome
16	<i>O. reticulata</i>	Dendritic trichome
		Multicellular trichome
17	<i>O. rostrata</i>	Strigose
		Setose hair
18	<i>O. stellata</i> var. <i>stellata</i>	Dendritic trichome
		Strigose
		Setose hair
19	<i>O. stellata</i> var. <i>crinita</i>	Dendritic trichome
		Strigose
		Setose hair
20	<i>O. stellata</i> var. <i>hispidissima</i>	Dendritic trichome
21	<i>O. tirunelvelica</i>	Setose
		Strigose
22	<i>O. virgata</i>	Dendritic trichome
23	<i>O. wynaadensis</i>	Dendritic trichome
		Multicellular stellate trichome
24	<i>O. zeylanica</i>	Multicellular trichome

All the objectives stated in the synopsis have been fulfilled in the current study. 23 species and 4 varieties have been recognized under 4 sections of the genus *Osbeckia* L. in India. Updated nomenclature, relevant citations, detailed descriptions, colour photographs and details of the habitat, phenology and distribution in India of each taxon are given. A taxonomic key is provided for the easy identification and the author's remarks are given as note along with the description.

Field exploration

Eighty four field trips were conducted during the course of the work (19.03.2014 to 31.03.2018) spent 248 days in the field of altitude ranges from 30 to 4000 m above sea level. The states of Andhra Pradesh, Arunachal Pradesh, Assam, Delhi, Kerala, Maharashtra, Meghalaya, Mizoram, Odisha, Sikkim, Tamil Nadu, Uttarakhand, and West Bengal were visited for collecting live specimens and consulting herbaria. The type localities of the respective taxa were visited for collection. The distribution of various species, subspecies and varieties of the genus were recorded. As many populations of each species have been collected from varying localities for studying the variations. Phenology and other relevant features are recorded in the field itself.

Germplasm conservation

Out of the 27 taxa reported live plants of 25 were collected. Besides specimens collected for laboratory examinations, plantlets were brought to Botanic garden and a germplasm maintained for further studies. A

photograph of the live collection maintained in the Botanic garden is given as appendix- VII.

Dry & wet preservation

Collected specimens were preserved under wet and dry conditions. Wet preservation is done in FAA and formalin, dry preservation is in the form of herbarium sheets. Wet preservation is done for phyto-morphological studies, especially the emergences on the hypanthium. Herbarium sheets are prepared by conventional method. List of herbarium specimens prepared is given in appendix-VIII. Specimens are deposited at St. Joseph's College, Devagiri Herbarium (DEV). Leaf samples were dried using standard silica drying method for future molecular studies.

Ecology and Ethno botanical studies

Habitat of each taxon is documented during field study. Also resorted to relevant literature and herbarium specimens for similar informations. Ethnic information regarding various species and their uses in local medicines were also documented. *Osbeckia stellata* is used for the treatment of fever and liver diseases. The decoction prepared from the roots of *O. chinensis* is used as a remedy for variety of ailments including diabetes mellitus and treatment of urinary diseases. The crude extract of *O. aspera* is traditionally used to treat liver diseases. *O. octandra* is used against jaundice and liver disorders.

Conservation status

The species newly described, *Osbeckia saddlepeakensis* is reported only from the type locality. According to IUCN criteria (2001, 2014) the species is treated as Data Deficient category (DD).

Systematic treatment

All the species collected were identified in consultation with protologue, types and other authentic collections. As far as possible, species were collected from their type localities. Detailed descriptions and illustrations are provided for each species. The nomenclature of all species is updated with latest literature and in consultation with types and protologues.

Type specimens/cibachromes/microfisches/images of types from K, US, BM, BR, C, G, L& P have been consulted. Specimens housed in 19 Indian herbaria (ASSAM, ARUN, BLAT, BSD, BSHC, BSI, CAL, CALI, DD, IFGTB, JCB, KFRI, MH, PBL, RAPINAT, SKU, SUK, TBGT, XCH) and the virtual database of 10 European herbaria (B, BM, BR, E, G, L, NY,P, U, W and K) were also consulted.

The phylogeographic distribution of each species in India is mapped based on field and herbarium studies.

New taxa discovered

1. One new species, *Osbeckia saddlepeakensis* Prashob *et.al.* (2018) was described during this study.

New status (*Syn. Nov.*)

1. *Osbeckia arunkumarensis* M.P.Nayar & G.S.Giri, *Syn. Nov.* (= *Osbeckia rostrata* D. Don)
2. *Osbeckia darjeelingensis* G.S.Giri & M.P.Nayar, *Syn. Nov.* (= *Osbeckia stellata* Buch.-Ham. ex D.Don. var. *stellata*)

3. *Osbeckia stellata* Buch.-Ham. ex D.Don var. *marginulata* (C.B. Clarke) C. Hansen, *Syn. Nov.* (= *Osbeckia stellata* Buch.-Ham. ex D.Don. var. *stellata*)
4. *Osbeckia nepalensis* Hook. var. *nutans* (Wall. ex C. B. Clarke) D. Maity , *Syn. Nov.* (= *Osbeckia nutans* Wall. ex C.B. Clarke)
5. *Osbeckia aspera* (L.) Blume var. *wightiana* (Benth. ex Wight & Arn.) Trimen, *Syn. Nov.* (= *Osbeckia wightiana* (Benth.) Wight & Arn.)
6. *Osbeckia aspera* (L.) Blume var. *travancorica* (Bedd. ex Gamble) C. Hansen, *Syn. Nov.* (= *Osbeckia travancorica* Bedd. ex Gamble)
7. *Osbeckia lineolata* Gamble var. *anamalayana* G.S. Giri & M.P. Nayar *Syn. Nov.* (= *Osbeckia gracilis* Bedd.)

Typification

Lectotypes were selected for the following taxa:

1. *Osbeckia glauca* Wall. ex Naudin
2. *Osbeckia kewensis* C.E.C.Fisch.
3. *Melastoma glaucum* Wall.
4. *Osbeckia lineolata* Gamble
5. *Osbeckia gardneriana* Wight
6. *Osbeckia linearis* Blume
7. *Osbeckia zeylanica* var. *non-rostrata* Haines
8. *Osbeckia boissieuana* Guillaumin

Endemism

Maximum diversity of *Osbeckia* has been noticed in the Western Ghats where, 15 species under 3 sections are present. North East Himalayas harbour 7 species and 4 varieties belonging to 3 sections. *Osbeckia saddlepeakensis* is endemic to Andaman and Nicobar Islands. The genus *Osbeckia* shows greater (62%) endemism, *ie.*, 17 out of 27 Indian taxa are endemic. 14 species are endemic to peninsular India, 1 species is endemic to North East Himalayas, 1 species is endemic to Andaman and Nicobar Islands. Remaining 6 species and 4 varieties present in India share borders with Bangladesh, Bhutan, China, Nepal and Myanmar and are thus endemic to Indo-China Himalayas.

Phenetic Analysis

A data matrix of 37 morphological characters was prepared for 27 Indian taxa. A dendrogram is drawn using the software NTSYSpc 2.02i, showing the interrelationships between Indian taxa.

The cladogram obtained evidently demonstrated that 27 taxa used in the morphometric analysis descend under 4 different homogeneous clades portraying the inter relationships among the species. The cladogram supported the infrageneric classification of the genus proposed by previous workers with minor deviations.

