

**Taxonomic and Phytogeographical investigations
on endemic plants of Western Ghats
with special reference to Goa**

*Thesis submitted to Goa University
for the award of degree of*

**Doctor of Philosophy
in
Botany**

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By

Vaishali C. Joshi

Submitted Final copy.

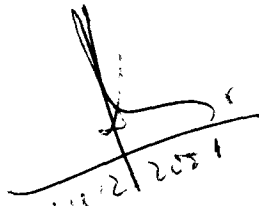
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STATEMENT

As required by the University Ordinance 0.19.8. (ii), I state that the present thesis "Taxonomic and Phytogeographical investigations on endemic Plants of Western Ghats with special reference to Goa." is my original contribution and the same has not been submitted on any previous occasion for any other degree or diploma of this University or any other University/ Institute. To the best of my knowledge, the present study is the first comprehensive work of its kind from the area mentioned.

The literature related to the problem investigated has been cited. Due acknowledgements have been made wherever facilities and suggestions have been availed of.

Place: Goa University

Date: 26/6/2000



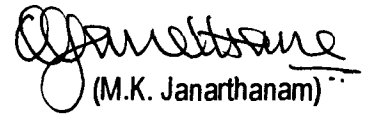
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CERTIFICATE

As required by the University Ordinance 0.19.8. (vi), this is to certify that the thesis entitled "Taxonomic and Phytogeographical investigations on endemic Plants of Western Ghats with special reference to Goa", submitted by Miss Vaishali C. Joshi for the award of the degree of Doctor of Philosophy in Botany, is based on her original and independent work carried out by her during the period of study, under my supervision.

The thesis or any part thereof has not been previously submitted for any other degree or diploma in any University or institute.



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I. INTRODUCTION

The Rio de Janeiro earth summit held in June 1992 laid emphasis on the conservation of global biodiversity. Principal goal of biodiversity conservation activity is to ensure long term survival of as many species as possible and to make sustainable use of its resources. The immediate task is to identify and prioritize important centers of biodiversity. But identifying the priority areas for conservation of biodiversity is a difficult task. Ecological and biogeographical patterns of species distribution have been used to determine priorities at global, national and regional scales (ICBP, 1992; WCMC, 1992; Sisk et al., 1994; Ceballos & Brown, 1995; Caldecott et al., 1996; Ceballos et al. 1998). In recent years, conservation emphasis has been shifted from single species to conservation of whole habitat and ecosystem as a way to minimize the number of protected species and of maintaining the structure and function of biological systems (Margules et al., 1988; WCMC, l.c; Dobson et al., 1997). Another approach is to identify areas with greater number of endemics or with restricted geographical range as they are prone to extinction than more wide spread species (Rabinowitz, 1981; WCMC, l.c.). Myers (1988, 1990) attempted to use endemic species to identify areas of global concern and identified 18 terrestrial 'hotspots' throughout the globe, characterized by high concentration of endemics. Recently, Myers et al. (2000) redefined hotspots as areas which contain at least 0.5% or 1,500 of the worlds 300,000 plant species as endemics and identified 25 hotspots. The Eastern Himalayas (Indo – Burma) and the Western Ghats (Western Ghats/ Sri Lanka) are two hot spots identified by Myers (l.c.) in India. Mc Neely et al. (1990) identified India as one of the 12-megadiversity countries. Within India, Nayar (1996) recognized three megacentres and twenty-five microcentres of endemism. Next to the Eastern Himalayas, the Western Ghats is the second largest center of endemism in

India. It extends North-South from the mouth of river Tapti in Gujarat to Kanniyakumari in Tamil Nadu. Clarke (1898), Hooker (1907) and Chatterjee (1939) had dealt with the Western Ghats and West Coast together as a single botanical region under the name 'Malabar'.

The major work on endemic plants of India was initiated by Chatterjee (l.c.), followed by Blasco (1970). Recent works by Ahmedullah and Nayar (1986) and Nayar (l.c.) provided a checklist of endemic species, but information on their taxonomy and phenology is lacking. Ramesh and Pascal (1997) provided distribution maps for endemic trees in the evergreen and semievergreen forests of the Western Ghats. But in order to conserve these endemic species, a thorough understanding of their taxonomy, phenology and distribution is essential. Lack of recent documentation is one of the main reasons for the endemic data to be minimal (Myers et al., l.c.). Hence, the work on "Taxonomic and Phytogeographical investigations on endemic plants of Western Ghats with special reference to Goa" was undertaken with the following objectives:

- To collect the endemic flowering plants of Western Ghats distributed in Goa.
- To study these specimens critically, draw taxonomic descriptions and work out nomenclature.
- To compare the characters of endemic species with protologues and with the descriptions of the closely related species.
- To redefine the circumscription / taxonomy of the species if required.
- To provide the phenological data of these endemic species with the aim to resolve temporal isolation from the closely related species.
- To gather the distribution data of these endemic species and to analyse their distribution pattern.
- To identify the refugia for threatened species, in case their distribution is narrow.

II. AREA OF STUDY

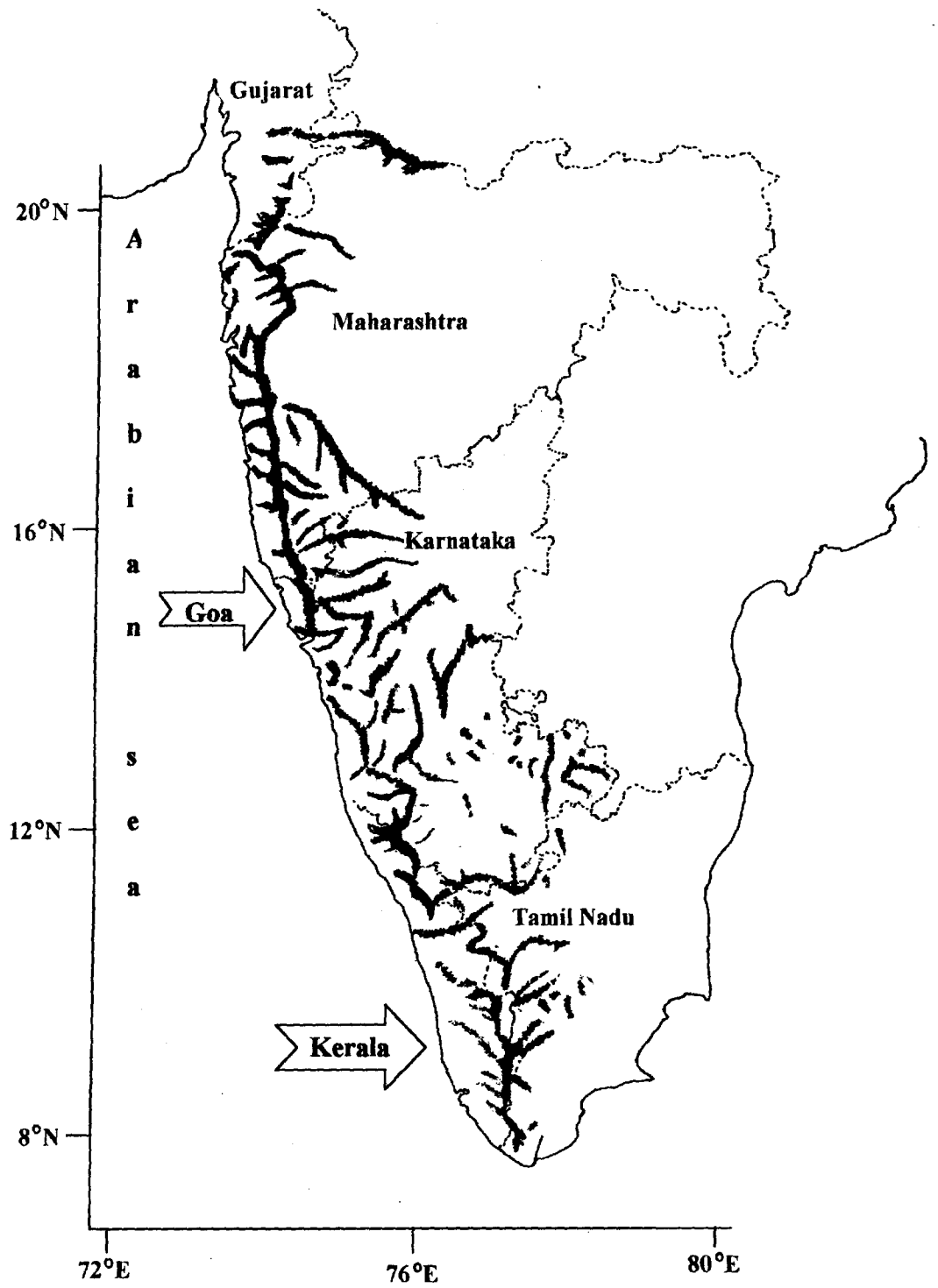
The study area is restricted to the political boundary of Goa state (Map 1). Goa is located between $15^{\circ} 48' N$ and $14^{\circ} 53' 54'' N$ and $74^{\circ} 20' 13'' E$ and $73^{\circ} 40' 33'' E$. It occupies an area of $3,702 \text{ km}^2$ and comprises of two districts and eleven talukas. It is bounded by the Sindhudurg district of Maharashtra in the north, Belgaum and Uttar Kannada districts of Karnataka in the east, and Uttar Kannada district of Karnataka in the south (Map 3). To the West of the study area is the Arabian Sea with the coastline of 105 km. To the east are the Western ghats which run in the north - south direction (Map 2). These ghats form part of Northern Western Ghats. The Goa region can be divided into three physiographic units 1) Hills and valleys along the Ghat zone, 2. Narrow coastline and 3. Mainland with plateaus between the hills and the coast. The Ghats occupy approximately 600 km^2 and have an average height of 800 m. The highest peak in Goa is in Sanso god (1,166m). The plateaus of mainland of Goa are of varying heights, which do not exceed beyond 100m and not less than 30 m. Their tops are usually leveled and in few places deeply notched with gullies. The study area is well drained with rivers and streams. Most of these rivers rise in the Sahyadri which is mostly outside the territory of Goa and empty themselves in the Arabian Sea. The principle rivers in Goa are Tiracol, Chapora, Colvale, Mandovi and Zuari.

Climate: The climate in the state of Goa is characterized by the monsoons. The southwest monsoon winds bring rain to the study area. These monsoons reach Goa by the first week of June, which gives an average rainfall of 350 cm. Maximum amount of rainfall is observed between the month of June – August (Graph 1). The withdrawal of the monsoon is seen by September. In addition to this, there are pre and post monsoon showers. Rainfall increases rapidly towards the ghats from 250 – 300 cm along the coast to over 400 cm near the Ghats.

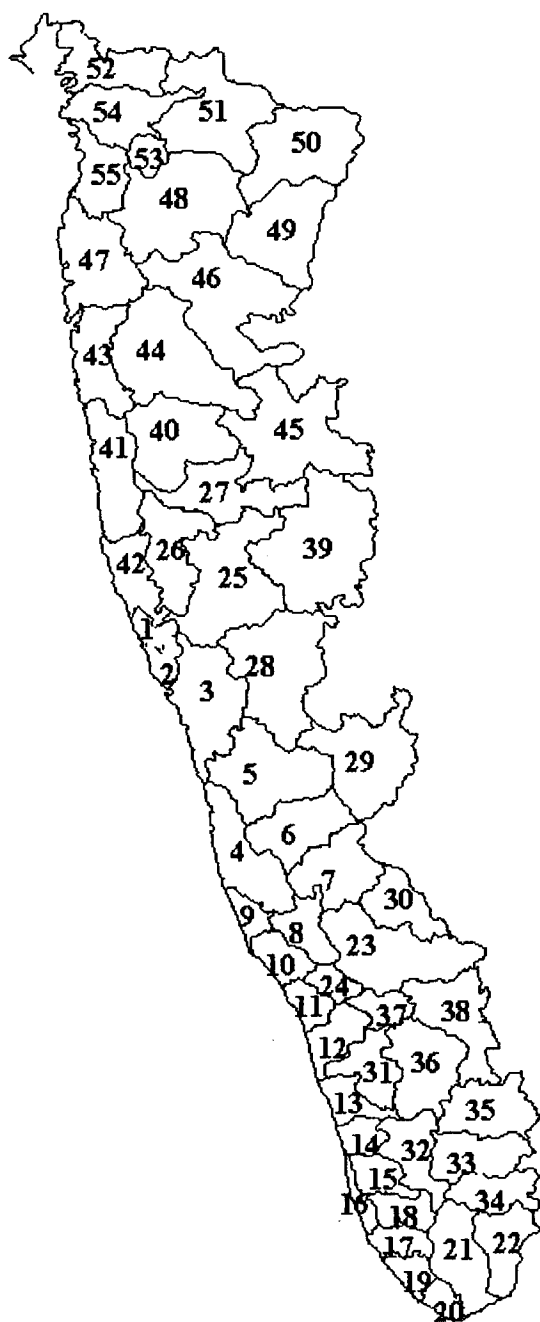
Map 1. Study Area – Goa State (IRS 1B LISS II Image)



Map 2. Western Ghats



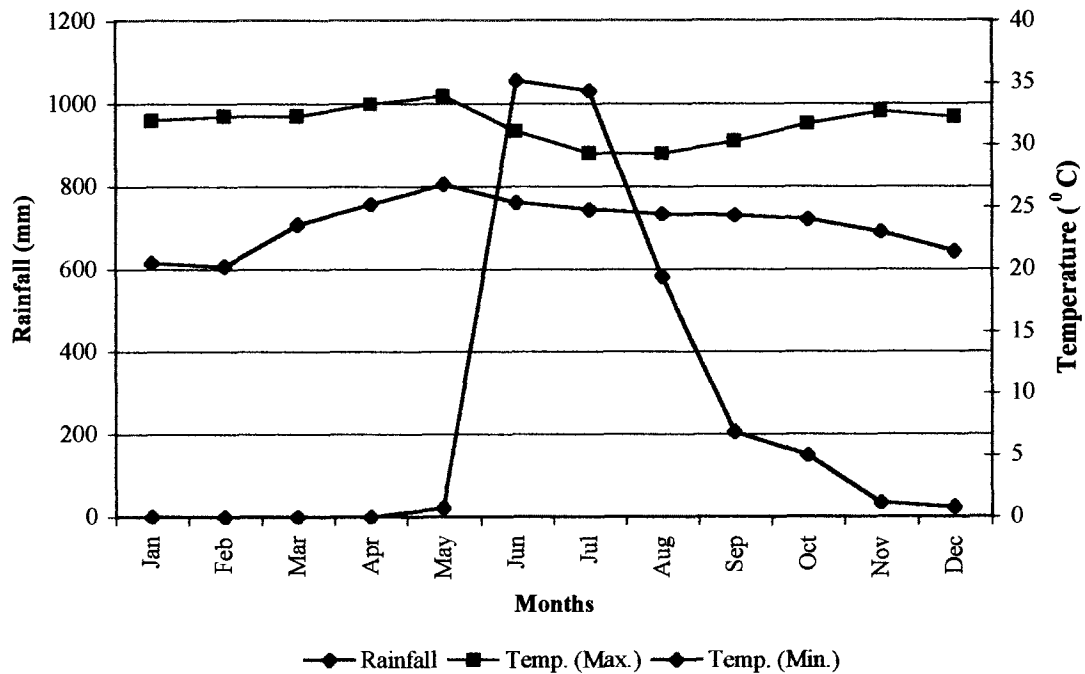
Map 3. Districts along the Western Ghats



Districts

1. North Goa
2. South Goa
3. Uttar Kannada
4. Dakshin Kannada
5. Shimoga
6. Chikmagalur
7. Hassan
8. Coorg.
9. Kasaragod
10. Cannanore
11. Calicut
12. Malappuram
13. Thrissur
14. Ernakulam
15. Kottayam
16. Alappuzha
17. Quilon
18. Pathnamthitta
19. Thiruvananthapuram
20. Kannyakumari
21. Tirunelveli
22. Tuticorin
23. Mysore
24. Wynaad
25. Belgaum
26. Kolhapur
27. Sangli
28. Dharwad
29. Chitradurga
30. Mandya
31. Palghat
32. Idukki
33. Madurai
34. Virudunagar
35. Dindigul
36. Coimbatore
37. Nilgiri
38. Erode
39. Bijapur
40. Satara
41. Ratnagiri
42. Sindhudurg
43. Alibag.
44. Pune
45. Solapur
46. Ahmadnagar
47. Thane
48. Nashik
49. Aurangabad
50. Jalgaon
51. Dhle
52. Bharuch
53. Ahwa
54. Surat
55. Valsad

Graph 1: Monthly average rainfall and temperature of three years (1996-98) in Goa



Temperature: The average temperature in the study area ranges from 30° C maximum to 21 ° C minimum. The temperature rises from March to May and May is the hottest of all the months when the temperature rises even up to 35°C. Between November and December although the day temperature is high the nights are cool (Graph 1).