Anatomical study

The significance of anatomical characters in the taxonomy of Indian *Osbeckia* is also attempted. General anatomy of the stems and leaves of the taxon is found more or less homogeneous whereas micro morphological and

anatomical features like pubescence, emergences and stomata are characteristic in many taxa.

Conclusion

Taxonomic revision of the genus *Osbeckia* L. in India has been done as it was envisaged while proposing the synopsis. The merits that could be claimed in the work are: the whole description and photographic illustration of each taxon are based on live specimens collected from the field. Identification of the taxa is done after seeing the protologue and type specimens. Herbarium specimens in India and overseas are consulted largely during the study. Among the binomials under the genus *Osbeckia* seven are synonymised and eight are lectotypified in the present study. *Osbeckia saddlepeakensis* Prashob *et.al.*, a new species was described as part of the study. An artificial key for the identification of the species is also could be given.

1. *Osbeckia walkeri* Arn., Companion Bot. Mag. 2: 309. 1837.

This species was described by Arnott (1837) from Ceylon, Sri Lanka. Recently Bachan and Pradeep (2017) reported it from Parambikulam, Anamalai part of southern Western Ghats, India. However, critical examination of the specimens from Parambikulam in Kerala with types of *O. walkeri* revealed that, the specimens are nothing but *O. gracilis* Bedd., Hence it is excluded from the study.

1. **Prashob, P.** Manudev, K.M., Sibichen M. Thomas, & Nampy, S. **2018**. *Osbeckia saddlepeakensis* (Melastomataceae): a new species from Andaman and Nicobar Islands, India. *Phytotaxa* **344 (2)**: 185–190. DOI: 10.11646/phytotaxa.344.2.7
2. **Prashob, P.** & Sibichen M. Thomas **2015**. *Osbeckia nayarii* Giri (Melastomataceae): a new distributional record for South India. *International Journal of Plant, Animal and Environmental Sciences* **6(1)**: 96–98.

Papers Communicated

1. **Prashob, P.**, Manudev, K.M., Sibichen M. Thomas, & Nampy, S. **2018**. Lectotypification of two names in *Osbeckia* L. (Melastomataceae) *Phytotaxa* (in press)
2. **Prashob, P.**, Arunkumar, P.G., Sibichen M. Thomas, & Nampy, S. **2018**. The taxonomic identity of *Osbeckia nayarii* (Melastomataceae) inferred from molecular, morphological and micro morphological (S.E.M) data. *Rheedea* (in press)

Other publications Authored/Co-Authored by the candidate during his Ph.D Programme

1. Joe, A. Hareesh, V.S., **Prashob P.** & Sabu, M. **2016**. *Didymocarpus moellerii* (Gesneriaceae): a new species from Northeastern India. *Phytotaxa* **266(1)**: 057–060. DOI:10.11646/phytotaxa.266.1.10

2. Hareesh, V.S., Joe, A., **Prashob, P.** & Sabu, M. **2016.** *Impatiens roingensis* (Balsaminaceae): a new species from North East India. *Webbia Journal of Plant Taxonomy and Geography* **71(2)**:187-190. DOI: 10.1080/00837792.2016.1190503
3. Sreejith, K.A., **Prashob, P.**, Sreekumar, V.B., Manjunatha, H.P. & Prejith, M.P. **2016.** Microhabitat Diversity in a lateritic hillock of northern Kerala, India. *An International Journal of Plant Research* **29**: 3. DOI: 10.5958/2229-4473.2016.00074.4

Papers/Posters Presented in National/International Conferences

1. **Prashob, P.** & Sibichen M. Thomas. **2017.** **A taxonomic study on *Osbeckia stellata* complex (Melastomataceae): evidence from nuclear DNA sequence data. (Oral).** XXVII Annual Conference of Indian Association for Angiosperm Taxonomy & International symposium on plant Systematics: Priorities and challenges, 10–12 November. Department of Botany, Delhi University Botanical society and IAAT.
2. **Prashob, P.** & Sibichen M. Thomas. **2017.** **Phylogeny of *Osbeckia* (Melastomataceae) in India. (Poster).** XIX International Botanical Congress, 23–29th July. Shenzhen, China.
3. **Prashob, P.** & Sibichen M. Thomas. **2016.** **Anatomical studies on the genus *Osbeckia* L. (Melastomataceae) in relation to Taxonomy. (Oral).** XXVI Annual Conference of Indian Association for Angiosperm Taxonomy and International Seminar on Conservation and Sustainable Utilization of Biodiversity. 7–9 November. Department of Botany, Shivaji University, Kolhapur.
4. **Prashob, P.** & Sibichen M. Thomas. **2015.** **The genus *Osbeckia* L.**

- (Melastomataceae) in South India. (Oral).** Silver Jubilee Conference of IAAT and Council Meeting of IAPT & International Seminar on Advancements in Angiosperm Systematics and Conservation. 19–21 November. Department of Botany, University of Calicut.
5. **Prashob, P. & Sibichen M. Thomas. 2014. Taxonomic significance of the 'emergences' on the hypanthium of the genus *Osbeckia* L. (Melastomataceae) in India - A preliminary study (Oral).** 24th Annual Conference of Indian Association for Angiosperm Taxonomy (IAAT) & International conference on trends in plant Systematics (TIPS) 31 October- 2 November, Bharathidasan University, Tiruchirappalli.

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1. Botanic Garden and Botanical Museum, Berlin-Dahlem Herbarium, Berlin, Germany (B*).
 2. Botanical Survey of India, Northern Circle, Dehradun, Uttarakhand, India (BSD).
 3. Botanical Survey of India, Southern Circle, Coimbatore, Tamil Nadu, India (MH).
 4. Botanical Survey of India, Western Circle, Pune, Maharashtra, India (BSI).
 5. Botanische Staatssammlung München (M*).
 6. Calicut University Herbarium, Department of Botany, University of Calicut, Kerala, India (CALI).
 7. Centre for Ecological Sciences Herbarium, Bengaluru (JCB).
 8. Central National Herbarium, Kolkata, West Bengal, India (CAL).
 9. Forest Research Institute, Indian Council of Forestry Research and Education, Dehradun, Uttarakhand, India (DD).
 10. Friedrich-Schiller-Universität Jena, Germany (JE*).
 11. Harvard University, U.S.A. Massachusetts. Cambridge (A*).
 12. Institute of Minerals and Materials Research Institute Herbarium, Bhubaneswar, Orissa, India (RRLB).
 13. Kerala Forest Research Institute Herbarium, Peechi (KFRI).
 14. Linnean Society of London, U.K. England (LINN*).
 15. Martin-Luther-Universität, Germany (HAL*).
 16. Museum National d'Histoire Naturelle, Paris, France (P*).
 17. National Botanic Garden, Belgium (BR*).
 18. National Herbarium of the Netherlands, Herbarium Utrecht (U*).

19. National Herbarium, Leiden University Branch, Netherlands (L*).
20. National History Museum, London, England (BM*).
21. National Museum of Natural History, Smithsonian Institution, Washington, USA (US*).
22. Natural History Museum of Denmark, Copenhagen, Denmark (C*).
23. Naturhistorisches Museum Wien, Austria (W*).
24. Rapinat Herbarium, St. Joseph's College, Trichy (RHT).
25. Royal Botanic Garden, Edinburgh, U.K. (E*).
26. Royal Botanical Gardens, Kew (K*).
27. Shivaji University Herbarium, Kolhapur (SUK)
28. St. Joseph's College Herbarium, Devagiri, Kozhikode (DEV).
29. St. Xavier's College, India. Tamil Nadu. Palayamkottai. (XCH).
30. Swedish Museum of Natural History, Sweden, Stockholm (S*).
31. The Candolle Herbarium, Geneva (G-DC*).
32. The Conservatory and Botanical Garden, Geneva (G*).
33. Tropical Botanical Garden Herbarium, Thiruvananthapuram (TBGT).
34. Universitat Wien, Austria (WU*).
35. University of Warsaw, Poland (WA*).
36. Wallich Herbarium, Kew (K-W*).
37. Willdenow Herbarium, Berlin (B-W*).

* consulted virtual database available online.



Appendix IV

Osbeckia Data Sheet -model

Taxonomic revision of the genus *Osbeckia* L.
(Melastomataceae) in India

Locality	
Habitat	
Altitude/ GPS Data	
Date of Collection	
Accession Number	
Collectors	
No. of plants in the population	
Special features for identification in field	

Habit

Annual

Perennial herb

Shrub

Woody

Erect

Prostrate

Hight

Stem

Intemode length

Colour

Sbape

Quadrangular

Hexangular

Winged

Indumentum

Hairy

Emergences

Scales

Leaves:

Shape:

Apex:

Base:

Veins:

Length:

Sessile

Breadth:

petiolate **Indumentum**Patent Thin Straight Ascending Appressed Curved Bristly **Inflorescence**Terminal Axillary & Terminal Axillary Solitary

Number of flowers:

CymePaniculate Cluster **Bract**

Size:

Shape:

Apex:

Base:

FlowersTetramerous Pentamerous Sessile Pedicellate **Hypanthium**Campanulate Urceolate Globose Obconic Glabrous Emergence Hairs Bristle

Notes:

IndumentumArachnoid Hirsute Puberulose Sericeous Pilose Scabrid Hispid Lanate Puberulent Pubescent Strigose Tomentose **Hairs**Normal Bulbous base Capitate Subulate Stellate hairs Glandular Hamate Clavate Crispate Dendritic Peltate scale Glochidiate

Intersepal emergence

Size:

Persistent

Deciduous

Stellate at tip

Not Stellate at tip

Number of hairs at tip:

Sepals

Size:

Persistent

Deciduous

Size:

Shape:

Apex:

Base:

Petals

Persistent

Deciduous

Coloure:

Size:

Shape:

Apex:

Base:

Anthers

Anther Beaked

Not Beaked

Colour:

Size:

Number :

Shape:

Twisted:

Stamens Isomorphic

Stamens Hetero morphic

Anther Beak:

Length:

Tubular beak:

Pore Size:

number of pores:

Pore position:

Dorsal

Ventral

Connective:

Filaments

Size

Filaments colour

Gynoecium:

Anther pocket:

Crown: type of hair

hairs

Locule 4

5

Style

Length:

Colour

Stigma

Punctuate

Capitate

disc

Capsule	Shape	Size	Dehiscence
Seeds			
Shape	Size		
Ornamentation:			

Appendix V

Data matrix used for Phenetic analysis

	Plants annual (0) Plants perennial (1)	Plants herb (0) Plants shrub (1)	Stem erect (0) Stem not erect (1)	Leaves lanceolate (0) Leaves Ovate (1)	Leaf base attenuate to obtuse (0) Leaf base cordate (1)	Lamina glabrous (0) Lamina hairy (1)	Acrodomous venation(0) non acrodomous venation (1)	Leaves with 1-3 nerves (0) Leaves with 5-7 nerves (1)	Leaf bullate (0) Leaf not bullate (1)	Plants glabrous (0) Plants hairy (1)
<i>O.abrahamii</i>	1	1	0	1	0	1	0	1	1	1
<i>O.aspera</i>	1	1	0	1	0	1	0	0	1	1
<i>O.travancorica</i>	1	1	0	1	0	1	0	0	1	1
<i>O.wightiana</i>	1	1	0	1	0	1	1	1	1	1
<i>O.gracilis</i>	1	1	0	1	0	1	0	0	1	1
<i>O.leschenaultiana</i>	1	1	0	1	1	1	0	0	1	1
<i>O.mehrana</i>	1	1	0	1	1	1	0	1	1	1
<i>O.nepalensis</i>	1	1	0	1	0	1	0	1	1	1
<i>O.nepalensis_var_albiflora</i>	1	1	0	1	0	1	0	1	1	1
<i>O.nutans</i>	1	1	0	0	0	0	0	0	1	1
<i>O.reticulata</i>	1	1	0	1	1	1	0	1	0	1
<i>O.tirunelvelica</i>	1	1	0	1	0	1	0	0	1	1

	Plants with appressed hair (1) Plants with not appressed hair (0)	Internode with a line of hairs (0) Internode without any line of hairs (1)	Inflorescence panicle (0) Inflorescence not panicle (1)	Inflorescence dense cluster of cyme (0) Inflorescence not a dense cluster of cyme (1)	Bract caducous (0) Bract persistent (1)	Bract base ovate-cordate (0) Bract base not ovate-cordate (1)	Bract glabrous (0) Bract hairy (1)	Flowers tetramerous (0) Flowers pentamerous (1)	Flowers pink (0) Flowers white (1)	Flowers white tinged with pink (0) Flowers not white tinged with pink (1)
<i>O.abrahami</i>	1	0	0	1	1	0	1	1	0	1
<i>O.aspera</i>	1	0	0	0	0	0	1	1	0	1
<i>O.travancorica</i>	1	0	0	0	0	0	1	1	0	1
<i>O.wightiana</i>	1	0	0	0	0	0	1	1	0	1
<i>O.gracilis</i>	1	0	0	1	0	0	1	1	0	1
<i>O.leschenaultiana</i>	1	0	0	0	0	0	1	1	0	1
<i>O.mehrana</i>	1	0	0	0	0	0	1	1	0	1
<i>O.nepalensis</i>	1	0	0	1	0	0	1	1	0	1
<i>O.nepalensis_var_albiflora</i>	1	0	0	1	0	0	1	1	1	1
<i>O.nutans</i>	1	0	0	1	0	0	1	1	0	1
<i>O.reticulata</i>	1	0	0	0	0	0	1	1	0	1
<i>O.tirunelvelica</i>	1	0	0	0	0	0	1	1	0	1

	Intersepal emergence present(0) Intersepal emergence absent(1)	Intersepal emergence stalked(0) Intersepal emergence not stalked(1)	Intersepal emergence with stellate head(0) Intersepal emergence without stellate head(1)	Intersepal emergence caducous (0) Intersepal emergence persistent (1)	Petals obovate/elliptic (0) Petals oblong/orbicular (1)	Stamen 10 (0) Stamen 8 (1)	Anthers beaked (0) Anthers not beaked (1)	Anthers twisted (0) Anthers not twisted (1)
<i>O.abrahami</i>	0	0	0	0	0	0	1	0
<i>O.aspera</i>	0	1	1	0	0	0	1	0
<i>O.travancorica</i>	0	0	0	0	0	0	1	0
<i>O.wightiana</i>	0	0	0	0	0	0	1	0
<i>O.gracilis</i>	0	1	1	0	0	0	1	0
<i>O.leschenaultiana</i>	0	0	0	0	0	0	1	0
<i>O.mehrana</i>	0	0	0	0	0	0	1	0
<i>O.nepalensis</i>	0	0	0	0	0	0	1	0
<i>O.nepalensis_var_albiflora</i>	0	0	0	0	0	0	1	0
<i>O.nutans</i>	0	0	0	0	0	0	1	0
<i>O.reticulata</i>	0	0	0	0	0	0	1	0
<i>O.tirunelvelica</i>	0	0	0	0	0	0	1	0