Humidity: In general the climate in the study area is perfectly tropical. Due to the proximity of the sea, the territory is humid, which further rises during monsoons. Humidity in Goa ranges from 70 – 95 %.

Geology: Major portion of Goa consists of the Pre-cambrian rocks, viz. the quartz-sericite-schist, metavolcanics, quartz-chlorite-schist, quartz-chlorite-biotite schist, meta-graywacks, conglomerate (tilloid), pink phyllite with lenticular bodies of banded manganiferous and ferruginous quartzites and a small portion to the north is occupied by the Deccan traps. A mantle of lateritic rock occurs extensively almost

over all types of rock. The pink phyllite, graywacke and quartz chlorite-schist are generally less lateritised, whereas the metabasalts has partial laterite. The quartzite and gneissic granites do not show any lateritisation. The narrow strip of Deccan trap has a thin cover of laterite (Gune, 1979).

Soil types: 1. The Lateritic soil which is derived from pink phyllite is the major soil types observed in the study area and is formed due to heavy rainfall and high temperature. It is highly acidic, brownish black to reddish brown, well drained, 2. Red gravelly soil derived from micaceous granite gneiss covers the undulated plateau mixed with black soil adjoining the river banks, 3. Alluvial soils including coastal alluvial along the coastal belt and in the low lying situations, it is acidic, reddish brown to yellowish red with coarse texture, 4. Sandy coastal soils occurring along the Coastal belt, is acidic with moderated organic matter and 5. Saline soil occurring mostly in the Khazan land along the foot plains of the river. Its silty –clay looms are excessively saline where as the hills and valleys along the Ghat zone are with old crystalline rocks of Granite and Quartz

The major vegetation type (Champion & Seth, 1968) in the study area are: 1. Southern tropical wet evergreen forests, 2. Southern tropical semi-evergreen forests, 3. South Indian moist deciduous forest, 4. Tidal swamp forests and 5. Tropical freshwater swamp forests.

For phytogeographical analysis of the endemic plants of Western Ghats distributed in Goa, the whole of Western Ghats belt has been taken into consideration.

Western Ghats: The Western Ghats form an important biogeographical zone in Peninsular India. It consists of a series of hill ranges running North-South along the West Coast of India, extending from Tapti (21°N) to Kanniyakumari (8°N). The Western ghats along with the West Coast fall under the “Malabar” botanical province of Clarke (1898), Hooker (1907), and Chatterjee (1939).

The Western Ghats are about 1,600 km. long, running north–south through the states of Gujarat, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu and varies in width from 10 - 80 km. The general elevation of the Ghats ranges from 700–1000 m. The ghats descend steeply in the West along the Arabian sea and merge gradually on the east with the Deccan plateau or plains through a series of small plateaus and hills. Thus the eastern limit is not very sharp (Meher-Homji, 1978). The ghats are characterized by conical and flat-topped hills interspersed with valleys and spurs. The ghats can be divided into three parts 1. Surat – Goa; 2. Goa – Nilgiris; 3. South of Palghat (Pascal 1988). Surat – Goa is the most heterogeneous part of the ghats which hugs the West coast for almost 600 Km. They are composed of flat – topped ridges which are due to the restricted flow of Deccan trap forming steep series of step like terraces and correspond to the western edge of vast plateau formed by the basaltic outpouring of Deccan trap (Krishnan, 1982; Pascal, l.c.). The coastal zone is about 50–60 km wide and is known as the “Konkan”. To the north of Goa the Ghats are made up of isolated conical, flat-topped hill with steep sides marked with striations. The ghats south of Amboli and Goa present gradual slopes without striations, whereas to the south of Goa, the Ghats loose their graded appearance and form steep barriers. The basaltic outpouring ceases to the north of Goa and to the south are the Pre-cambrian rocks. Towards the south of Goa the Ghats tends to recede 50–65 km from the coast. To the south of Nilgiris is the Palghat gap. It is about 300 m in elevation and has a maximum width of 24 km (Vajravelu & Vivekananthan, 1996). The ghats again rise to the south of Palghat to form the Anaimalai hills. Anaimudi is the highest peak (2,695 m) in the Western Ghats. The important rivers originating from the Western Ghats are Bhavani, Bhima, Godavari, Kalinadi, Kaveri, Kodayar, Krishna, Periyar, Tapti and Tambraparni.

Climate: The climate of the Western Ghats is influenced by the South West monsoons. The annual rainfall varies from 2350 mm in the North to 7450 mm in the South (Vajravelu & Vivekanathan, l.c.). The western side of the ghats is on the threshold of southwest monsoons and bears the brunt of monsoons, whereas the eastern leeward slopes receive only a fraction of rains (Meher-Homji, 1992). The north east monsoons are very short and the total rainfall is comparatively less. Maximum rainfall in the Ghats is in July. The rainfall in the ghats is not proportional to the elevation, its orography is the determining factor for the release of rains (Meher-Homji, l.c.). There is a sharp decrease in the rainfall period as one move from South to North of Western Ghats. In southern most part of Western ghats there is dry period of just 2–3 months, as it is influenced by the south west as well as the north east monsoons, whereas it is 7–8 months in Northern most part of Western Ghats.

Temperature: The effect of temperature on the monsoon is negligible. The minimum temperature is in the month of December and January and then rapidly increases till May. The arrival of monsoon reduces the temperature. The mean annual temperature of the Western Ghats varies between 24⁰ C in the North to 20⁰ C towards the south (Vajravelu & Vivekananthan, l.c.).

The major vegetation types (Champion & Seth, l.c.) observed along the Western Ghats are as follows: 1. Southern tropical wet evergreen forest, 2. Southern tropical semievergreen forest, 3. South Indian moist deciduous forest, 4. Tidal swamp forest, 5. Tropical fresh water swamp forest, 6. Tropical seasonal swamp forest, 7. Tropical riparian fringing forest, 8. Southern tropical dry deciduous forest, 9. Southern tropical thorn forest, 10. Southern tropical broad leaved hill forest and 11. Southern montane wet temperate forest.

III. REVIEW OF LITERATURE

De Candolle (1855) first used the concept "Endemic area" which is defined as an area of a taxonomic unit, especially a species which has a restricted distribution or habitat, isolated from its surrounding region through geographical, ecological or temporal barriers. Later on several definitions have appeared for the word endemic. According to Good (1953), the word endemic is ascribed to any species or taxonomic unit, which is so distributed, as to be confined to one particular country or region, or restricted to a floristic province.

Engler (1882) appears to be the one who recognized two types of endemics (old and new) which is widely used by plant geographers. According to him, new endemics are known as autochthonous endemics and are developing in different ecological niches or habitats through specialization from active genetic stock, whereas old or paleoendemics (relicts) are preservations of ancient stock, which were once widely distributed but now confined to a very limited portion of the former territory. Drude (1890) identified 'relict' as endemic taxa occurring in disjunct areas as their intermediate links were lost and new endemics as secondary endemics. Whereas Diels (1909) identified these secondary endemics or newly evolving endemics as progressive endemics, while others (Herzog, 1926; Braun – Blanquet, 1923; Chevalier & Guenot, 1925) called these secondary endemics as neoendemics.

Willis (1922) quantified the idea of youthful endemics with J – shaped or hollow curves and concluded that the size of area is correlated with the age of taxon. However according to Stebbins and Major (1965) this is true only for "neoendemics" which have not yet reached the climatic limits, are recent in origin and have just split off from a parental entity.

Wherry (1944) classified the newly evolving endemics or neoendemics as primary endemics and relicts or epibiotics as secondary endemics and believed that the primary endemics will reach their maximum phase and there after diminish or become relict or secondary endemics. Cain (1944) identified two types of endemics, one which are relatively youthful species and the other which are relatively old, relict species (epibiotics).

Stebbins and Major (l.c.) recasted Cain's two categories as paleoendemics and neoendemics and they incorporated the age of endemics, systematic position, cytological data (chromosome number and ploidal level) and mode of origin to categorize the endemics. According to Stebbins and Major (l.c.) relict status is presumably the result of increasing constriction of their specialized habitat over time. Whereas neoendemics are recent in origin and has split off from a parental entity and may be passed for a future expansion of their range and gene pools. Similar system of classification was proposed by Favarger & Contandriopoulos (1961) for narrow endemics which have restricted distribution. Anderson (1937), Wulff (1937, 1943) and Senn (1938) suggested the use of cytological data to distinguish paleo and neoendemics. Favarger & Contandriopoulos (l.c.) classified endemics into the following four types: 1) Paleoendemics, which are ancient, show little variability, ecologically specialized and are on the way of extinction. Their present area of occurrence may be relic and have high polyploid, and whose diploid ancestors are unknown or extinct. 2) Schizoendemics, which are the result of gradual speciation or more or less simultaneous divergence from a parent. Related schizoendemics may have the same number of chromosomes, but they can be of any age and degree of divergence from their parents. 3) Patroendemics, which are diploid endemics which

have given rise to widespread polyploids and 4) Apoendemics, which are polyploids arisen from their widespread diploid or lower polyploid parents. Richardson (1978) predicted that the nature of plant distribution will change or alter with time and all species will start as neoendemics and end as paleoendemics. The endemics with narrow or restricted distribution range are called as narrow endemics by Mason (1946). Gentry (1986) observed that the rate of speciation in the tropics is much higher than in the temperate ^{region} and concluded that the tropical forests deserve much more attention than temperate zone ecosystems, not only because of their species richness but also because of the greater concentration of endemics. He included "Anthropogenic" endemic for the endemic species whose highly restricted distribution is due to human intervention and habitat destruction. These endemics are often categorized as rare. Kruckeberg and Rabinowitz (1985) advocated that species showing narrow distribution range need to be conserved, lest many of the valuable genetic resources will be lost. Simpson (1953) has drawn attention to cases of extinction resulting from narrow specialization to restricted habitats.

In 1980, IUCN carried out a project to identify areas with major plant diversity, to formulate World conservation strategies. The two categories involved in this were i) the area is evidently species rich and ii) the area must be known to contain large number of endemic species. Thus the principle goal of conservation is to ensure long term survival of as many species as possible.

Mittermeier (1988) and Mittermeier & Werner (1988) recognised that a very small number of countries situated mainly in the tropics possess a large fraction of the worlds species diversity and introduced the concept of Megabiodiversity countries, and suggested that they require special international attention. Mc Neely et al. (1990)

used country species list of vertebrates, swallowtail butterflies and higher plants to identified 12 megabiodiversity countries in the world. India is one of them in the tropics.

Myers (1988) used endemic plant species to identify the areas of global conservation concern. He identified 10 regions or "Hotspots" that are characterized by high concentration of endemic species and are experiencing unusually rapid rate of habitat modification or loss. In subsequent publication, Myers (1990) identified another eight areas and thus making a total of 18 hotspots. The Eastern Himalayas and the Western Ghats are the two "Hotspots" in India identified by him. Myers et al. (2000) redefined "Hotspots" as areas comprising at least 0.5 % of all plant species worldwide or 1500 of the Worlds 300,000 plants and increased the number of "Hotspots" to 25 which fit this definition. The scope of Eastern Himalayas and the Western Ghats is broadened and named as Indo - Burma and Western Ghats/Sri Lanka respectively and identified them as hottest hot spots in India of the eight hottest hot spots in the world. Bibby et al. (1992) applied simple method of assigning taxonomic uniqueness to endemic species based on the diversity of gene and family to which it belongs. It is realised that in order to conserve these endemic species a thorough understanding of the flora of the region / country is essential. However, according to Prance and Elias (1977) many countries lack inventory of threatened species as they lack national flora. The IUCN Red data book (Lucas & Synge, 1978) and other publications by Perring and Farewell (1977) and Takhtajan (1975) played an important role in focussing World's concern in the loss or extinction of species. It was observed that biodiversity is not distributed uniformly throughout the globe and even the endemics are distributed unevenly across the land areas of the world

(Kruckeberg & Rabinowitz, l.c; Gentry, l.c.). The tropical forests are biologically and ecologically, the most complex and diverse biomes on earth (Myers 1988, Gentry l.c.), as they cover only 6% of the earth's land surface, but harbor 50% of the earth's species. Lucas and Synge (l.c.) mentioned that the removal of the tropical forests would result in extinction of plants and animals at an unprecedented rate.

Ramesh and Pascal (1991) considered the Western Ghats as the most important biogeographic zone in Peninsular India, due to ^{its} varied topography, bioclimate and richness in endemics. Turrill (1964) also considered peninsular regions close to oceanic islands in having conditions favorable for endemism. Subramanyam and Nayar (1974) compared the Western Ghat hilltops to islands with regards to the distribution of the endemics. Shetty and Vivekananthan (1971) considered the summits of Western Ghats in peninsular India as "islands amidst island".

The work on endemic plants in India including Peninsular India was initiated by Chatterjee (1939). He compiled a list of dicotyledonous genera endemic to India, Burma and Sri Lanka of which 34 were considered endemic to Peninsular India. Genera such as *Adenoon*, *Calacanthus*, *Decaschistia*, *Diotocanthus*, *Goniocaulon*, *Meyenia*, *Nothopegia*, *Octotropis* and *Stenosiphonium* mentioned by Chatterjee (l.c) are no more endemic as they have a wider distribution. He estimated that around 6,700 dicot species are endemic to India and 2045 to Peninsular India. Rao (1972) re-evaluated Chatterjee's work and listed 164 genera for the Indian floristic region and neighboring countries like Sri Lanka and Burma. Blasco (1970) covered only South India and reported 1268 endemic dicot species. Later on Nayar (1980) and Ahmedullah & Nayar (1986) reported 56 endemic genera to Peninsular India of which 45 are monotypic. Now about 60 genera are considered endemic to Peninsular India

and about 1500 species endemic to Western Ghats (Nayar 1996). Nayar (1996) believed that all endemics start as neoendemics and end up as paleo endemics. He identified three mega centers (viz. Western Ghats, Eastern Himalaya and Western Himalaya) and twentyfive micro centers of endemism in India. Of the twentyfive micro centers eight are in the Western Ghats.

The Floras published in the region contributed to evaluate the number of endemic taxa to a greater extent. Following the first botanical book of the region by Garcia da Orta's (1565) a major work on the floristics of Western Ghats by Van Rheede (1678–1703) appeared under the title, 'Hortus Malabaricus'. Other major contributions by Wight (1834, 1838, 1840) and Beddome (1869–1874) are monumental in understanding the flora of Western Ghats. The first major Floras on northern Western Ghats are by Graham (1839) and Dalzell and Gibson (1861). Hooker (1872–1897) published "The Flora of British India" in seven volumes which also dealt about the plants of Western Ghats. The publication of regional and local floras by Cooke (1901–1908), Talbot (1909), Rao (1914) and Gamble (1915–1935) provided firm base for future floristic studies.

After the reorganization of Botanical Survey of India in the early fifties, there was a spurt in the botanical activity. Parallel floristic works were carried out by various institutions, including colleges and Universities along the Western Ghats. Some of the important published floristic works along the Western Ghats are Santapau (1966), Vartak (1966), Saldanha and Nicolson (1976), Sharma et al. (1977), , Shah (1978), Arora et al. (1981), Vivekananthan, (1981), Mathew (1981-1983), Manilal & Sivarajan (1982), Nair & Henry (1983), Saldanha (1984, 1996), Rao (1985–1986), Yoganarasimhan et al. (1986), Henry et al. (1987–1989), Subramanian

et al. (1987), Bole & Pathak (1988), Chandrabose & Nair (1988), Kulkarni (1988), Manilal (1988), Ramachandran & Nair (1988), Almeida (1990), Keshav Murthy & Yoganasimhan (1990), Vajravelu (1990), Lakshminarasimhan and Sharma (1991), Kothari & Murthy (1993), Mohanan & Henry (1994), Deshpande et al. (1993-1995), Sasidharan and Sivarajan (1991), Almeida (1996), Lakshminarasimhan (1996) and Naithani et al. (1997). In addition to these, some unpublished works along the Western Ghats are by Mohanan (1984), Ansari (1985), Ravikumar (1993) and Stephen (1994). The Floras published outside the Western Ghats helped in understanding the extended distribution of endemic plants of Western Ghats. Revisionary works, monographs and taxonomic accounts on families/genera at national and international levels have contributed in understanding the phenology, habitat specificity and distribution range of the endemics. Some of the relevant recent works along the Western Ghats are by Santapau (1951) and Nayar (1980) on family Acanthaceae, Thothathri (1982) on *Derris*, Karthikeyan (1983) on Poaceae, Santapau & Kapadia 1966 (1967), Bose & Bhattacharjee (1980), Abraham & Vastsala (1981), Joseph (1987) and Anasari & Balakrishnan (1990) on Orchids, Mitra (1982) on Annonaceae, Ansari (1984) on genus *Ceropegia*, Sur (1987) on *Ischaemum*, Renuka (1992) on the genus *Calamus*, Nair (1991) on *Impatiens* endemic to Nilgiris and Anamalais, Binojkumar & Balakrishnan (1991) on family Euphorbiaceae, Sreekumar & Nayar (1991) on Grasses, Sanjappa (1992) on Legumes, Kumar and Bhattacharya (1992) on family Begoniaceae, Janarthnam & Henry (1992) on the genus *Utricularia*, Ansari & Balakrishnan (1994) on *Eriocaulon*, Rao & Datt (1996) on Asteraceae and Sivarajan & Pradeep (1996) on Malvaceae. Apart from these, there are

hundreds of published papers describing new species, new records and endemic plants along the Western Ghats.