	Plants annual (0) Plants perennial (1)	Plants herb (0) Plants shrub (1)	Stem erect (0) Stem not erect (1)	Leaves lanceolate (0) Leaves Ovate (1)	Leaf base attenuate to obtuse (0) Leaf base cordate (1)	Lamina glabrous (0) Lamina hairy (1)	Acrodymous venation(0) non acrodymous venation (1)	Leaves with 1-3 nerves (0) Leaves with 5-7 nerves (1)	Leaf bullate (0) Leaf not bullate (1)	Plants glabrous (0) Plants hairy (1)
<i>O.virgata</i>	1	1	0	0	0	1	0	0	1	1
<i>O.wynaadensis</i>	1	1	0	1	0	1	0	1	1	1
<i>O.nayarii</i>	1	1	0	1	0	0	0	1	1	0
<i>O.rostrata</i>	1	1	0	1	0	1	0	1	1	1
<i>O.stellata_var_stellata</i>	1	1	0	1	0	1	0	1	1	1
<i>O.stellata_var_crinita</i>	1	1	0	1	0	1	0	1	1	1
<i>O.stellata_var_hispidissima</i>	1	1	0	1	0	1	0	1	1	1
<i>O.capitata</i>	0	0	0	1	0	1	0	0	1	1
<i>O.chinensis</i>	0	0	0	0	0	1	0	0	1	1
<i>O.chinensis var.pusilla</i>	0	0	0	0	0	1	0	0	1	1
<i>O.zeylanica</i>	0	0	0	0	0	1	0	0	1	1
<i>O.brachystemon</i>	0	0	1	1	0	1	0	0	1	1
<i>O.muralis</i>	0	0	0	1	0	1	0	0	1	1
<i>O.parvifolia</i>	0	0	0	1	0	1	0	0	1	1
<i>O.saddlepeakensis</i>	0	0	0	1	0	1	0	0	1	1

	Plants with appressed hair (1) Plants with not appressed hair (0)	Internode with a line of hairs (0) Internode without any line of hairs (1)	Inflorescence panicle (0) Inflorescence not panicle (1)	Inflorescence dense cluster of cyme (0) Inflorescence not a dense cluster of cyme (1)	Bract caducous (0) Bract persistent (1)	Bract base ovate-cordate (0) Bract base not ovate-cordate (1)	Bract glabrous (0) Bract hairy (1)	Flowers tetramerous (0) Flowers pentamerous (1)	Flowers pink (0) Flowers white (1)	Flowers white tinged with pink (0) Flowers not white tinged with pink (1)
<i>O. virgata</i>	1	0	0	0	0	0	1	1	0	1
<i>O. wynaadensis</i>	1	0	0	1	0	0	1	1	0	1
<i>O. nayarii</i>	0	1	0	1	0	1	0	0	0	1
<i>O. rostrata</i>	1	1	0	1	0	0	1	0	0	1
<i>O. stellata</i> var. <i>stellata</i>	1	0	0	1	0	0	1	0	0	1
<i>O. stellata</i> var. <i>crinita</i>	1	0	0	1	0	0	1	0	0	1
<i>O. stellata</i> var. <i>hispidissima</i>	1	0	0	1	0	0	1	0	0	1
<i>O. capitata</i>	1	0	0	1	0	1	1	0	0	1
<i>O. chinensis</i>	1	0	0	1	0	1	1	0	0	1
<i>O. chinensis</i> var. <i>pusilla</i>	1	0	0	1	0	1	1	0	0	1
<i>O. zeylanica</i>	1	0	0	1	0	1	1	0	0	1
<i>O. brachystemon</i>	1	0	0	1	0	1	1	0	1	0
<i>O. muralis</i>	1	0	0	1	0	1	1	0	0	1
<i>O. parvifolia</i>	1	0	0	1	0	1	1	0	0	1
<i>O. saddlepeakensis</i>	1	0	0	1	0	1	1	0	0	1

	Pedice l glabrous (0) Pedice l hairy/sparcely ciliate (1)	Hypanthium urceolate(0) Hypanthium campanulata(1)	Hypanthium glabrous(0) Hypanthium hairy(1)	Hypanthium with emergences(0) Hypanthium without emergences(1)	Hypanthium with scales and bristles(0) Hypanthium without scales and bristles (1)	Hypanthium caducous (0) Hypanthium persistent (1)	Calyx lobes asymmetrical(0) Calyx lobes symmetrical (1)	Sepal triangular(0) sepal subulate(1)	Calyx caducous (0) Calyx persistent (1)
<i>O.virgata</i>	1	1	1	0	1	1	1	0	0
<i>O.wynaadensis</i>	1	1	1	1	0	1	1	0	0
<i>O.nayarii</i>	0	0	0	0	1	0	1	1	0
<i>O.rostrata</i>	1	0	1	0	1	1	1	1	0
<i>O.stellata_var_stellata</i>	1	0	1	0	1	1	1	1	0
<i>O.stellata_var_crinita</i>	1	0	1	0	1	1	1	1	0
<i>O.stellata_var_hispidissima</i>	1	0	1	0	1	1	1	1	0
<i>O.capitata</i>	1	0	0	1	1	1	1	1	0
<i>O.chinensis</i>	1	1	1	0	1	1	1	1	0
<i>O.chinensis var.pusilla</i>	1	1	1	0	1	1	1	1	0
<i>O.zeylanica</i>	1	1	1	0	1	1	1	1	0
<i>O.brachystemon</i>	1	1	1	0	1	1	1	1	1
<i>O.muralis</i>	1	1	1	0	1	1	1	1	1
<i>O.parvifolia</i>	1	1	1	0	1	1	1	1	1
<i>O.saddlepeakensis</i>	1	0	1	0	1	1	1	1	1

	Intersepal emergence present(0) Intersepal emergence absent(1)	Intersepal emergence stalked(0) Intersepal emergence not stalked(1)	Intersepal emergence with stellate head(0) Intersepal emergence without stellate head(1)	Intersepal emergence catuucous (0) Intersepal emergence persistent (1)	Petals obovate/elliptic (0) Petals oblong/orbicular (1)	Stamen 10 (0) Stamen 8 (1)	Anthers beaked (0) Anthers not beaked (1)	Anthers twisted (0) Anthers not twisted (1)
<i>O.virgata</i>	0	0	0	0	0	0	1	0
<i>O.wynaadensis</i>	0	1	1	0	0	0	1	0
<i>O.nayarii</i>	1	1	1	0	1	1	0	0
<i>O.rostrata</i>	0	0	0	0	1	1	0	0
<i>O.stellata_var_stellata</i>	0	0	0	0	1	1	0	0
<i>O.stellata_var_crinita</i>	0	0	0	0	1	1	0	0
<i>O.stellata_var_hispidissima</i>	0	0	0	0	1	1	0	0
<i>O.capitata</i>	0	1	1	1	0	1	1	1
<i>O.chinensis</i>	0	0	0	1	0	1	1	1
<i>O.chinensis var.pusilla</i>	0	1	1	1	0	1	1	1
<i>O.zeylanica</i>	0	1	1	1	0	1	1	1
<i>O.brachystemon</i>	0	0	0	1	0	1	0	0
<i>O.muralis</i>	0	0	0	1	0	1	0	0
<i>O.parvifolia</i>	0	0	0	1	0	1	0	0
<i>O.saddlepeakensis</i>	0	1	1	1	0	1	0	0

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Appendix VII

Species maintained in the Botanical Garden



Appendix-VIII Details of herbarium sheets prepared

Sl. No	Species collected	Locality	No. of herbarium specimens prepared
1	<i>O. abrahamii</i>	Erattupetta, Vagamon	12
2	<i>O. aspera</i>	Ponmudi, Eravikulam N.P	27
3	<i>O. brachystemon</i>	Eravikulam N.P, Sispara	21
4	<i>O. capitata</i>	Laitkor, Upper Shillong	16
5	<i>O. gracilis</i>	Sispara, Eravikulam N.P	16
6	<i>O. leschenaultiana</i>	Eravikulam N.P, Anamudi shola	21
7	<i>O. mehrana</i>	Kalakkad Mundanthurai Tiger Reserve, Pongalapara	17
8	<i>O. muralis</i>	Medical college Kozhikode, Thodayad	23
9	<i>O. nayarii</i>	Jowai, Pynursla, Sholayar	5
10	<i>O. nepalensis</i>	West Kameng, Dowki, Pynursla	21
11	<i>O. nepalensis</i> var. <i>albiflora</i>	West Sikkim, West kameng, Pynursla	14
12	<i>O. nutans</i>	West Kameng	8
13	<i>O. parvifolia</i>	Wayanad, Baba Budan giri	8
14	<i>O. reticulata</i>	Eravikulam N.P., Anamudi shola	13
15	<i>O. rostrata</i>	Kalimpong, Lava, Dello, Darjeeling, Shillong	16
16	<i>O. saddlepeakensis</i>	North Andaman	3
17	<i>O. stellata</i> var. <i>stellata</i>	Teesta River, Mangan, North Sikkim, Shillong, Laitkor	19
18	<i>O. stellata</i> var. <i>hispidissima</i>	Shillong, Laitkor	5
19	<i>O. stellata</i> var. <i>crinita</i>	Shillong, Balipara Assam	8
20	<i>O. travancorica</i>	Agasthyamala, Ponmudi, Vagamon, Ilaveezhaponchira	29
21	<i>O. tirunelvelica</i>	Kalakkad Mundanthurai Tiger Reserve	4
22	<i>O. virgata</i>	Ponmudi, Eravikulam N.P, Pakranthalam, Pookode, Agasthyamala, Ponmudi, , Muthappanpuzha	37
23	<i>O. wightiana</i>	Kotagiri, Coonoor,	13
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Osbeckia saddlepeakensis (Melastomataceae): a new species from Andaman and Nicobar Islands, India

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Abstract

Osbeckia saddlepeakensis, a new species of Melastomataceae from Andaman and Nicobar Islands, India is described. The new species is easily distinguished by its small flowers, hypanthium with emergences only on basal portion, lanceolate and ciliate sepals, short stalked intersepalal emergences and oblong to narrowly ovoid anthers with a single apical pore.

Keywords: Endemic, North Andaman, Melastomataceae, Saddle Peak, Taxonomy

Introduction

The genus *Osbeckia* Linnaeus (1753: 345) (Melastomataceae), comprises about 50 species worldwide (Mabberley 2008) is principally Asiatic in distribution. Based on the current phylogenetic analysis of Veranso-Libalah *et al.* (2017) this genus belongs to tribe Melastomateae. It is distinguished by a hypanthium covered with different types of hairs, bristles and emergences, isomorphic stamens and ribbed capsules dehiscing apically by 4 or 5 pores. Hansen (1977) in his revision reported 17 species and 7 varieties from India. Since then, several taxa were described by various authors (Giri 1983; Giri & Nayar 1983; Giri & Nayar 1984; Nayar & Giri 1984; Giri & Nayar 1986; Manickam & Murugan 2001; Kottaimuthu & Gnanasekaran 2015) bringing the total number into 22 species and 4 varieties in India.

As part of the ongoing revisionary studies on the genus in India, the authors came across an interesting specimen collected from Saddle Peak in the Andaman and Nicobar Islands, which is morphologically similar to *Osbeckia muralis* Naudin (1850: 56) and *O. brachystemon* Naudin (1850: 57). However, detailed analysis of morphology, type specimens and relevant literature revealed it to be a new taxon, which is described here.

Materials and methods

The specimens analyzed in the present work were collected through extensive field trips in different parts of India from 2010 to 2017. Detailed morphological studies were made using all the available materials and variations were recorded. Observations were made with Leica EZ4HD 3.0 Mega Pixel Digital Stereo microscope and photomicrographs of flowers were taken using Leica Application Suite Version 2.0. Description was prepared after examination of all the available specimens. For description of taxa, the terminology followed Lawrence (1951), Stearn (1983) and Simpson (2010). Information on related species was based on the protologue and consulting specimens (including type) cited below. Acronyms of Herbaria are in accordance to the Index Herbariorum (Thiers, 2018).

Osbeckia muralis Naudin: INDIA. Karnataka: Canara, Manglore, *Hohenacker 577* (Lectotype, P02441130, image!); Shimoga Dist., 26 September 1978, *K.P. Sreenath & K.R. Keshava Moorthy 2910* (CAL). Kerala: Kozhikode Dist., Kozhikode, Medical College campus, 22 September 2014, *Prashob & Sibichen 5946* (DEV); Malappuram Dist., Calicut University campus, 17 April 1984, *A. Babu 38296* (CAL). Maharashtra: Pune Dist., Ambavne village, 29 December 1964, *S.Coll. 101092* (CAL).

Osbeckia brachystemon Naudin: INDIA, Kerala: Idukki Dist., Munnar, Lockheart gap, 10 October 1963, *K.M. Sebastine 17507* (CAL); Idukki Dist., Anamudi Shola National Park, Methap, 08 November 14, *Prashob & Sibichen 5555* (DEV). TamilNadu: Nilgiris (as Nellihery), 1840, *Perrottet 189* (Holotype, P02441103, image!); Nilgiris, Naduvattam, 02 October 1956, *N.P. Balakrishnan 141* (MH); Thoopithookiparai, Kodaikanal, 16 August 1987, *K.M. Matthew 50254* (RHT).

Taxonomic treatment

Osbeckia saddlepeakensis Prashob, Manudev, Sibichen & Nampy *sp. nov.* (Figure 1)

Osbeckia saddlepeakensis is similar to *O. muralis* and *O. brachystemon*, but differs by its small flowers (2–4.5 mm across), triangular bracts, hypanthium with emergences on basal portion and absence of simple hairs, short stalked inter-sepal emergences, lanceolate and ciliate sepals and oblong to narrowly ovoid anthers with a single apical pore.

Type:—INDIA. North Andaman Islands: Saddle Peak, ca. 690 m elev. 29 September 2010, *Santhosh Nampy & K.M. Manudev 3526* (holotype CAL!, isotypes CAL!, DEV!, MH!).