Further, recently published volumes of Flora India (Sharma & Balakrishnan, 1993; Sharma & Sanjappa 1993; Sharma et al., 1993; Hajra et al., 1995a, 1995b, 1996, 1997) also contributed largely in understanding the endemic species along the Western Ghats.

Apart from floristics, work on the Phytogeography of the Western Ghats has been carried out by Arora (1964), Legris and Meher-Homiji (1968), Nayar and Ahmed (1984), Mehrotra and Jain (1980) and Nair and Daniel (1986). In addition, works dealing with the Ecology and Phenology of plants along the Western Ghats such as Gadgil & Meher-Homiji (1986a, 1986b), Rao (1989), Sivaraj & Krishnamurthy (1989), Bhat (1992), Lokesha and Vasudev (1993, 1997), Aravajy (1995), Ganesh et al. (1996), Daniels (1997), Subash Chandran (1997) and an unpublished work of Soubadra Devy (1998) help us to understand the general phenological patterns of specific habitats.

The herbarium collections deposited in major herbaria along the Western Ghats also provide valuable information on the distribution of the endemics along the Western Ghats. Some of the important herbaria along Western Ghats are 1) MH, Coimbatore and 2) BSI, Pune. In addition to these major herbaria along the Western Ghats, other herbaria of relevance are RHT (Tiruchirapalli), BLATT (Bombay), JCB (Bangalore) and HIFP (Pondicherry). Recently, Ramesh and Pascal (1997) have provided distribution of endemic tree species in the evergreen and semievergreen forests of Western Ghats based on herbarium collections. However, the information on

the distribution of endemic trees in the moist deciduous forests and information on endemic herbs, shrubs and climbers are lacking.

Most of the endemic species, because of their narrow distribution range and habitat destruction come under endangered category. The problem of threatened plants was first discussed in the 11th Technical meeting of the IUCN held in 1969. So a project on study, survey and conservation of endangered species of flora (POSSCEFF) was undertaken by Botanical Survey of India. Although we have an accurate information on nearly 1000 threatened and endangered plant species, still gap exists in our knowledge on biology and taxonomic status of several species and this information is essential in planning appropriate conservation strategies. The publications such as "The Red data book of Indian plants" by Nayar and Sastry (1987, 1989, 1990), "Threatened plants of India - a state of art report" by Jain and Sastry (1980) and "Conservation of the Tropical plant Resources" by Jain and Mehra (1983) have triggered the studies on endemic plants of the region.

The state of Goa which lies on the windward side of the Western Ghats has a characteristic flora as it is a part of the northern Western ghats and also the northern most boundary of the luxuriant evergreen forests of the Western Ghats. The evergreen forests here are not continuous, and are restricted only to few patches. Goa under the Portuguese rule of over four and a half centuries did not get much botanical attention except for few sporadic publications like "Coloquios dos simples e Drogas da India" (Garcia da Orta l.c.) and "Tratado de las Drogas" (Acosta 1578) which include some commonly known medicinal plants of the region. Dalgado (1898) published "Flora de Goa e Savantwadii" in commemoration of fourth centenary celebrations of Portuguese entry into India, wherein he listed 731 wild and 279 cultivated species

with vernacular names and brief notes without any specific data on their location. After liberation, Vartak (1966) published "Enumeration of plants of Gomantak", wherein he provided a check list of 1512 species mostly gathered from publications and he included areas such as Ratanagiri district of Maharashtra and Uttar Kannada district of Karnataka under the name "Gomantak". This Flora reported only around 200 species from Goa. The subsequent major publication entitled, "Flora of Goa, Diu, Daman, Dadra and Nagerhaveli" by Rao (l.c.) gives account of the flora of the area. But all the above mentioned floras do not give any insight into the endemic species. But recently published Flora by Naithani et al (l.c.) provided an account of the "Forest flora of Goa" with a few endemic species. But overall, the information on the distribution on the endemic species of Western Ghats present in Goa and their distribution pattern along the entire Western Ghats is lacking.

IV. MATERIALS AND METHODS

the works of

A checklist of endemic plants from the study area was prepared using Rao (1985–86), Naithani et al. (1997), Ahmedullah & Nayar (1986) and Nayar (1996). Based on the preliminary observations carried out in the study area, the following habitats were identified for intensive fieldwork: 1. Evergreen forests, 2. Semievergreen forests, 3. Moist deciduous forests, 4. Mangroves, 5. Plateau, 6. Rivers, lakes and streams, 7. Khazan land, 8. Beaches, 9. Cultivated fields and 10. Open areas other than plateaus.

To collect the endemic species, each of these habitats ^{was} intensively surveyed by undertaking fortnightly visits between January 1997 and October 1999. The specimens were collected in polythene bags to prevent desiccation. The field data regarding their habit, habitat, phenology, flower colour, associated plants etc. were noted down. Further phenological details were collected and added during the subsequent visits. Photographs were taken for most of the collected endemic species using Pentax K1000 or Nikon FM 10 SLR cameras. The collected specimens were processed and preserved using conventional herbarium techniques. Ethyl alcohol saturated with mercuric chloride was used to treat the specimens. The dried specimens were mounted on standard herbarium sheets. The specimens were identified using local and regional floras and monographs. The identity of each specimen was confirmed by comparing with the authentic herbarium specimens available at BSI (Pune), MH (Coimbatore), RHT (Tiruchirapalli), JCB (Bangalore), CALI (Calicut), BLAT (Mumbai) and HIFP (Pondicherry). The identified herbarium specimens were labeled and deposited in the herbarium, Department of Botany, Goa University.

The specimens were critically studied, described by adapting terminology from Lawrence (1951) and illustrations were drawn using WILD M3Z Leica Stereo

microscope. The observations were compared with protologues, except in few cases. Type specimens were also consulted in a few required cases. The endemics were also compared with their closely related species to check their taxonomic distinctness. The closely related species were identified by referring to the protologues and information gathered from floras. The differences are tabulated to highlight their taxonomic distinctness. Specimens deposited in other herbaria were also studied to understand their variation and to gather distribution data. Nomenclature was worked out and updated using International Code of Botanical Nomenclature (Greuter, 1994).

For all the collected endemic species, information on their distribution along the Western Ghats was gathered from district and regional floras and from various herbaria. Only for Goa the exact localities where the endemic plants were collected are given, whereas for other states only the districts in which they occur are mentioned. For Gujarat, the districts are reported for only a few species wherever the information was available. To visualize the distribution pattern of the endemic species along the Western Ghats, boundaries of districts along the Western Ghats were digitized using digitizing tablet and saved as bitmap. The distribution was marked by filling colours using Paintbrush in Windows 98.

Status of each endemic species has been evaluated using the following IUCN norms (1995, 1997):

Extinct (Ex): Taxa that are no longer known to exist in the wild after *repeated* searches of the type localities *and other known or likely places*.

Extinct/Endangered (EX/EN): Taxa possibly considered to be extinct in the wild.

Endangered (EN): Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have

been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Vulnerable (VU) Taxa believed likely to move into the Endangered category in the near future if the causal factors continue operating. Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant but are under threat from serious adverse factors throughout their range.

Rare (R): Taxa with small world populations that are not at present Endangered or Vulnerable but are at risk. These taxa are usually localised within restricted geographic areas or habitats or are thinly scattered over a more extensive range.

Low risk (LR): A taxon is ^{at} low risk when it has been evaluated, ^{and} does not satisfy the criteria for any of the categories mentioned above.

While evaluating, mostly local distribution was taken in to account and in few cases their whole distribution range is taken into account and evaluated based on the local observations, herbarium collections and published literature. Information on their economic and medicinal uses were gathered from field as well as from literature. Their Chromosome ^{number} details were also gathered from Kumar and Subramaniam (1986).

For all the collected endemic species, a computerized database was constructed incorporating details on their phenology, habit, habitat and distribution using Microsoft Access. From the database statistics (viz. first Published name, year and their authors, phenology, habit, habitat and distribution along Western Ghats) ^{was} gathered for all the collected endemic species. Using this statistics, graphs were

constructed using Microsoft Excel. Other details regarding the distribution patterns of various species, the change in status of endemic species, newly reported endemic species, number of endemic species published by various major authors etc. are provided in the form of tables.

Endemic herbs of Western Ghats present in Goa were listed. Floras (both published and unpublished manuscripts) of well worked out districts of Western Ghats were checked for their presence or absence. For each species scoring was made by giving '1' if it is present in a particular district or '0' if it is absent. This data is provided in Appendix -I. The obtained data was used to construct Tree diagram showing similarity among the districts of Western Ghats with regard to endemic herbs. The options, Cosine of Vectors of Values and Average Linkage (between groups) method in Statistical Package for Social Sciences was used for this purpose.

Under the systematic treatment, the families, genera within each family and species within each genus are arranged in alphabetical sequence. Each species has been provided with full nomenclature along with citations of Floras of Western Ghats and other important publications followed by detailed description, reference to figures and plates in thesis. Flowering and fruiting seasons, habitat information, distribution and reference to maps, status assigned as per IUCN norms, chromosome number and notes dealing with various aspects including morphology, taxonomy, related species, nomenclature and economic uses wherever they are applicable. For most of the species, a table showing the differences with the closely related species has been provided. The specimens examined are given under Appendix - II.

V. RESULTS

i) SYSTEMATIC TREATMENT

ACANTHACEAE

Barleria strigosa Willd. var. **terminalis** (Nees) Clarke in Hook. f., Fl. Brit. Ind. 4: 490. 1884; Cooke, Fl. Bombay 2: 462. 1967 (repr. ed.); Santapau, Fl. Khandala 201. 1967; Rao, Fl. Goa 2: 319. 1986; Almeida, Fl. Savantwadi 1: 317. 1990; Deshpande et al., Fl. Mahabaleshwar 2: 438. 1995. *B. terminalis* Nees in DC. Prodr. 2: 225. 1847; Kothari & Moorthy, Fl. Raigad 305. 1993. *B. caerulea* Graham, Cat. Bombay Pl. 161. 1839, non Roxb. 1832.

Shrubs up to 1.5 m high. Stems green, sparsely strigose. Leaves simple, opposite, decussate, petiolate; petiole c 4 cm long, strigose, green; lamina up to 18 x 8.5 cm, elliptic-lanceolate, cuneate at base, entire and ciliate along margins, acuminate at apex; sparsely strigose adaxially, veins more prominent abaxially with dense, strigose hairs along the veins. Inflorescence a spike, bracteate, densely crowded at end of the branches. Bracts and bracteoles c 3 x 0.9 cm, linear-lanceolate, acute-acuminate, ciliate, strigosely hairy outside, glabrous inside, hairs more dense along the margins and mid vein. Calyx lobes 4, outer two c 1.5 x 0.4 cm, linear with strigose hairs, inner two c 2.5 x 1 cm, obovate, acute, densely strigosely hairy outside, soft within with small, silvery white hairs. Corolla infundibuliform, two lipped, pale blue, tube up to 3.5 cm long; upper lip with one lobe, c 3 x 1.8 cm long, pale blue, rounded at apex, lower lip with four lobes, c 3 x 1 cm, pale blue. Stamens 2; filaments c 3.6 cm long, densely hairy at base, sparsely hairy above; anthers two celled, c 0.7 cm long; staminodes 2, situated inside the corolla tube. Style long, pale blue; stigma

two fid. Capsules c 1.8 cm long, flat, oblong–ellipsoid, acute, glabrous, four seeded; seeds compressed, ellipsoid with silky hairy. (Fig. 1 A-C; Plate 1 A).

Fl. & Fr.: November – February.

Habitat: ~~Along the Ghats~~ in moist deciduous and semievergreen forests.

Distribution: Maharashtra (Raigad, Ratnagiri, Satara, Sidhudurg & Thane); Goa (Badsare – Wagal forest, Butpal, Codal, Kanpal hills, Molem - Anmod, Netravali & Verlem); Karnataka (Belgaum & Hassan). (Map 4).

Status: (LR).

Chromosome number: 40.(2n)

Notes: This variety was not reported by Ahmedullah and Nayar (1986) and Nayar (1996) as endemic to Western Ghats. Based on Cooke's Flora (l.c.) and observed distribution data it is concluded that it is endemic and restricted to northern Western Ghats. It is closely associated with *Thelepaepale ixiocephala*, which is also endemic to Western Ghats. Its leaves and roots are used in cough and inflammation. Taxonomically it is closely related to *Barleria strigosa* var. *strigosa* which is distributed in Bengal, Assam, Orissa, Chota Nagpur, Sikkim and also cultivated in India and Malaya. The differences between them are as follows:

<i>Barleria strigosa</i> var. <i>terminalis</i>	<i>Barleria strigosa</i> var. <i>strigosa</i>
Leaves sparsely strigose above.	Leaves glabrous above.
Spike subtrilobated, not or very obscurely 1- sided.	Spike dense, many fid, 1- sided.
Outer sepal linear, obtuse, strigose hairy.	Outer sepal ovate, denticulate, minutely strigose.

Gymnostachyum glabrum (Dalz.) T. Ander. in J. Linn. Soc. 9: 506. 1867; Clarke Hook. f., Fl. Brit. India 4: 509. 1884; Vartak, Enum. Pl. Gomantak 83. 1966; Cooke, Fl. Bombay 2: 454. 1967 (repr. ed); Rao, Fl. Goa 2: 324. 1986; Kulkarni, Fl.

Sindhudurg 325. 1988; Almeida, Fl. Savantwadi 1: 320. 1990; Deshpande et al., Fl. Mahabaleshwar 2: 442. 1995. *Cryptophragmium glabrum* Dalz. in Kew J. Bot. 2: 338. 1850.

Shrubs, up to 3 m high. Stem obtusely quadrangular, glabrous, grooved. Leaves simple, opposite, decussate, petiolate; petiole c 2 cm long; lamina up to 15 x 5 cm, elliptic-lanceolate, base tapering, decurring into petiole, margins undulated or slightly toothed, acuminate at apex, dark green and sparsely pubescent adaxially, pale green abaxially with prominent midrib, lateral veins 12-5 pairs. Inflorescence terminal, branched racemes up to 30 cm long, glandular hairy; branches opposite, decussate, with 2-3 flowered paired clusters. Bracts in pairs, c 0.5 cm long, linear, acute, sparsely pubescent; bracteoles c 0.2 cm long, acute, pubescent. Calyx tube c 0.2 cm long, glandular hairy; teeth 5, unequal, each c 0.5 cm long, linear, acute. Corolla two lipped, tube c 1.5 cm long, greenish cream coloured with purple spots, hairy outside; upper lip 2-lobed, lobes very short, c 0.2 cm, linear, acute, pale blue with purple spots; lower lip 3-lobed, c 0.5 cm, oblong, obtuse, cream coloured with purple spots. Stamens two, inserted at the mouth of corolla tube, hairy at insertion point; filaments 2, c 0.7 cm long, purple at base, pale green above; anthers 2 celled. Ovary c 0.5 cm long, cylindrical, green, slightly swollen at base, 2 locular; ovules supported on a hard retinacula; style c 1.5 cm long, purple and hairy at base, white above, stigma green. Capsule c 2 cm long with persistent calyx, green with glandular purple hairs; apex acute, purple; seeds in two rows in each valve, orbicular, attached to retinacula, flat, pale yellow, slightly ciliate along margins. (Fig. 1 D-I; Plate 1 B).

Fl. & Fr.: December – February.

Habitat: Undergrowth in moist deciduous and semievergreen forests.

Distribution: Maharashtra (Ratnagiri, Satara & Sindhudurg); Goa (Anjunem, Barsare-Tudal, Canacona, Caranzol, Dudhsagar & Vageri hills); Karnataka (Uttar Kannada). (Map 4).

Status: (LR).