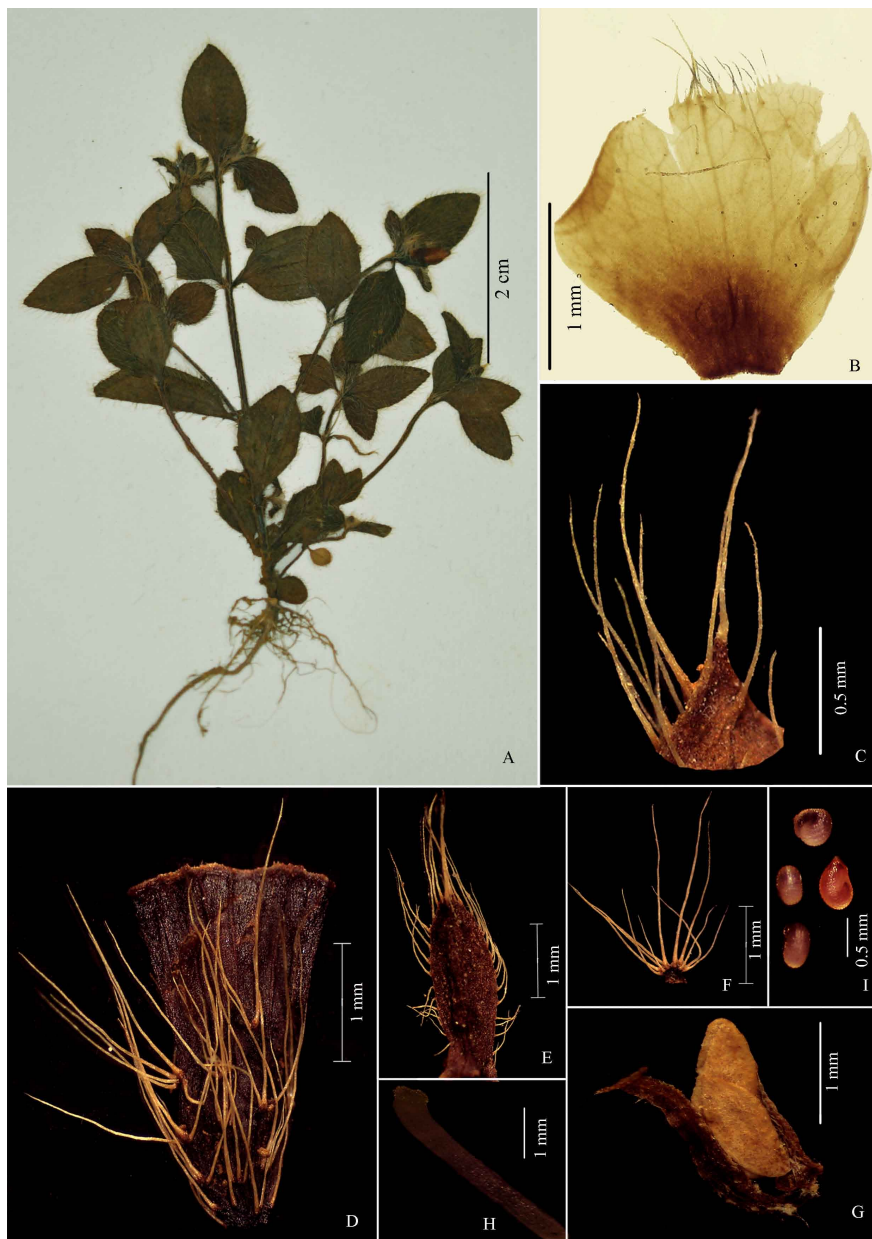


FIGURE 1. *Osbeckia saddlepeakensis* Prashob, Manudev, Sibichen & Nampy. **A.** Habit; **B.** Petal-abaxial view; **C.** Floral bract; **D.** Hypanthium with sessile emergences on lower part; **E.** Sepal; **F.** Inter sepal emergence; **G.** Stamen; **H.** Style; **I.** Seed. (All from *Santhosh Nampy & K.M. Manudev 3526*).

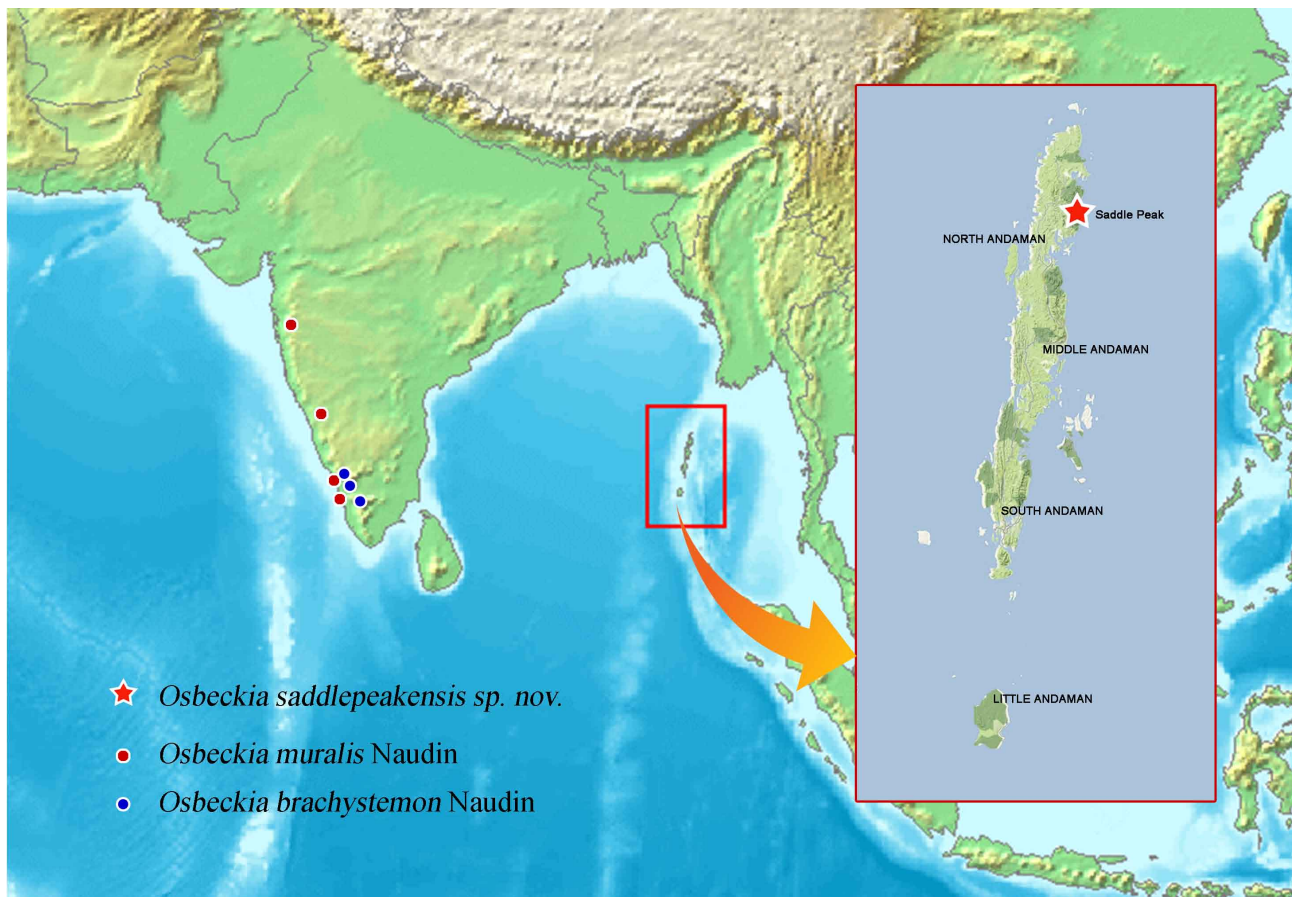


FIGURE 2. Map showing the distribution of *Osbeckia saddlepeakensis* sp. nov., *O. brachystemon* Naudin and *O. muralis* Naudin (Not to Scale © Wikimedia commons).

Annual, erect, branched herbs, 1.5–8 cm tall. Stems, petioles, lamina, peduncles and pedicels covered with ascending to patent thin hairs; hairs simple, 1–3 mm long, unbranched. Stems quadrangular, sparsely hairy, laxly villous. Leaves opposite; petioles 1–3 mm long; lamina ovate, 3-nerved, 0.5–1.5 × 0.3–1 cm, obtuse at base, acute at apex, ciliate at margins, both sides densely hairy. Inflorescence a terminal, short clustered panicle, 3–5-flowered, subtended by 1 or 2 pairs of leaves. Flowers bracteate, tetramerous, 2–4.5 mm across; bracts triangular, 0.3–0.8 mm long, ciliate; pedicels 0.3–1.0 mm long; Hypanthium obconic, 1.8–2.5 × 1.5–2.3 mm, sparsely covered with emergences on lower portion, upper portion glabrous; inter-sepal emergences 0.5–1.0 mm long, short stalked, caducous; stalk 0.2–0.5 mm long, terete, glabrous; head stellate with a few long hairs; other emergences sessile, smaller in size, restricted to lowermost part of hypanthium. Sepals 4, lanceolate, 1.5–2.5 mm long, ciliate at margins, caducous. Petals 4, obovate, 1.5–3.0 × 1–2 mm, ciliate at apex, pink. Stamens 8, isomorphic; filaments 2–2.5 mm long, glabrous, pink; anthers ovate, 1–2 mm long, yellow, acute at apex, not twisted; pore single, oblique on dorsal side, connective with conspicuous collar having two small dorsal lobes or tubercles and two ventral lobes. Ovary 4-locular, 1.8–1.5 mm long, united with hypanthium for about half its length, anther pockets present, crown absent; style 2–4 mm long, glabrous; stigma capitate. Capsules obconic, 4-ribbed, 1.8–2.5 × 1.5–2.3 mm; seeds many, 0.2–0.5 mm long, minute, curved.

Etymology:—The species is named after the type locality ‘Saddle Peak’, the highest peak in Andaman and Nicobar Islands.

Distribution, habitat and phenology:—Hitherto known only from type locality. It grows as an undergrowth in evergreen forests at an elevation of 650–700 m. Flowering and fruiting from August to October.

Taxonomic affinities:—*Osbeckia saddlepeakensis* is one of the smallest members of the genus in India that shows affinities to *O. brachystemon* and *O. muralis*. However, the former is geographically isolated, occurring only in Andaman and Nicobar Islands, while the latter two species are found in the mainland (See Figure 2). A comparison of the diagnostic morphological characters of the three species is given in Table 1 and Figure 3.

Conservation status:—*Osbeckia saddlepeakensis* is known only from the type locality. According to IUCN criteria (2001, 2014), the species falls under the category Data Deficient (DD).

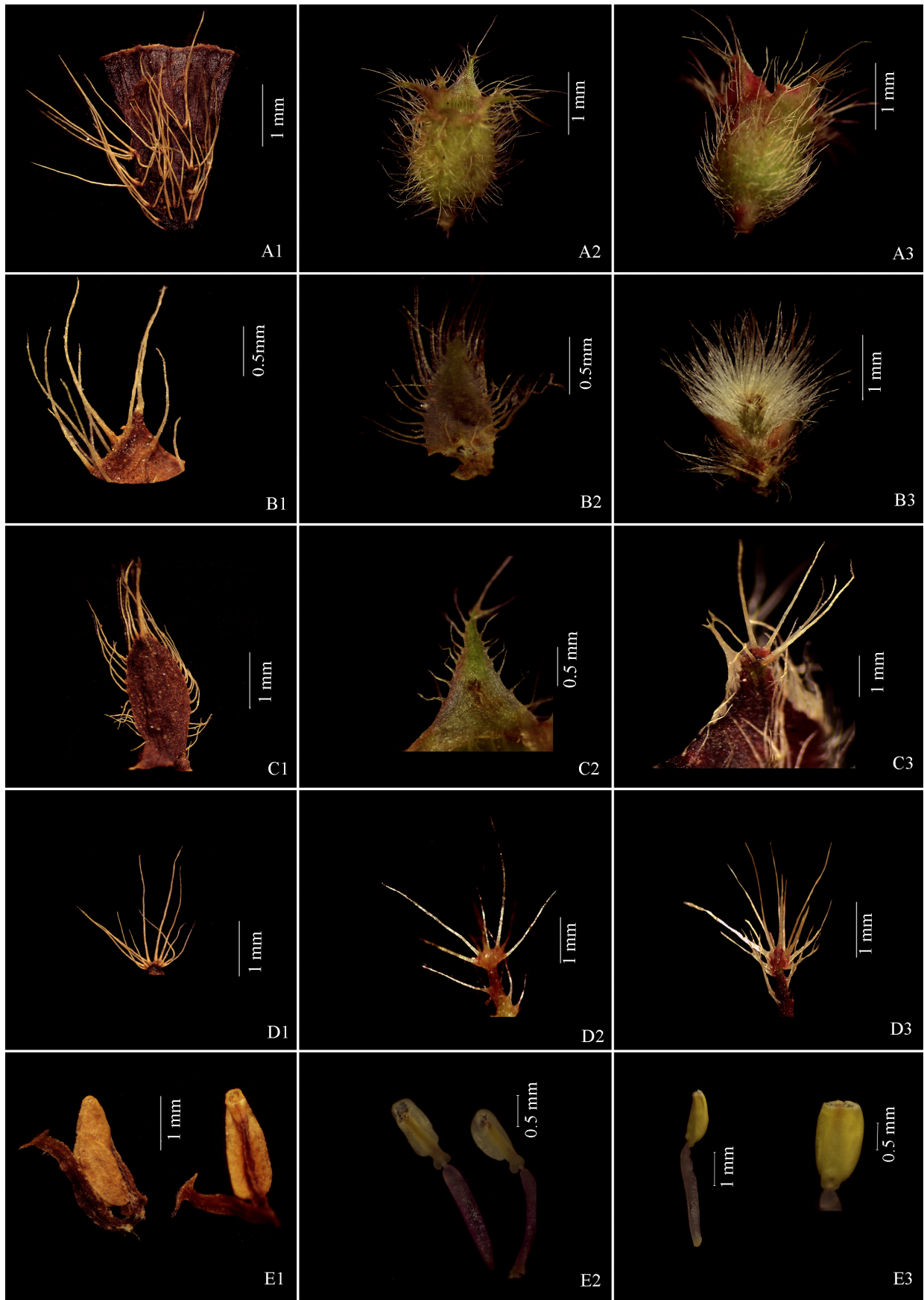


FIGURE 3. Morphological comparison of *Osbeckia saddlepeakensis* Prashob, Manudev, Sibichen & Nampy (**A1–E1**), *O. muralis* Naudin (**A2–E2**) and *O. brachystemon* Naudin (**A3–E3**). A1–A3. Hypanthium with emergences; B1–B3. Bracts; C1–C3. Sepals; D1–D3. Intersepal emergences; E1–E3. Stamens. (A1–E1 from Santhosh Nampy & K.M. Manudev 3526; A2–E2 from Prashob & Sibichen 5946; A3–E3 from Prashob & Sibichen 5555).