Notes: It is not reported by Ahmedullah and Nayar (1986) and Nayar (1996) as endemic to Western Ghats. In the present study it is observed that the distribution of this species is restricted to the northern and central Western Ghats. It is closely related to *G. latifolium* (Dalz.) T. Anders. which is also endemic to the northern Western Ghats but differs from it as stated below:

<i>Gymnostachyum glabrum</i>	<i>Gymnostachyum latifolium</i>
Leaves elliptic-lanceolate, base tapering, often decurrent into petiole, margins undulate or toothed, acuminate, main nerves 12-15 pairs, prominent.	Leaves broadly ovate, base rounded or truncate, acute at apex, main nerves 10-14 pairs.
Flowers in terminal racemes.	Flowers in axillary racemes or panicles.
Calyx glandular hairy, segments linear – lanceolate.	Calyx glabrous, segments linear.
Stamens not exerted beyond corolla.	Stamens exerted beyond corolla.
Filaments hairy at base.	Filaments glabrous.
Capsule with glandular hairs.	Capsule glabrous.

Haplanthodes neilgherryensis (Wight) Majumdar Bull. Bot. Soc. Bengal 25: 76. 1971; Sharma et al., Biol. Mem 2 (1 & 2): 106. 1977; Panigr. & Dar, Bull. Bot. Surv. India 23: 201. 1981; Kumari in Henry et al., Fl. Tamil Nadu 2: 148. 1987; Kulkarni, Fl. Sindhudurg 325. 1988; Almeida, Fl. Savantwadi 1: 320. 1990; Vajravelu, Fl. Palghat 349. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 365. 1991; Kothari & Moorthy, Fl. Raigad 300. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 442. 1995; Sasidharan & Sivarajan, Fl. Thrissur 339. 1996. *Haplanthus neilgherryensis* Wight, Ic. t. 1556. 1850; Gamble, Fl. Madras 2: 737. 1967 (repr. ed); Shah, Fl. Gujarat 540.

1978. *Haplanthus tentaculatus* Nees in DC. Prodr. 11. 513. 1847 p.p. *Haplathus tentaculatus* Nees var. *neilgherryensis* (Wight) Clarke in Hook. f., Fl. Brit. India 4: 507. 1884; Cooke, Fl. Bombay 2: 453. 1967 (repr. ed.). *Bremekampia neilgherryensis* (Wight) Sreem. in Bull. Bot. Surv. India 6: 233. 1965; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 346. 1976; Arora et al., Bot. South Kanara 46. 1981.

Prostrate herbs. Stem pubescent hairy, obtusely quadrangular, green, with long internodes; internodes c 7 cm; hairs cottony at base. Leaves simple, opposite, petiolate; petiole c 7 cm long, pale green, decurrent; lamina up to 12 x 7 cm, ovate, cuneate at base, entire along margins, acuminate at apex, lateral veins 8–9 pairs; dark green, sparsely pubescent adaxially, pale green, less pubescent adaxially with 8–9 pairs of veins. Inflorescence axillary as well as terminal spikes, up to c 5 cm long. Cladodes c 1 cm long, linear, slightly two toothed at tip, densely pubescent or villous. Bracteoles c 0.2 cm long, linear, villous. Flowers sessile in midst of cladodes. Calyx lobes 5, c 0.5 cm long, linear, lanceolate, glandular hairy. Corolla tube c 1 cm long, cream coloured at base, pubescent; lobes five, each c 0.4 cm long, lilac–purple with purple veins. Stamens two, inserted slightly above the base of the corolla tube; filaments broad, green; anthers white with stiff hairs. Ovary c 0.2 cm long, cylindrical, conical at apex, pubescent; style c 0.7 cm long, white, purple at the tips. Capsules c 0.8 cm long, oblongoid, pubescent. (Fig. 1 J-P; Plate 1 D).

Fl. & Fr.: January–April.

Habitat: On lateritic slopes or bunds, in open areas and plateaus.

Distribution: Gujarat (Kutch); Maharashtra (Kolhapur, Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Codal, Goa University Campus, Old Goa & Shiroda);

Karnataka (Chikmagalur & Dakshin Kannada); **Kerala** (Calicut, Idukki, Kasaragod, Malappuram, Palghat & Thrissur); **Tamil Nadu** (Coimbatore & Nilgiri). (Map 4).

Status: (LR).

Notes: Forms new report to the state of Goa and found distributed throughout the Western Ghats. In extremely dry conditions, it's leaves turn purple. It is closely related to *Haplanthodes tentaculatus* (Linn.) Majumdar which is distributed in central and western Peninsular India and differ from it as stated below:

<i>Haplanthodes neilgherryensis</i>	<i>Haplanthodes tentaculatus</i>
Flowers in axillary as well as terminal spikes.	Flowers in axillary whorls.
Cladodes linear, erect.	Cladodes broad, curved.

Justicia wynaadensis (Nees) Wall. ex T. Anders. in J. Linn. Soc. Bot. 9: 515. 1867; Clarke in Hook. f., Fl. Brit. India 4: 533. 1885; Vartak, Enum. Pl. Gomantak 82. 1966; Cooke, Fl. Bombay 2: 488. 1967 (repr. ed.); Gamble, Fl. Madras 2: 755. 1967 (repr. ed); Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 552. 1976; Kulkarni, Fl. Sindhudurg 331. 1988; Ramachandran & Nair, Fl. Cannanore 342. 1988; Almeida, Fl. Savantwadi 1: 324. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 335. 1990; Vajravelu, Fl. Palghat 353. 1990; Deshpande et al., Fl. Mahabaleshwar 2: 448. 1995; Sasidharan & Sivarajan, Fl. Thrissur 343. 1996. *Gendarussa wynaadensis* Nees in Wall. Pl. As. Rar. 3: 104. 1832. *Adhatoda wynaadensis* (Nees) Nees in DC. Prodr. 11: 406. 1847.

Suffruticose herbs. Stem smooth, green, glabrous, young parts pubescent. Leaves simple, opposite, decussate, petiolate; petiole c 3 cm long, sparsely pubescent; lamina up to 15 x 6 cm, elliptic-lanceolate, decurrent at base, entire along margins, acuminate at apex, midrib prominent, lateral veins 6-8 pairs; dark green adaxially,

sparsely hairy, pale green abaxially. Inflorescence axillary as well as terminal, lax, bracteate spikes up to 20 cm long, densely pubescent, sometime branched at base. Flowers sessile, in pairs, opposite, decussate. Bracts two, c 0.2 x 0.05 cm, lanceolate, densely pubescent, enclosing a pair of flowers. Bracteoles two, c 0.2 x 0.01cm, linear, enclosing each flower. Calyx tube c 0.2 cm long, campanulate, densely pubescent; teeth 5, c 0.4 cm long, linear, acute. Corolla tube c 0.6 cm long, distinctly 2-lipped, upper lip c 0.3 cm long, hairy inside as well as outside, cream coloured - white with purple veins; lower lip 3-lobed, lobes c 0.3 cm long, acute, triangular, cream coloured with purple spots. Stamens 2, inserted at the base of corolla tube; filaments c 0.3 cm long, cream coloured, glabrous; anthers c 0.1 cm long, pale greenish - brown, 2 celled with a long spur at base, spur white. Ovary c 0.3 cm long, ellipsoid, glabrous, green; style c 0.5 cm long, slightly purple, sparsely hairy. Capsules c 1.5 cm long, densely pubescent, four seeded; seeds rugose with obtuse tubercles. (Fig. 1 Q-S).

Fl. & Fr.: January – March.

Habitat: Open areas along slopes of plateaus, moist deciduous and semievergreen forests.

Distribution: **Maharashtra** (Kolhapur, Ratnagiri, Satara & Sindhudurg); **Goa** (Bandh – St Cruz, Nirankarichi rai & Taleigao); **Karnataka** (Belgaum, Chikmagalur, Coorg, Hassan, Uttar & Dakshin Kannada); **Kerala** (Cannanore, Palghat, Thrissur, Ernakulam, Malappuram & Wyanad); **Tamil Nadu** (Coimbatore, Madurai & Nilgiri). (Map 4).

Status: (LR).

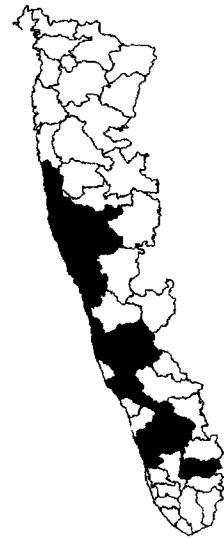
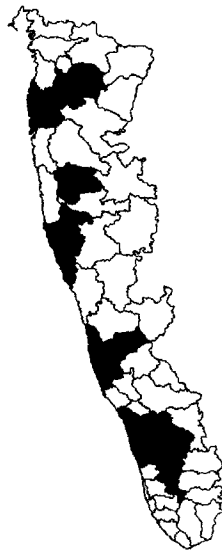
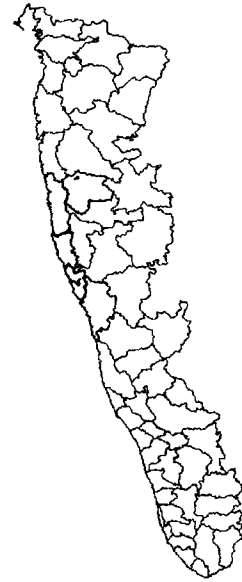
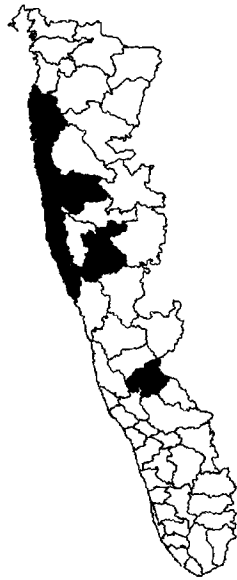


Figure 1: *Barleria strigosa* Willd. var. *terminalis* (Nees) Clarke: A. Habit; B. Inflorescence; C. Stamens. *Gymnostachyum glabrum* (Dalz.) T. Ander.: D. Leaf; E. Calyx; F. Flower; G. L.S of flower; H. Pistil; I. Capsule. *Haplanthodes neilgherryensis* (Wight) Majumdar: J. Leaf; K. Inflorescence; L. Calyx; M. Flower; N. Pistil; O. Stamens; P. Capsule. *Justicia wynaadensis* (Nees) Wall. ex T. Anders: Q. Habit; R. Flower; S. Pistil with calyx.



PLATE 1: A. *Barleria strigosa* Willd. var. *terminalis* (Nees) Clarke, B. *Gymnostachyum glabrum* (Dalz.) T. Ander., C & E. *Mackenzia integrifolia* (Dalz.) Bremek., D. *Haplanthodes neilgherryensis* (Wight) Majumdar, F. *Neuracanthus sphaerostachyus* (Nees) Dalz.

Map 4: Distribution of *Barleria strigosa* var. *terminalis*, *Gymnostachyum glabrum*, *Haplanthodes neilgherryensis* and *Justicia wynaadensis* along Western Ghats.



***Barleria strigosa* Willd. var. *terminalis* (Nees) Clarke**



***Gymnostachyum glabrum* (Dalz.) T. Ander**



***Haplanthodes neilgherryensis* (Wight) Majumdar**



***Justicia wynaadensis* (Nees) Wall. ex T. Anders.**

Notes: Distributed throughout the Western Ghats. This forms new report to the state of Goa. Ahmedullah and Nayar (1986) and Nayar (1996) have not included this in the list of plants endemic to Western Ghats. It is closely related to *J. gendarussa* Burm. which is distributed in India, Sri Lanka and Malacca (Clarke l.c.) but differs from it as stated below:

<i>Justicia wynaadensis</i>	<i>Justicial gendarussa</i>
Flowers in lax spikes.	Flowers clustered in spikes.
Leaves long petioled, elliptic-lanceolate, acuminate at both ends, sparsely hairy; main nerves 6–8, prominent.	Leaves shortly petioled, narrowly lanceolate, glabrous; main nerves 7, not conspicuous.
Capsule densely pubescent.	Capsule glabrous.

Mackenzia integrifolia (Dalz.) Bremek., Mat. Mon. Strob. 182. 1944; Santapau, Fl. Khandala 197. 1967; Arora et al., Bot. South Kanara 47. 1981; Rao, Fl. Goa 2: 329. 1986; Kulkarni, Fl. Sindhudurg 334. 1988; Almeida, Fl. Savantwadi 1: 325. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 337. 1990; Kothari & Moorthy, Fl. Raigad 299. 1993; Naithani et al., Forest Fl. Goa 471. 1997. *Endopogon integrifolius* Dalz. in Kew J. Bot. 2: 343. 1850. *Strobilanthes integrifolius* (Dalz.) Kuntz. Rev. 499. 1891; Clarke in Hook f., Fl. Brit. India 4: 458. 1884; Gamble, Fl. Madras 2: 731. 1967 (repr. ed). *Leptacanthus alatus* Wight, Ic. t. 1527. 1850. *Strobilanthes perfoliatus* T. Anders. in J. Linn. Soc. 9: 471. 1867; Cooke, Fl. Bombay 2: 448. 1967 (repr. ed.); Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 554. 1976.

Erect, branched shrubs up to 3 m high. Stems woody, sparsely pubescent. Leaves simple, opposite, decussate; lamina up to 10 x 4 cm, oblanceolate, auricled at base, decurrent into the petiole, entire along margin, acuminate at apex, dark green adaxially, pale green abaxially. Inflorescence axillary as well as terminal, branched, bracteate spikes, c 9 cm long. Bracts in pairs, c 2 cm long, linear-lanceolate, truncate

at base, acute at apex, with long greenish purple, sticky, glandular hairs. Bracteoles in pairs, c 1.5 cm long, with stiff glandular hairs. Calyx lobes 5, unequal, slightly fused at base, c 1.5 cm long, linear-lanceolate with long stiff glandular hair. Corolla tubes c 2 cm long, purple with yellow throat, hairy; lobes 5, c 1 x 0.5 cm, subequal, orbicular. Stamens 4, didynamous, inserted on the throat of corolla tube; long filaments c 0.7 cm long, hairy at base, short ones c 0.2 cm long, glabrous; anthers yellow, 2-celled. Ovary 2 celled, globose; style c 1.7 cm long, hairy at base. Capsule c 1.5 x 0.5 cm, oblanceolate, cream coloured with persistent calyx, bracts and bracteoles, 2 seeded; seeds supported by hard hooked retinaculæ. (Fig. 2 A-D; Plate 1 C-E).

Fl. & Fr.: December – January.

Habitat: Undergrowth in moist deciduous and semi evergreen forests.

Distribution: **Maharashtra** (Satara, Sindhudurg, Raigad & Thane); **Goa** (Butpal, Caranzol, Cotigao, Dudhsagar, Ordofond & Verlem); **Karnataka** (Coorg, Hassan, Shimoga, Uttar & Dakshin Kannada); **Kerala** (Cannanore). (Map 5).

Status: (LR).

Notes: It is distributed in the northern and central Western Ghats. It can be grown in gardens for its beautiful foliage and flowers.

Neuracanthus sphaerostachyus (Nees) Dalz. in Kew J. Bot. 2: 140. 1850; Clarke in Hook. f., Fl. Brit. India 4: 491. 1884; Santapau in Univ. Bombay Bot. Mem. 2: 66. 1952; Cooke, Fl. Bombay 2: 465. 1967 (repr. ed.); Santapau, Fl. Khandala 203. 1967; Rao, Fl. Goa 2: 329. 1986; Kulkarni, Fl. Sindhudurg 335. 1988; Lakshminarasimhan & Sharma, Fl. Nasik 374. 1991; Kothari & Moorthy, Fl. Raigad 301. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 450. 1995. *Lapidagathis sphaerostachya* Nees in DC. Prodr. 11. 254. 1847. *Neuracanthus lawii* Wight, Ic. t.1531. 1850.

Undershrubs up to 80 cm high. Stems smooth, glabrous or sparsely hairy; internodes up to 7 cm long. Leaves simple, opposite, sessile; lamina up to 8 x 4.2 cm, oblong-ovate, cordate-truncate at base, undulate, scabrid along margins, acute-acuminate at apex, dark green adaxially, with hairs all over, pale green abaxially, veins scabrid. Inflorescence axillary, bracteate spikes up to 5 cm long. Bracts c 1.5 x 1 cm, ovate, 5 nerved, acute-acuminate at apex, purple-rose coloured, with white silky hairs along margins, densely hairy at base. Calyx lobes five, two lipped, c 0.7 cm long, linear, purple-rose pink, with dense silky hairs. Corolla tube white; lobes indistinctly two lipped; upper lip three lobed, dark blue, with ciliate hairs in the folding, densely ciliate on outer side, less on the inner, undulate along margins, lower lip two lobed, blue with white lines, ciliate along margins. Stamens four, didynamous, upper two filaments longer than the lower filaments; anthers two lobed, white, poricidal, enclosed inside the corolla tube; corolla tube densely hairy near the insertion of the stamens. Ovary c 0.1 cm long, cylindrical, stout, glabrous; styles c 0.12 cm long, glabrous; stigma white, flat. Capsules ovoid, glabrous; seeds densely hairy. (Fig. 2 E-I; Plate 1 F).

Fl. & Fr.: August – December.

Habitat: In bushes on plateaus and along the margins of lakes.

Distribution: Gujarat; Maharashtra (Kolhapur, Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Loliem, Makazana & Tilamola). (Map 5).

Status: (LR).

Notes: Restricted to the northern Western Ghats and is comparatively rare in the study area. Closely related to *Neuracanthus trinervis* Wight, which is having comparatively a long spike and also distributed in Western Peninsula.

Nilgirianthus barbatus (Nees) Bremek. in Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41: 172. 1944; Vartak, Enum. Pl. Gomantak 81. 1966; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 555. 1976; Sharma et al., Biol. Mem 2 (1 & 2): 107. 1977; Nair & Nayar, Fl. Courtallum 1: 82. 1986; Kumari in Henry et al., Fl. Tamil Nadu 2: 153. 1987; Kulkarni, Fl. Sindhudurg 336. 1988; Manilal, Fl. Silent valley 208. 1988; Almeida, Fl. Savantwadi 1: 326. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 338. 1990; Vajravelu, Fl. Palghat 356. 1990; Joshi et al., J. Econ. Tax. Bot. 21 (2): 499. 1997. *Strobilanthes barbatus* Nees in Wall. Pl. Asiat. Rar. 3: 85. 1832; Clarke in Hook. f., Fl. Brit. India 4: 437. 1884; Cooke, Fl. Bombay 2: 445. 1967 (repr.ed); Gamble, Fl. Madras 2: 727. 1967 (repr. ed.). *Strobilanthes tetrapteris* Dalz. in Kew J. Bot. 2: 342. 1850.

Erect, woody shrubs up to 3 m high. Stem woody, quadrangular, strongly winged. Leaves simple, opposite, decussate, petiolate; petiole c 2.5 cm long, flattened, strongly winged; lamina up to 22 x 9 cm, elliptic-lanceolate to oblanceolate, coriaceous, decurrent at base, serrate along the margins, acuminate at apex, dark green, glabrous with 8-10 pair of lateral veins adaxially, palegreen abaxially. Inflorescence axillary as well as terminal bracteate spikes; spikes c 5 cm long. Bracts c 1 x 0.7 cm long, orbicular, acuminate at apex, enclosing 4-6 flowers. Bracteoles two, c 1.5 x 0.2 cm, linear-lanceolate, acuminate at apex. Calyx tube c 0.4 cm long, tubular; calyx teeth 5, c 0.6 cm long, unequal, linear. Corolla tube up to 0.7 cm long; lobes 5, acute at apex, with prominent midrib, densely hairy inside. Stamens didynamous; shorter filaments c 0.2 cm long, longer c 0.5 cm long, densely hairy, attached at the middle of the corolla tube; anther 2-celled, white or cream coloured.

Ovary c 0.2 cm long, cylindrical, green, smooth, enclosed by small annulare; style c 1 cm long, glabrous, cream coloured; stigma 2, c 0.3 cm long, unequally winged, flattened, white. Fruit cylindrical, surrounded by annulare, glabrous, green, acute-acuminate at apex; seeds 2, supported on hard retinaculæ, glabrous. (Fig. 2 J-P; Plate 2 A).

Fl. & Fr.: January - February.

Habitat: Near fresh water *Myristica* swamp.

Distribution: **Maharashtra** (Sindhudurg); **Goa** (Nirankarichi rai – Valpoi); **Karnataka** (Chikmagalur, Coorg, Hassan, Uttar & Dakshin Kannada); **Kerala** (Idukki, Kottayam, Palghat & Quilon); **Tamil Nadu** (Coimbatore, Madurai, Nilgiri & Tirunelveli). (Map 5).

Status: (R).

Notes: It is observed to be distributed from Sindhudurg to southern part of the Western Ghats. It is a new report to the State of Goa. It does not flower at regular interval.

Thelepaepale ixiocephala (Benth.) Bremek. in Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede 41: 188. 1944; Santapau, Fl. Khandala 198. 1967; Shah, Fl. Gujarat 555. 1978; Arora et al., Bot. South Kanara 48. 1981; Rao, Fl. Goa 2: 333. 1986; Kumari in Henry et al., Fl. Tamil Nadu 2: 62. 1987; Kulkarni, Fl. Sindhudurg 341. 1988; Almeida, Fl. Savantwadi 1: 332. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 378. 1991; Kothari & Moorthy, Fl. Raigad 298. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 458. 1995; Naithani et al., Forest Fl. Goa 468. 1997. *Strobilanthes ixiocephalus* Benth. in Flora 32: 557. 1849; Clarke in Hook. f., Fl. Brit. India 4: 444. 1884; Vartak, Enum. Pl. Gomantak 81. 1966; Cooke, Fl. Bombay 2: 448. 1967

(repr.ed.); Gamble, Fl. Madras 2: 730. 1967 (repr. ed). *Strobilanthus glutinosa* Graham, Cat. Bom. Pl. 162. 1839, non Nees 1847. *Strobilanthes neesiana* Wight, Ic. t. 1523. 1850.

Erect shrubs, up to 2 m high. Stems obtusely angled, with sparsely placed hairs; hairs soft, with long internodes up to 5 cm long, slightly swollen at base, purple. Leaves simple, opposite, petiolate; petiole up to 8 cm long, pubescent; lamina up to 14 x 4 cm, elliptic-lanceolate, cuneate at base, dentate along margins, acute at apex, dark green adaxially, pale green abaxially, densely hairy on both surfaces; hairs stiff. Inflorescence leaf opposite, bracteate spikes. Peduncle up to 2 cm long, hairy; hairs glandular. Bracts up to 1.5 x 0.5 cm long, cream coloured with green tinge, hairs viscous. Bracteoles up to 0.7 x 0.1 cm, linear–spatulate, creamish with green margins. Calyx tube up to 0.4 cm long, pale green, hairy. Sepals 5, up to 0.6 cm long, linear, pale cream coloured with green veins, tips green with viscous hair. Corolla tube up to 2 cm long, narrow, up to 0.8 cm, enclosed in calyx teeth, inflated above, cream or pale lilac with white veins, throat hairy inside; hairs long stiff, white; lobes 5, c 0.4 x 0.6 cm, pale lilac with white veins, emarginate, obtuse. Stamens didynamous; filaments, white, hairy at base; anthers c 0.3 cm long, white; pollen echinulate. Style white, hairy on one side, slightly coiled near the stigma. Capsules c 1.2 cm long, compressed, obovoid, glabrous, two seeded, seeds ovoid, flattened. (Fig. 2 Q-V; Plate 2 B).

Fl & Fr.: October – January.

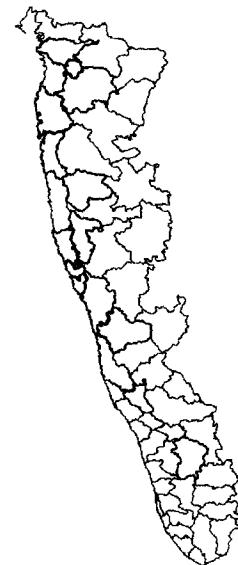
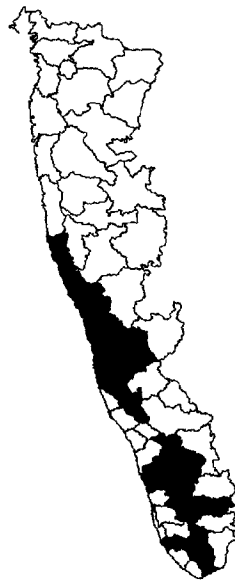
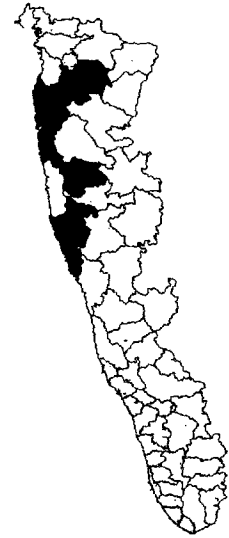
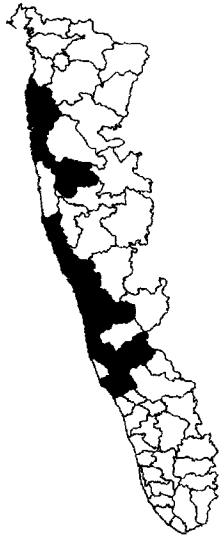
Local name: Pit – karvi.

Habitat: Forms thick carpet of understory in moist deciduous and semievergreen forests of Goa.



Figure 2: *Mackenzia integrifolia* (Dalz.) Bremek: A. Habit; B. Calyx; C. Flower; D. Stamens. *Neuracanthus sphaerostachyus* (Nees) Dalz.: E. Habit; F. Calyx; G. L.S of flower; H. Stamens; I. Pistil. *Nilgirianthus barbatus* (Nees) Bremek.: J. Habit; K. Bract; L. Calyx; M. Flower; N. Stamen; O. Pistil; P. Nutlet. *Thelepaepale ixiocephala* (Benth.) Bremek.: Q. Habit; R. Calyx; S. Flower; T. L.S of flower; U. Corolla lobes; V. Stamens.

Map 5: Distribution of *Mackenzia integrifolia*, *Neuracanthus sphaerostachyus*, *Nilgirianthus barbatus* and *Thelepaepale ixiocephala* along Western Ghats.



● ***Mackenzia integrifolia***
(Dalz.) Bremek.

● ***Nilgirianthus barbatus***
(Nees) Bremek.

● ***Neuracanthus sphaerostachyus***
(Nees) Dalz.

○ ***Thelepaepale ixiocephala***
(Benth.) Bremek.

Distribution: Gujarat (Surat, Dangs); Maharashtra (Kolhapur, Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Butpal, Cabo (Raj Bhavan), Caranzol hill, Chandranath, Cotigao, Dudhsagar, Jamad foresy near Nanorem, Molem, Nanecha Donger on Way between Codal, Nanorem, Tudal, Valpoi & Ambecho gol – Valpoi); Karnataka (Coorg, Shimoga, Uttar & Dakshin Kannada); Kerala (“Hosagaddi”); Tamil Nadu (Coimbatore). (Map 5).

Status: (LR).

Notes: It is distributed throughout the Western Ghats. It is an endemic genus to India and Sri Lanka among the related genera it comes close to *Supushpa scrobiculatus* (Dalz. ex. Clark) Suryan but differs from it as stated below:

<i>Thelepaepale ixiocephala</i>	<i>Supushpa scrobiculatus</i>
Leaves elliptic-lanceolate, densely hairy.	Leaves elliptic-acuminate, nearly glabrous.
Corolla lilac with white veins	Corolla blue.
Capsule two seeded.	Capsule four seeded.
Stamens four, pollen globose, echinate or tubercled.	Stamens six, pollen ellipsoid, longitudinally ribbed.

ALISMATACEAE

Wiesneria triandra (Dalz.) Micheli in A. DC. Monogr. Phan. 3: 82. 1881; Cooke, Fl. Bombay 3: 346. 1967 (repr. ed.); Singh & Kulkarni in Red Data Book Indian Pl. 3: 7. 1990; Mohanan & Henry, Fl. Thiruvananthapuram 500. 1994; Cook, Aqua. Wetland Pl. India 40. 1996. *Sagittaria triandra* Dalz. in Hooker’s J. Bot. Kew Gard. Misc. 2: 144. 1850.

Rooted, emergent, marshy herbs, up to 40 cm high. Stem absent. Leaves simple, petiolate; petiole up to 20 cm long, hollow, succulent, ribbed vertical as well as transverse; lamina up to 15 x 2 cm, linear-lanceolate, stout at base, margin entire, acute at apex, glabrous. Inflorescence with long peduncle; peduncle up to 26 cm long,

stout, trigonous, with 7-9 whorls of flowers, lower two whorls pistillate, upper staminate. Pistillate flowers: Lower whorls with 9 flower, in groups of three. Each whorl subtended by 3 bracts; bracts with sheathing base, c 0.2 x 0.2 cm, truncate. Perianth 3, c 0.4 x 0.2 cm, linear - oblong. Ovary stout c 0.2 cm long, unilocular; stigma bifid, discoid or flattened. Staminate flowers: Stamens 3; filaments very short, white; anthers 2 celled, yellow, basifixed. Fruit a capsule, brown with persistent stigma. (Fig. 3 A-E; Plate 2 C).

Fl. & Fr.: July – October.

Habitat: In temporary water pools on lateritic plateaus.

Distribution: Maharashtra (Ratnagiri & Sindhudurg); Goa (Verna); Karnataka (Dakshin Kannada); Kerala: (Tirvananthapuram). (Map 6).

Status: (VU)

Notes: It is reported to be rare in the Red data book (Singh & Kulkarni l.c.) with scattered distribution only from Sindhudurg and Goa. Recent publications (Mohanani & Henry l.c.) show its extended distribution. Although this species has been published as early as 1850, its distribution is discontinuous, may be due to its habitat specificity and lack of investigation during the monsoons on Plateaus.

ANACARDIACEAE

Holigarna arnottiana Hook. f., Fl. Brit. India 2: 36. 1876; Vartak, Enum. Pl. Gomantak 39. 1966; Cooke, Fl. Bombay 1: 298. 1967 (repr.ed); Gamble, Fl. Madras 1: 191. 1967 (repr. ed.); Sharma et al., Biol. Mem 2 (1 & 2): 35. 1977; Arora et al., Bot. South Kanara 22. 1981; Manilal & Sivarajan, Fl. Calicut 73. 1982; Chitra in Nair & Henry, Fl. Tamil Nadu 1: 87. 1983; Rao, Fl. Goa 1: 93. 1985; Kulkarni, Fl.

Sindhudurg 94. 1988; Ramachandran & Nair, Fl. Cannanore 116. 1988; Almeida, Fl. Savantwadi 1: 111. 1990; Keshava Murthy & Yoganasimhan, Fl. Coorg 123. 1990; Vajravelu, Fl. Palghat 136. 1990; Mohanan & Henry, Fl. Thiruvananthapuram 128. 1994; Almeida, Fl. Maharashtra 1: 288. 1996; Saldanha, Fl. Karnataka 2: 204. 1996; Sasidharan & Sivarajan, Fl. Thrissur 121. 1996; Naithani et al., Forest Fl. Goa 173. 1997. *H. longifolia* Wight & Arn., Prodr. 169. 1834, non Roxb. 1832.

Trees, up to 10 m high with grey-pale brown bark. Leaves simple, alternate, petiolate; petiole c 1–1.5 cm long, stout, flattened, grey with 2 petiolar spur; spur c 0.6 cm long, deciduous; lamina up to 20 x 6 cm, oblanceolate, acute at base; base very narrow, broad above the middle, undulate along margins, acute at apex, lateral veins 10–12 pairs, dark green adaxially, pale green abaxially. Inflorescence terminal, bracteate panicles, up to 15–20 cm long, young parts golden yellow, tomentose; bracts c 0.3 cm long, triangular, acute at apex, tomentose; bracteoles c 0.1 cm long, tomentose; tomentum golden brown. Pedicels c 0.5 cm long, stout, densely tomentose. Calyx tube c 0.4 cm long, campanulate, yellow - brown tomentose; teeth small. Petals 5, c 0.3 x 0.1 cm, linear-lanceolate, acute, triangular at apex, densely woolly, tomentose inside, less tomentose outside. Stamens 5, alternating with petals, c 0.15 cm long, linear, glabrous; anthers small, golden yellow, two celled. Style 3, inserted at the base of the calyx tube, c 0.3 cm long, densely hairy; hairs silvery white at base; stigma 2 lobed, c 0.1 cm long, flattened, brown. Drupe c 2.6 cm long, oblique, ovoid, rounded at top, glabrous. (Fig. 3 F-J; Plate 2 D).

Fl. & Fr.: February – April.

Local name: Ranbibo.

Habitat: Open areas along streams, on plateaus and lowland moist deciduous forests.

Distribution: Maharashtra (Sindhudurg); Goa (Butpal, Bambolim, Codal stream, Nadquem, Netravali & Sanguem); Karnataka (Chikmagalur, Coorg, Hassan, Mysore, Shimoga & Uttar & Dakshin Kannada); Kerala (Calicut, Cannanore, Idukki, Kasaragod, Kottayam, Palghat, Thrissur & Thiruvananthapuram); Tamil Nadu (Coimbatore, Kanniyakumari, Nilgiri & Tirunelveli). (Map 6).

Status: (LR).