TABLE 1. Comparison of diagnostic morphological characters of *Osbeckia saddlepeakensis* (Melastomataceae) and the most allied species.

Character	<i>O. saddlepeakensis</i>	<i>O. muralis</i>	<i>O. brachystemon</i>
Habit	1.5–8 cm tall	5–55 cm tall	10–65 cm tall
Hypanthium	Obconic; emergences on lower portion only; simple hairs absent	Urceolate; emergences all over; simple hairs present	Urceolate; emergences all over; simple hairs present
Bracts	Triangular	Lanceolate	Ovate
Sepals	Lanceolate without stellate head, midrib absent	Triangular with stellate head, midrib prominent	Triangular with stellate head, midrib prominent
Petals	Obovate, pink	Ovate, pink	Obovate, white tinged with pink
Inter-sepal emergences	Caducous, stalk 0.2–0.5 mm long, glabrous	Persistent, stalk ca. 1 mm long with patent hairs	Persistent, stalk ca. 1 mm long with patent hairs
Other emergences	Sessile	Stalked	Stalked
Stamens	Filaments 2–2.5 mm long, pink; anthers acute at apex with single apical pore	Filaments 3–5 mm long, pink; anthers truncate at apex with two apical pores	Filaments 2.5–4 mm long, white; anthers truncate at apex with two apical pores

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<https://doi.org/10.12705/663.5>



***OSBECKIA NAYARII* GIRI (MELASTOMATACEAE) A NEW DISTRIBUTIONAL RECORD FOR SOUTH INDIA**


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ABSTRACT: *Osbeckia nayarii* Giri (Melastomataceae) earlier known from North Eastern Himalaya of India, and Bangladesh is recorded for the first time from southern Western Ghats. The present collection represent a disjunct distribution of this species in dissimilar geographic areas deserves scientific scrutiny. Detailed descriptions and photographs of the species are provided for easy identification of the taxon.

Key words: *Osbeckia*, New record, South India.

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INTRODUCTION

The genus *Osbeckia*. L. comprises about 50 species worldwide [1]. It is distributed from tropical Africa, south and south-east Asia to Northern Australia [2]. Of the 50 species, 31 are found in Asia [2]. In India, the genus is represented by 26 species [3] and Gamble [4] reported 20 species from South India. In India the maximum diversity of the genus is noticed in the Western Ghats followed by north eastern parts of India.

As part of taxonomic revision of the genus *Osbeckia* L. in India, live plants were collected and examined from cited locations and the herbarium specimens at various Indian herbaria such as ASSAM, BSI, BSD, CALI, CAL, DD, DEV, JCB, PBL, KFRI, MH, RHT, and TBGT were consulted. Images of type specimens were procured from virtual data bases of K, MEL, US, BM, BR, C, G and L to confirm the identity. All the 12 species and 4 varieties including *O. nayarii* Giri were collected and critically examined. Giri [5] described the species *O. nayarii* based on the specimens collected from Khasia hills of Meghalaya by C. B. Clarke. Authors had made intensive field explorations in North Eastern India including the type locality and collected live specimens of *O. nayarii*.

During our recent exploration tour in Tamil Nadu, the first author collected similar specimens from Valpari near Sholayar dam. On critical examination, with the protologue and the holotype deposited at CAL; it was identified as *Osbeckia nayarii* Giri, hitherto known only from North Eastern Himalayas of India. Therefore, the present collection is a new distributional record for South India. A detailed description and relevant photographs are provided for easy identification.

TAXONOMIC TREATMENTS

Osbeckia nayarii Giri, J. Econ. Tax. Bot. 4(2): 609. 1983; Giri & S.K. Mandal, J. Bombay Nat. Hist. Soc. 98(1): 151. 2001

Holotype: INDIA. Meghalaya, Khasia hills, 600 m. 14.09.1886, C.B Clarke 44776 A (CAL!).

Erect perennial shrub, 1-1.5 m high, glabrous throughout. Stem and branches strongly quadrangular, distinctly winged at angles. Leaves simple, opposite, petiolate; petiole 5-10 mm long, reddish brown; lamina 10-15 × 3-6 cm, elliptic to lanceolate, base and apex acute, 5-7 nerved. Inflorescence a terminal lax panicle, 5-12 flowered, Flowers actinomorphic, tetramerous, pedicellate and bracteate. Bract 10-15 × 2-6 mm, ovate, caducous; Pedicel 3-7mm. Hypanthium 12-14 × 4 -6.5 mm, urceolate, with a distinct neck. Sepals 4, 10-13 × 2.5- 3.5 mm, ovate with a prominent midrib, margin ciliate, caducous. Intersepal emergences absent. Petals 4, 16-20 × 10-14 mm, ovate, pink- purple. Stamens 8, filaments 2-4 cm long, anthers 2-4.5 mm long twisted, pore apical, connective prolonged in to a small indistinctly lobed collar. Ovary 12-14 mm long, urceolate, 4-locular, united with hypanthium, anther pocket and crown covered with appressed hairs; style 2.5-4 mm long, curved; stigma slightly swollen. Capsule 4 - 5.5 mm long, enclosed by an urceolate calyx tube with a long neck (hypanthium). Seeds 0.1-0.2mm long, minute, curved (Fig. 1).



Fig.1. *Osbeckia nayarii* Giri A. Twig; B. Inflorescence; C. Quadrangular winged stem; D. Stamens; E. Hypanthium & Sepal; F. Bract; G. Sepal; H. Hypanthium. (from prashob P & Sibichen M. Thomas 6018).

Habitat: Occurs in grasslands, (1000-2000m above sea level)

Flowering and fruiting: July- November.

Distribution: India, Bangladesh, China and Myanmar

Specimens examined: INDIA, **Assam**, Golpara, 1914, *Upendranath Kanjilal* 6914(CAL); **Meghalaya**, East Khasia hills district, Pynursla, 1755 m, 15.09.2015, *Prashob & Sibichen* 6112 (DEV), Ri-Bhoi District, Nongpoh, 987 m, 06.08.2014, *Manudev K.M.*, 57412 (CALI); **Tamilnadu**, Coimbatore, Valpari Sholayar dam, 1225 m, 03.10.2015, *Prashob & Sibichen* 6018 (DEV); **Kerala**, Kozhikode, St. Joseph's College Botanical garden (cultivated) 55 m, 06.10.2015, *Sibichen & Prashob* 1620 (DEV).

Note: *Osbeckia nayarii* Giri is distinct from all other species of *Osbeckia* due to quadrangular stem winged at angles, glabrous throughout and absence of intersepal emergence.

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