Notes: Wood can be easily seasoned and is used in making boats etc. All parts of the tree yield a black resinous juice, which is used as varnish, for waterproofing the boats and furniture. The juice is also used in fixing black pattern on linens and cotton cloth. The leaves are also used as manure. Fruit and bark has medicinal value. It also causes allergy to some people. Its distribution extends from Sindhudurg to Kanniyakumari. It is closely related to *H. ferruginea* March., which is also endemic to Western Ghats. Although both the species are reported from Goa, only *Holigarna arnottiana* could be collected. As shown in the table, the differences between these two species are only quantitative. Specimens in various herbaria also shows overlapping characters. Further instigations are required to ascertain the taxonomic status:

<i>H. arnottiana</i>	<i>H. ferruginea</i>
Leaves oblanceolate, acute at base, acute-acuminate at apex, up to 20 x 6 cm.	Leaves obovate, attenuate at base, obtuse or elongate at apex, up to 14 x 7 cm.
Lateral veins 10–12 pairs	Lateral veins 10 pairs
Petiole c 1.5 cm long.	Petiole c 2.5 cm long.
Flowers 0.3 cm diameter.	Flowers 0.6-0.8cm in diameter.
Terminal buds hairy.	Terminal buds glabrous.

Holigarna grahamii (Wight) Kurz. J. Asiat. Soc. Bengal 42: 305. 1872; Hook. f., Fl. Brit. India 2: 37. 1876; Vartak, Enum. Pl. Gomantak 39. 1966; Cooke, Fl. Bombay 1: 298. 1967 (repr. ed); Gamble, Fl. Madras 1: 191. 1967 (repr. ed.); Santapau, Fl.

Khandala 51: 1967; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 375. 1976; Sharma et al. Biol. Mem 2 (1 & 2): 35: 1977; Yoganarasimhan et al., Fl. Chikmagalur 214. 1981; Chitra in Nair & Henry, Fl. Tamil Nadu 1: 87. 1983; Kulkarni, Fl. Sindhudurg 95. 1988; Almeida, Fl. Savantwadi 1: 111. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 124. 1990; Vajravelu, Fl. Palghat 136. 1990; Deshpande et al., Fl. Mahabaleshwar 1: 148. 1993; Almeida, Fl. Maharashtra 1: 288. 1996; Sasidharan & Sivarajan, Fl. Thrissur 121. 1996; Saldanha, Fl. Karnataka 2: 205. 1996; Naithani et al., Forest Fl. Goa 174. 1997. *Semecarpus grahamii* Wight, Ic. t. 235. 1839. *Holigarna wightii* Balakr. in J. Bombay Nat. Hist. Soc. 63: 327. 1966.

Medium sized trees, up to 10 m high. Branches stout, bark grayish black with lenticels. Leaves simple, alternate, petiolate; petiole c 2.5 cm long, broad, swollen in middle with two appendages; appendages caducous; up to 32 x 15 cm, cuneate at base, broad triangular slightly above the middle, acute-acuminate at apex, lateral veins 20-25 pairs, dark green, coriaceous adaxially, abaxially palegreenish, white, ferruginously pubescent. Inflorescence terminal, panicles up to 16 cm long, ferruginously tomentose. Staminate flowers: Teeth five, small, acute, ferruginously tomentose. Petals 5, villous, hairy inside. Stamens 5, inserted at the disc, cohering at the base. Pistillate flowers in slightly shorter panicles than staminate. Disk thick with raised margins; styles 3-4, unequal in length; stigma capitate, pilose. Drupe shallowly grooved, reddish purple, enclosed in cup shaped torus. (Fig. 3 K- L; Plate 2 E).

Fl & Fr.: January – June.

Local name: Biboi.

Habitat: Evergreen and semievergreen forests.

Distribution: Maharashtra (Satara, Sindhudurg & Thane); Goa (Gaodongrem–Mangal & Molem-Anmod); Karnataka (Belgaum, Chikmagalur, Coorg, Hassan, Mysore, Uttar & Dakshin Kannada); Kerala (Calicut, Cannanore, Palghat, Thrissur & Wyanad); Tamil Nadu (Kanniyakumari & Nilgiri). (Map 6).

Status: (LR).

Notes: Wood is useful in making matches and packing cases. The tree also yield a black juice which is used as varnish. It is distributed throughout the Western Ghats and is distinct among the species distributed in the region. It is closely related to *H. longifolia* which is distributed in Chittagong & Peru (Hook. f. l.c.) and which has leaf with more triangular suddenly acuminate tip.

ANCISTROCLADACEAE

Ancistrocladus heyneanus Wall. ex Graham, Cat. Pl. Bombay 28. 1839; Dyer in Hook. f., Fl. Brit. India 1: 299. 1874; Vartak, Enum. Pl. Gomantak 26. 1966; Cooke, Fl. Bombay 1: 93. 1967 (repr. ed.); Gamble, Fl. Madras 1: 62. 1967 (repr. ed); Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 172. 1976; Sharma et al., Biol. Mem 2 (1 & 2): 18. 1977; Srinivasan in Nair & Henry, Fl. Tamil Nadu 1: 31. 1983; Saldanha, Fl. Karnataka 1: 286. 1984; Rao, Fl. Goa. 1: 31. 1985; Nair & Nayar, Fl. Courtallum 82. 1986; Subramaniam et al., Fl. Palghat 17. 1987; Kulkarni, Fl. Sindhudurg 37. 1988; Manilal, Fl. Silent Valley 24. 1988; Almeida, Fl. Savantwadi 1: 56. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 65. 1990; Vajravelu, Fl. Palghat 76. 1990; Deshpande et al., Fl. Mahabaleshwar 1: 81. 1993; Kothari & Moorthy, Fl. Raigad 25. 1993; Das in Sharma et al. Fl. India 3: 254. 1993; Mohanan

& Henry, Fl. Thiruvananthapuram 76. 1994; Sasidharan & Sivarajan, Fl. Thrissur 57. 1996.

Erect climbing shrubs, bark brown with hooks; hooks coiled, bending downwards. Leaves subopposite, alternate, crowned at the end of branches; lamina up to 26 x 0.7 cm, oblanceolate-oblong, cuneate at base, entire along margins, subacute, midrib prominent, lateral veins 10–12 pairs, darkgreen adaxially, slightly pale green abaxially. Inflorescence a panicle, up to 6 cm long; flowers caducous. Sepals five, c 0.3 x 0.4 cm, obovate, succulent, green, truncate at base, entire along margins, rounded at apex, with prominent reticulate veins. Petals 10, c 0.5 x 0.4 cm, obovate, fleshy, white. Stamens 5, at the base of petals; filaments c 0.1 cm long, stout, broad at base; anthers two celled, small, yellow. Ovary broad; styles three. Fruits with five wings, calyx tube exceeding the fruit. (Fig. 3 M-P; Plate 2 F).

Fl. & Fr.: March – May.

Local name: Khardali.

Habitat: Along the streams in semievergreen forests.

Distribution: Maharashtra (Raigad, Ratnagiri, Satara & Sindhudurg); Goa (Colem – Sonali & Gaodongrem); Karnataka (Chikmagalur, Coorg, Hassan, Shimoga, Uttar & Dakshin Kannada); Kerala (Silent valley, Idukii, Palghat, Pathnamthitta, Quilon, Thrissur & Thiruvananthapuram); Tamil Nadu (Tirunelveli). (Map 6).

Status: (LR).

Notes: It is distributed throughout Western Ghats. This is a new report to the state of Goa. It is closely related to *A. extensus* Wall. which is distributed from Pegu to Tanasserim (Myanmar) and differs from *A. heyneanus* by having calyx tube equaling the fruit.

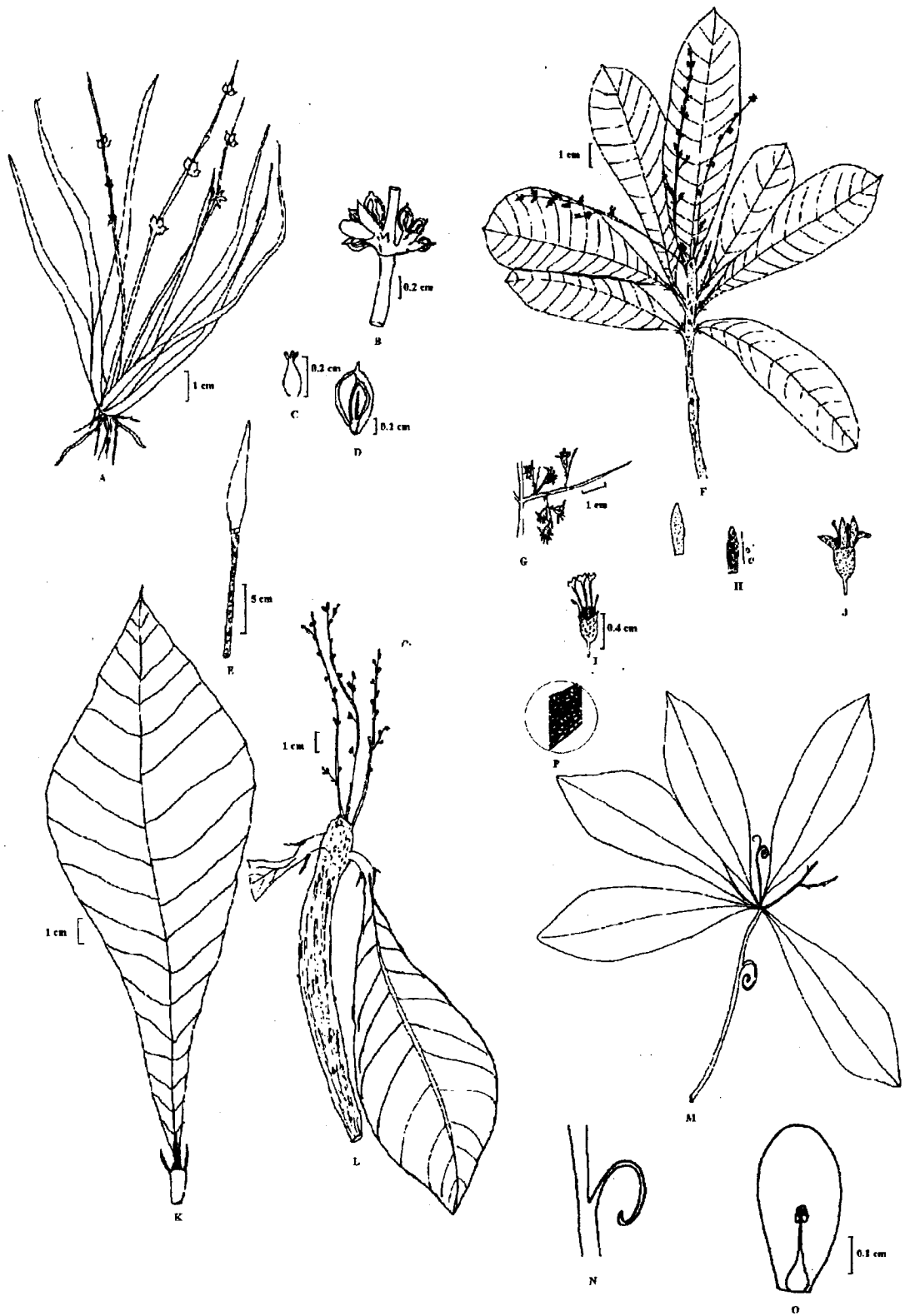
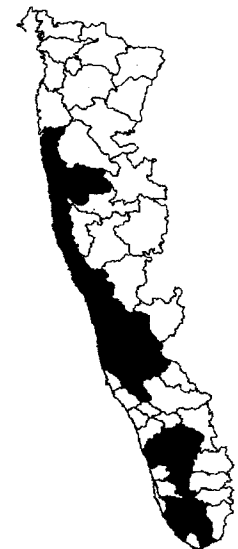
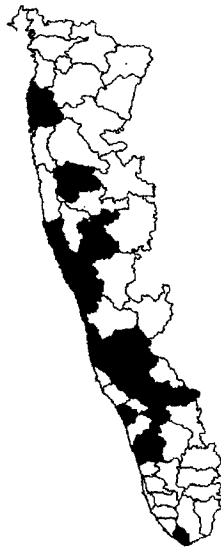
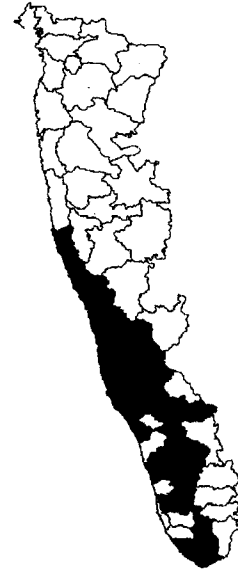
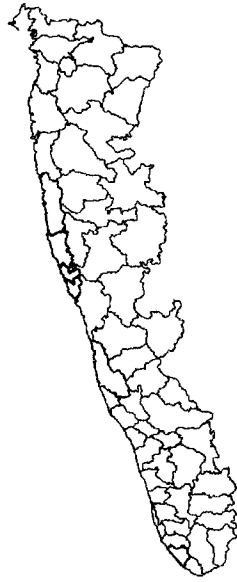


Figure 3: *Wiesneria triandra* (Dalz.) Micheli: A. Habit; B. Fruiting body; C. Ovary; D. Nutlet; E. Leaf. *Holigarna arnottiana* Hook. f.: F. Habit; G. Inflorescence; H. Petal; I. Stamens; J. Flower. *Holigarna grahamii* (Wight) Kurz.: K. Leaf; L. Branch with inflorescence. *Ancistrocladus heyneanus* Wall. ex Graham: M. Habit; N. Hook; O. Petal with stamen; P. Leaf venation pattern.



PLATE 2: A. *Nilgirianthus barbatus* (Nees) Bremek, B. *Thelepaepale ixiocephala* (Benth.) Bremek (inset-close up of flower), C. *Wiesneria triandra* (Dalz.) Micheli, D. *Holigarna arnottiana* Hook. f. (inset - fruit), E. *Holigarna grahamii* (Wight) Kurz. (inset - young fruit), F. *Ancistrocladus heyneanus* Wall. ex Graham.

Map 6: Distribution of *Wiesneria triandra*, *Holigarna arnottiana*, *Holigarna grahamii* and *Ancistrocladus heyneanus* along Western Ghats.



○ *Wiesneria triandra* (Dalz.)
Micheli

● *Holigarna grahamii*
(Wight) Kurz.

● *Holigarna arnottiana* Hook. f.

● *Ancistrocladus heyneanus*
Wall.

ANNONACEAE

Sageraea laurina Dalz. in Kew J. Bot. 3: 207. 1851; Van Heusden in Nord. J. Bot. 17 (1): 45. 1996. *Guatteria laurifolia* Graham, Cat. Bom. 4, 1839, non *Gutteria laurifolia* (SW.) Dunal, Mongor. Anon. 132, t. 32 (1817); Santapau, Fl. Khandala 3. 1967; Ramamurthy in Nair & Henry, Fl. Tamil Nadu 1: 6. 1983; Rao, Fl. Goa 1: 4. 1985; Kulkarni, Fl. Sindhudurg 16. 1988; Almeida, Fl. Savantwadi 1: 35. 1990; Keshava Murthy & Yoganarasimhan. Fl. Coorg 33. 1990; Naithani et al., Forest Fl. Goa 37. 1997. *Bocagea dalzellii* Hook. f. & T.Thom. in Hook. f., Fl. Brit. India 1: 92. 1872.p.p; Cooke Fl. Bombay 1: 18. 1967 (repr. ed.). *Oxandra laurifolia* (SW.) A. Rich. Non. illeg. *Sageraea laurifolia* (Graham) Blatter in J. Bombay Nat. Hist. Soc. 34: 294. 1930; Vartak, Enum. Pl. Gomantak 21. 1966; Saldanha, Fl. Karnataka 1: 49. 1984; Kulkarni, Fl. Sindhudurg 16. 1988; Deshpande et al., Fl. Mahabaleshwar 1: 55. 1993; Kothari & Moorthy, Fl. Raigad 4. 1993; Saldanha, Fl. Karnataka 2: 49. 1984. *Sageraea dalzellii* Bedd. Ic. t. 42. 1868 – 1874; Gamble, Fl. Madras 1: 6. 1967 (repr. ed.); Sasidharan & Sivarajan. Fl. Thrissur 33. 1996.

Medium size trees, up to 9 m high. Bark grayish green, smooth with few lenticels. Leaves simple, alternate, petiolate; petiole c 0.9 cm long, glabrous; lamina up to 25 x 6 cm, oblong–lanceolate, coriaceous, acute at base, entire along margins, acute – bluntly acuminate, mid vein slightly sunken on adaxial side, prominent abaxially, lateral veins inconspicuous, dark green, shining adaxially, pale green abaxially. Flowers in umbell, 4–8 flowered. Bracts 3–4, at base of pedicels, c 0.2 x 0.4 cm, truncate at base, ciliate along margins, rounded at apex, glabrous, green. Pedicels c 0.5 cm long, glabrous, green. Sepals 3, c 0.2 x 0.35 cm, broadly ovate, glabrous, green. Petals 6, arranged in two whorls of 3 each; outer petals c 0.7 x 0.6 cm, broadly

ovate, truncate at base, rounded at apex, fleshy, inner 3 petals, c 0.6 x 0.5 cm, ovate – orbicular. Stamens on torus, c 12–16; connectives projecting above the dorsal anther. Style short, hairy; stigma short. Fruits in the axils of the fallen leaves; fruiting pedicel c 1.5 x 0.5 cm, stout, green, fruits c 3.5 x 2 cm, oblongoid–ovoid, green, glabrous, acrid 6–8 seeded; seeds in two series. (Fig. 4 A- C; Plate 3 A).

Fl. & Fr.: December – February.

Local name: Sajeri.

Habitat: Moist deciduous and semievergreen forests.

Distribution: Maharashtra (Raigad, Satara, Sindhudurg & Thane); Goa (Cotigao & Molem – Anmod); Karnataka (Coorg & Uttar Kannada); Kerala (Thrissur); Tamil Nadu (Coimbatore, Nilgiri & Tirunelveli). (Map 7).

Status: (LR).

Notes: Most of the Floras in the region quoted '*laurifolia*' as the specific epithet , which is illegitimate. Hence, *S. laurina* Dalz. is quoted as correct name following Van Heusden (l.c.). Thoguh this species is distributed throughout the Western Ghats including Tamil Nadu, in Kerala it is recorded for only one district. The reasons for this apparent gap is not known. It is closely related to *S. zeylanica* which is endemic to Sri Lanka and can be distinguished from it as stated below:

<i>Sagarea laurina</i>	<i>Sagarea zeylanica</i>
Lamina coriaceous with broadest part below the middle, up to 25 x 6 cm, pale greenish brown when dry.	Lamina subcoriaceous with broadest part usually near the middle, up to 18 x 6 cm, reddish brown to greenish brown when dry.
Sepals free.	Sepals connate.
Trees up to 10 m high	Trees up to 15 m high.
Petiole c 0.9 cm long.	Petiole c 1.7 cm long.
Pedicel c 0.5 cm long.	Pedicel c 1.7 cm long.
Fruit subglobose – oblongoid.	Fruit subglobose .

ARACEAE

Amorphophallus commutatus (Schott) Engl. in DC. Monogr. 2: 319. 1879 & Pflanze. 48: 95. 1911; Hook, f., Fl. Brit. India 6: 515. 1893; Vartak, Enum. Pl. Gomantak 108. 1966; Cooke, Fl. Bombay 3: 337. 1967 (repr. ed.); Santapau, Fl. Khandala 291. 1967; Shah, Fl. Gujarat 2: 697. 1978; Kulkarni, Fl. Sindhudurg 466. 1988; Almeida, Fl. Savantwadi 2: 53. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 488. 1991; Kothari & Moorthy, Fl. Raigad 420. 1993; Sasidharan & Sivarajan, Fl. Thrissur 483. 1996; Lakshminarasimhan, in Sharma et al., Fl. Maharashtra Monocot. 210. 1996. *Concephallus commutatus* Schott in Bonplandia 7: 28. 1859.

Cormatous herbs; corm up to 10 x 21 cm, spherical-oblongoid, bulbiferous, depressed with roots from top. Leaves solitary, up to 35 cm in diameter, trisected; petiole up to 100 x 6 cm, rough with minute spinules, greenish, variously molted; lamina initially trisected, each segment again dichotomously branched, leaf segments up to 17 x 8 cm, elliptic, decurrent on each side, penninerved, acuminate, intramarginal veins prominent. Peduncles c 42 cm long, rough with minute spinules, spotted with white-purple. Cataphylls long, brown. Spathe c 18 x 9 cm, ovate-elliptic or broadly lanceolate, acute, acuminate, thick, brownish purple-green, with minute spinules in lower portion at base. Spadix c 25 cm long, sessile, exceeding spathe, appendages dark brown to yellow, terete, smooth, spongy, hollow inside, tapering upwards, apex pointed or obtuse. Staminate flowers c 2-6 cm long, below appendage; stamens sessile, rounded; anther yellow with pink lines along dehiscence, neuters absent. Pistillate flowers c 1.6- 5.4 cm long, ovaries numerous, pear shaped, one celled, solitary, basal, style short; stigma disciform. Berry subglobose-obovoid, orange red, one seeded, red at maturity. (Fig. 5 A-C; Plate 3 B & C).

Fl. & Fr.: May – October.

Habitat: Open lateritic plateaus and open areas in moist deciduous forests.

Distribution: Gujarat; Maharashtra (Kolhapur, Raigad, Satara, Sindhudurg & Thane); Goa (Goa University Campus, Dodamarg, Margao, Molem & Verna Plateau); Karnataka: (Shimoga, Uttar & Dakshin Kannada). (Map 7).

Status: (LR).

Notes: It is very common on the lateritic plateaus. It is restricted to the northern and central Western Ghats. The inflorescence is much variable and at times reaches up to 2 m high.

Amorphophallus konkanensis Hettterscheid, Yadav & Patil in *Blumea* 39: 289. 1994; Hettterscheid & Ittenbach. in *Aroideana* 19: 90. 1996; Patil & Yadav in *J. Econ. Tax. Bot.* 22. 191. 1998.

Cormatous herbs, up to 0.5 m high; corms globose, depressed, up to 15 cm in diameter, crowned with roots from top. Leaves solitary, petiolate; petiole up to 100 cm long, smooth, brown or greenish brown mottled with pinkish or whitish vertically elongate streaks; lamina initially trisected, up to 90 cm in diameter, rachis winged, leaf segments up to c 16 x 3 cm, linear-lanceolate, penninerved with distinct intramarginal veins. Culm irregular, c 5 x 6 cm, pale brown-cream. Stalk up to 40 cm long; spathe up to 6 cm long, acute at apex, overlapping at base, dark purple inside, pale with white patches outside. Pistillate flowers c 1 cm long. Ovary globose, stout, three lobed, greenish yellow, situated at base followed by neuters. Neuters 6, c 0.6 x 0.4 cm, stout, ovoid, pale cream-buff coloured. Staminate flowers up to 3 cm long, yellow, matured, flowers at the base. Usually staminate flowers and neuters projecting out of the spathe. Scape c 7 cm long, pale greenish yellow. Fruit a culster of fruiting

berries; berries globose, shining, bright orange when matured . (Fig. 5 D-F; Plate 3 D-E).

Fl. & Fr.: June – July.

Habitat: Near bushes along roadside and on open lateritic plateaus.

Distribution: Maharashtra (Sindhudurg) ; Goa (Dodamarg & Kalem). (Map 7).

Status: (R).

Notes: This species is recently described from Sidhudurgh district of Maharashtra. Later it was reported from Goa by Yadav & Patil (l.c.). Distribution is restricted to the northern Western Ghats. It is the first plant to bloom soon after the first shower of rains in summer and has very short life span. Spathe of this species is much smaller than those of other species in this area. It is very rare in Goa. In general, morphology and colour pattern of *A. konkanensis* is very similar to *A. mysorensis* Barnes & C.E.C. Fischer, from which it differs markedly in the semi – flattened staminodes and basal placentation.

Arisaema sivadasanii Yadav, Patil & Janarthanam, *Aroideana* 2: 53 – 56. 1997.

Herbs with corm; corm c 2.5 cm in diameter, globose, pale brown, wrinkled. Leaves solitary, petiolate; petiole c 50–100 cm long, 2–5 cm in diameter, dark purple with white–cream patches, leaf segments sessile 4–5, c 15 x 5 cm, ovate–lanceolate, cuneate at base, entire along margins, acute–acuminate at apex, darkgreen adaxially, palegreen and shining abaxially with prominent midvein, penninerved with intramarginal venation. Peduncles c 20–30 cm long, arising from the leaf sheath, palegreen, c 1 cm in diameter. Spathe c 9 cm long, tube c 3.5 cm long, tapering towards the base, limbs ovate–oblong, acuminate, slightly bending at right angle to the tube, c

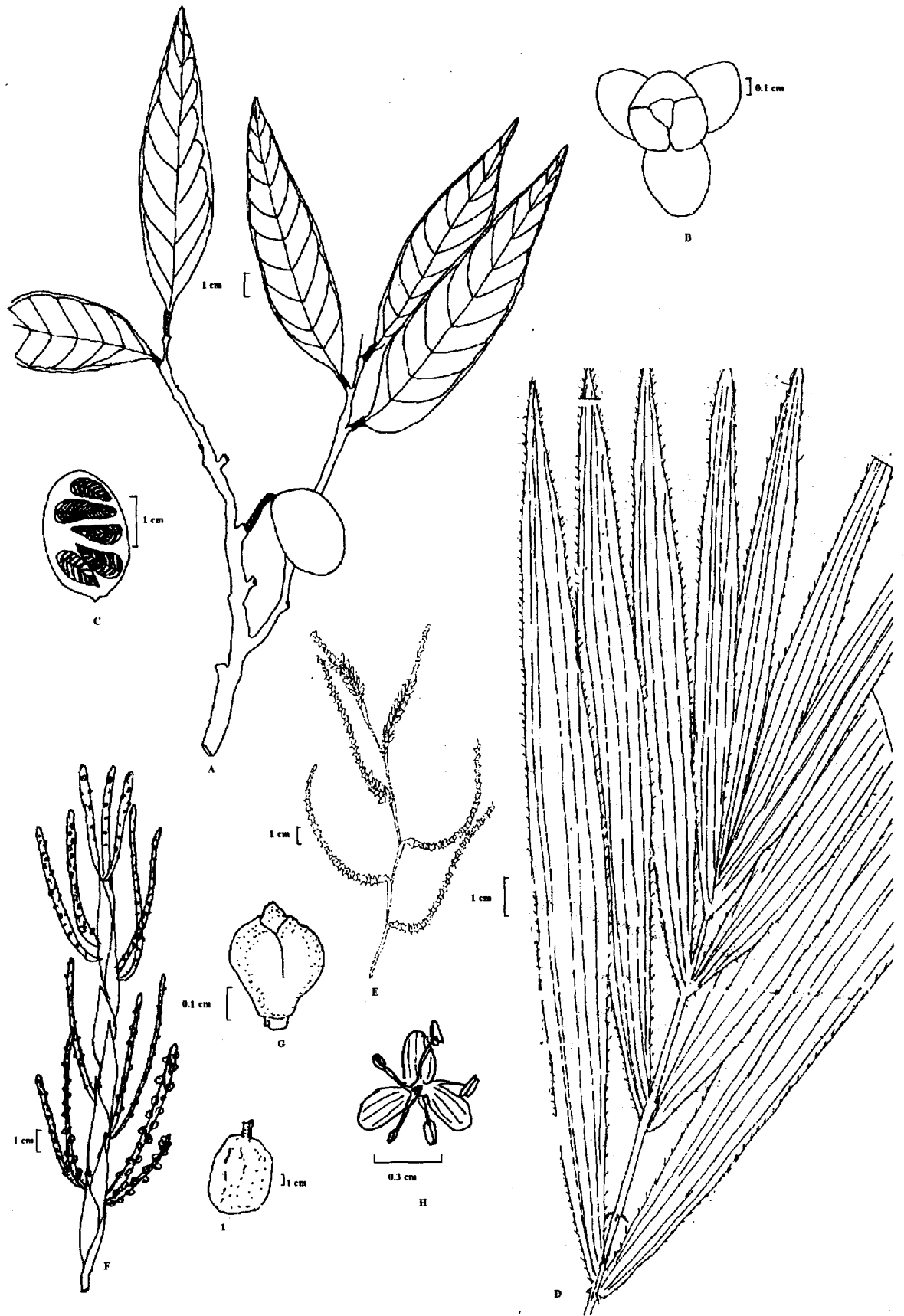


Figure 4: *Sageraea laurina* Dalz.: A. Habit; B. Flower; C. L.S of fruit. *Calamus thwaitesii* Becc. & Hook. f.: D. Leaves; E. Inflorescence. *Hyphaene dichotoma* (Wight) Furtado: F. Spadix; G. Pistillate flower; H. Staminate flower; I. Fruit.

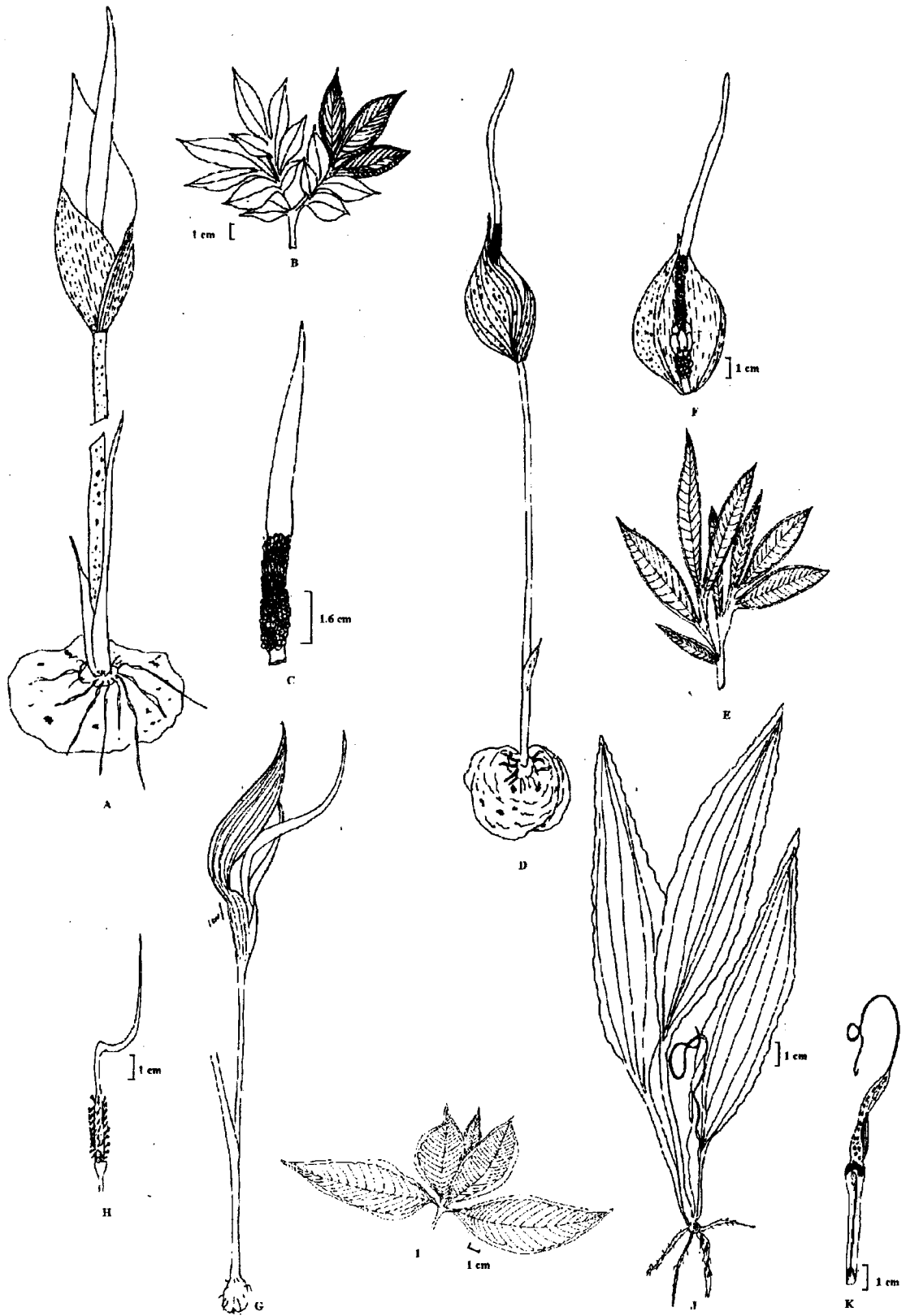
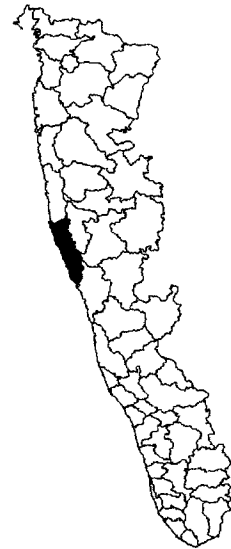
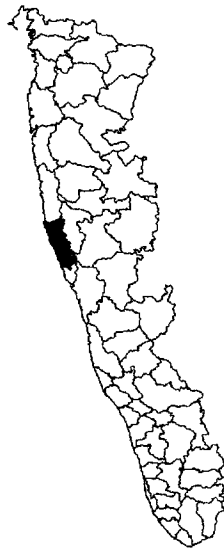
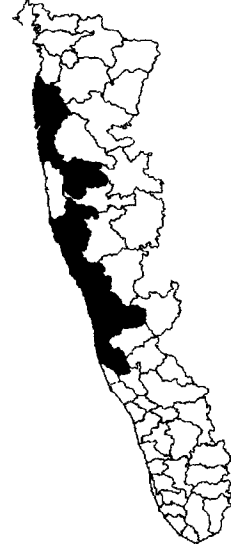
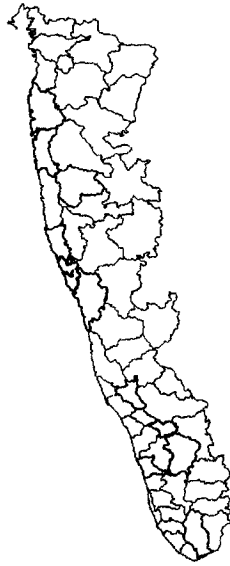


Figure 5: *Amorphophallus commutatus* (Schott.) Engl.: A. Habit; B. Leaves; C. Spadix. *Amorphophallus konkanensis* Hettterschied, Yadav & Patil: D. Habit; E. Leaves; F. Spadix. *Arisaema sivadasanii* Yadav, Patil & Janarthanam: G. Habit; H. Spadix; I. Leaves. *Cryptocoryne cognata* Schott.: J. Habit; K. Spadix.



PLATE 3: A. *Sageraea laurina* Dalz. (inset close up of flower), **B & C.** *Amorphophallus commutatus* (Schott) Engl., **D & E.** *Amorphophallus konkanensis* Hetterschied, Yadav & Patil **F.** *Arisaema sivadasanii* Yadav, Patil & Janarthanam, **G.** *Cryptocoryne cognata* Schott, **H.** *Arenga wightii* Griff.

Map 7: Distribution of *Sageraea laurina*, *Amorphophallus commutatus*, *Amorphophallus konkanensis* and *Arisaema sivadasanii* along Western Ghats.



○ *Sageraea laurina* Dalz.

● *Amorphophallus commutatus* (Schott) Engl.

● *Amorphophallus konkanensis* Hettterschied

● *Arisaema sivadasanii* Yadav, Patil & Janarthanam

5 x 3.7 cm, green. Pistillate flowers at the base, usually in clusters of 2–4 flowers together. Ovary green, sparsely hairy, pear shaped–globose; style short; stigma discoid white; ovules 5–7 basal. Staminate flowers: Inflorescence c 2.5 cm long, stout c 0.5 cm in diameter, palegreen; anthers 3–4 lobed, pale yellow, appendage up to 10 cm long, dark purple, slightly exerted from spathe, acute at apex. (Fig. 5 G-I; Plate 3 F).

Fl & Fr.: July – October.

Habitat: Along the periphery of the forest and roadsides.

Distribution: Maharashtra (Sindhudurg); Goa (Karmal ghat); Karnataka (Uttar Kannada). (Map 7).

Status: (LR).

Notes: It is recently described from Sindhudurg district of Maharashtra. Other than type locality it is also reported from study area during the present work and also observed in the border areas of Karnataka. It is a new report to the State of Goa. It is closely related to *A. neglectum* Schott. and *A. tortulosum* (Wall.) Schott. in its habitat preference, general vegetative morphology and spadix architecture, but differs from them in having a single leaf, a short thick appendage that projects out slightly from the spathe limb.

Cryptocoryne cognata Schott in Bon - Plandia 5: 22. 1857; Hook. f., Fl. Brit. India 6: 494. 1893; Cooke, Fl. Bombay 3: 329.1967 (repr. ed.); Kulkarni, Fl. Sindhudurg 468. 1988; Almeida, Fl. Savantwadi 2: 54. 1990; Singh & Kulkarni in Nayar & Sastry, Red Data Book Indian Pl. 3: 27. 1990; Cook, Aqua. Wetland Pl. India 55. 1996; Lakshminarasimhan, in Sharma et al., Fl. Maharashtra Monocot. 215. 1996.

Perennial herbs with tuberous roots. Leaves 6–8, simple, petiolate; petiole up to 19 cm long, sheathing at base; lamina up to 23 x 3 cm, lanceolate, cuneate at base, undulate along margins, acuminate at apex, mid vein prominent with 7–8 side veins, green, shining. Spathe up to 17 x 0.5 cm, stock c 0.7 cm long, cylindrical, stout, cream coloured, kettle c 3 cm long, white with purple spots inside the tube, tip dark purple; limbs c 13 cm long, with dark purple blotches at base, inner surface purple, tuberculate, outer smooth, purple. Staminate flowers c 0.3 cm long, stout, cylindrical; anthers numerous, yellow, separated from the female flowers by 1.5 cm. Pistillate flowers c 1 x 0.5 cm long; ovaries 5–6 in a whorl; stigma elliptic, borne vertically, white. Capsule c 1.2 x 0.8 cm; seeds numerous, small, c 0.2 cm long, slightly elliptic, curved, brownish black. (Fig. 5 J - K; Plate 3 G).

Fl. & Fr.: September – November.

Habitat: In streams with gravelly bed and clear water.

Distribution: Goa (Bhatachi wadi – Bicholim); Maharashtra (Sindhudurg). (Map 8).

Status: (EN)

Notes: It is distributed in the northern Western Ghats. It is known from only one locality in Goa in a stream with gravelly bed. Reduction in population was observed in the area of collection, probably due to the construction activity in the surrounding areas. It is submerged in water bed with its tubers very deep in the soil. It is reported as endangered in the Red data Book (Singh & Kulkarni, l.c.). It is closely related to *C. retrospiralis* (Roxb.) Kunth. which is distributed in India and Bangladesh (?) but differs from it as shown in the following table:

<i>Cryptocoryne cognata</i>	<i>Cryptocoryne retrospiralis</i>
Spathe tube stout, up to 3 cm long.	Spathe tube up to 14 cm long.
Kettle long (3 cm), not pronounced, throat with collar peculiarly spotted.	Kettle short (2 cm), pronounced, throat without collar.
Limb dark purple inside, somewhat twisted.	Limb red spotted on light grounds inside
Leaf blade broadly lanceolate.	Leaf blade narrowly lanceolate to linear.
Plants of gravelly beds of stream.	Plants of river.

ARECACEAE

Arenga wightii Griff. in Calc. J. Nat. Hist. v. 5: 475. 1845; Hook. f., Fl. Brit. India 6: 422. 1892; Blatt., Palms Brit India & Ceylon 359. 1926; Cooke Fl. Bombay 3: 314. 1967 (repr. ed.); Gamble, Fl. Madras 3: 1087. 1967 (repr. ed.); Ramamoorthy & Gandhi in Saldanha & Nicolson, Fl. Hassan 774. 1976; Dransfield & Moger, J. Linn. Soc. 88: 9. 1984; Ramachandran & Nair, Fl. Cannanore 489. 1988; Karthikeyan et al., Fl. Ind. Enum. Mono. 18. 1989; Vajravelu, Fl. Palghat 526. 1990; Sasidharan & Sivarajan, Fl. Thrissur 121. 1996; Mohanan & Henry, Fl. Thiruvananthapuram 490. 1994; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 490. 1996.

Tall, stout, monoecious palm, forming dense clump by succors; trunk 3–5 feet high. Leaves up to 9 m long; leaflets alternate, 90–120 cm long, linear, ensiform, pale beneath, the margins sparingly toothed from the middle, two auricles at the base, the lower auricles very long, 6–7 cm long, obliquely overlapping the petiole, the apex narrowed, unequally two lobed, jagged-toothed. Spadix decurved, pendulous; peduncle up to 60 cm long, concealed with the sheathing, lacerate spathe. Staminate flowers: Flowers in pairs, distant strongly scented; branches of the spadix 2 feet long, subfastigiate, slender, with scaly bracts at the base of each; buds acute. Sepals three, orbicular, imbricate with thick base. Petals three, oblong, thick, coriaceous. Pistilate

flowers: Branches of the spadix rudimentary at base where they bear rudimentary flowers. Sepals broadly cordate, small. Petals triangular, acute, cuspidate. Stigma three, short recurved. Fruits spirally arranged and crowned on the lower half of the branches of the spadix (upper half naked), globose turbinate, broader than long, much depressed at apex, with persistent stigma. Seeds three, convex on one face, unequally angular on the other naked with branched veins covering the apex of the seed, smooth, brown; albumen uniform. (Plate 3 H).

Fl. & Fr.: November – January.

Habitat: In evergreen forests.

Distribution: Goa (Dudhsagar); Karnataka (Chikmagalur & Uttara Kannada); Kerala (Cannanore, Idukki, Kottayam, Palghat, Quilon, Thrissur & Thiruvananthapuram); Tamil Nadu (Coimbatore). (Map 8).

Status: (LR).

Notes: It is common in evergreen forests of southern Western Ghats. This forms a new report to the state of Goa. It is not observed in flowering and fruiting in Goa. The flower and fruit descriptions are adapted from Cooke (l.c.). It is closely related to *A. westerhoutii* Griff. which is distributed in Malaya and Peninsular Thailand (Dransfield & Moger l.c.) and differs from *A. wightii* by its bifarious leaflets.

Calamus thwaitesii Becc. & Hook. f., Fl. Brit. India 6: 441. 1892; Ramamoorthy & Gandhi in Saldanha & Nicolson, Fl. Hassan 124. 1976; Ramachandran & Nair, Fl. Cannanore 490. 1988; Vajravelu, Fl. Palghat 474. 1990; Renuka, Ratten W. Ghats 51. 1992; Sasidharan & Sivarajan. Fl. Thrissur 480. 1996; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 186. 1996; Naithani et al., Forest Fl. Goa 602. 1997.

C. longisteus Thw. Enum. Plant. Zey. 330. 1864. *C. thwaitesii* Becc. var. *canaranus* Becc. in Ann. Roy. Bot. Gard. Calcutta 11: 138. 1908; Cooke, Fl. Bombay 3: 317. 1967 (repr. ed.).

Robust straggler, stem up to 30 m high with internodes up to 45 cm long with brown spots; sheath yellow, densely armed with spines arising from a raised rim like surface; large spines c 3 x 0.7 cm, flat with small spines scattered in between, black with yellow base; knee absent, ocrea absent, flagellum up to 9 cm long. Leaf compound, petiolate; petiole up to 35 cm long, petiole and rachis yellow, armed with spines; spines arranged in oblique whorls, flat, black; leaflets numerous, up to 80 x 45 cm, sharply spinous along margins and adaxial side of midvein; abaxially with long bristles up to 1 cm long. Inflorescence up to 6 m long, primary sheath up to 10 cm long, split open distally, densely armed with spines; spines arranged in semicircular row, reflexed; secondary sheath up to 3-4 cm long in male rachilla, up to 8 cm long, flowers distichous in female rachilla up to 15 cm long. Male flowers solitary. Fruits c 2 x 1.3 cm, ovoid. Scales in twelve vertical rows, median groove yellow with deep brown margins. (Fig. 4 D-E; Plate 4 A).

Fl. & Fr: February – March.

Habitat: In evergreen and semievergreen forests.

Distribution: Goa (Cotigao, Caranzol in Valpoi, Dudhsagar, Molem–Anmod & Tambdi Surla); Karnataka (Hassan); Kerala (Cannanore & Thrissur). (Map 8).

Status: (LR).

Notes: It is distributed in the northern and central Western Ghats. It is commonly observed along the Ghats. This is one of the best canes available along Western Ghats and is used in making cane furniture and in paper industry.

Hyphaene dichotoma (Wight) Furtado in Gard. Bull. Singapore 25: 209. 1970; Kothari & Moorthy, Fl. Raigad 415. 1993; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 490. 1996. *Borassus dichotoma* Wight in Graham, Cat. Bombay Pl. 226. 1839. *Hyphaene indica* Becc. in Agri. Colon. 2: 173. 1908; Blatt., Palms Brit. India & Ceylon 157, t.33, f. 24. 1926. Rao in J. Bombay nat. Hist. Soc. 60(3): 761-763.1963.

Trees, dichotomously branched. Leaves flattened-multifid, suborbicular, ligulate, petiolated; petiole up to 200 cm long, broad at apex, rounded abaxially, channeled adaxially, flattened near apex, armed with stout spines, broad at base, black; ligule irregular, developed more on one side, margins irregular, spinous; segments about 40, largest on the sides, narrowing at apex into acuminate, point divided in to secondary ridge; primary ribs stout on under surface. Male spadix stout. Spathe tubular, ending at apex on one side in a triangular acuminate limb, covered with dense wooly tomentum, branches of spadix about 6; lowest c 2.5 cm in diameter, bearing about six flowering branchlets, digitately arranged, next bearing five and apical one with two; branches arise from a receptive spathe; branchlets long, axillary part tough, subligneous, no flowers at abase. Flowers three for each scale, straw coloured, globules at the apex, the flowering branchelet, narrows into a small, obtuse tail, devoid of flowers. Female spadix unknown. Fruits obovate-pyriform, attenuate at base, irregularly, rounded in the upper, orange-brown coloured, third pericarp very large in comparison with the seed; sarcocarp well developed at base and sides; endocarp thick on the ventral side; seeds slightly above the center of the fruit obovate. (Fig. 4 F-I; Plate B-D).

Fl. & Fr.: January – April.

Habitat: Along the sea shore in sandy soil.

Distribution: Gujarat (Diu); Maharashtra (Raigad & Thane); Goa (Miramar & Calangute). (Map 8).

Status: (R).

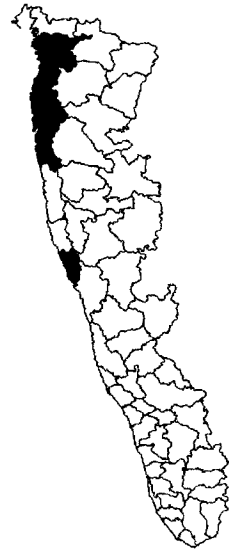
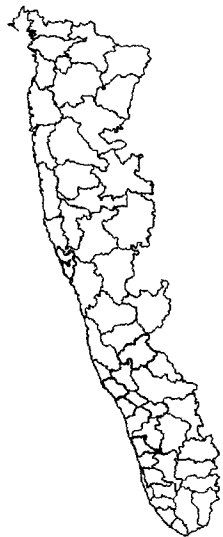
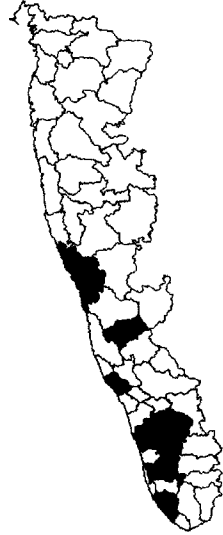
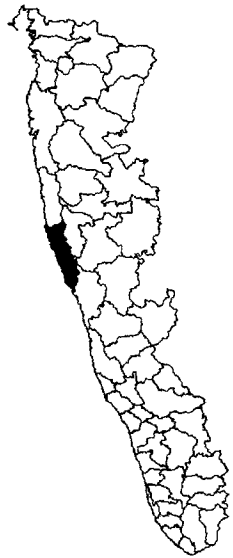
Notes: It is distributed along the coast line of northern Western Ghats. In Goa probably the Portuguese might have introduced it from Daman coast as it could be located only along Miramar and Calangute beaches near the settlements. A lot of confusion with regard to whether it is an endemic or an introduced one (Meher Homji l.c) still exists. However, Dransfield (Pers.com), the authority on palms feels that *H. dichotoma* is indeed endemic to the Western Ghats, although there may be a record also from Sri Lanka. *H. thebaica* Mart. is closely related to it, but so far is restricted to continental Africa where a number of other species also occur. He mentions that in the Peninsula there are a number of odd looking *Hyphaenes* which are not quite *H. thebaica* nor are they quite *H. dichotoma*. And in India both *H. dichotoma* as well as *H. thebaica* are observed in the Botanical gardens. So there is a need for a good modern revision of the genus. He thinks it is quite safe to assume that the western Ghats populations are true *H. dichotoma*. It can be easily distinguished from *Hyphaene thebaica* which is originally from Africa (Bonde, 1987) and associated with *H. dichotoma* in the West Coast near Bombay as stated below:

<i>Hyphaene dichotoma</i>	<i>Hyphaene thebaica</i>
Inflorescence is less hairy with few rhomboidal but not prominent cushions in each spiral.	Inflorescence is more hairy with large distinct rhomboidal tomentose cushion in each spiral distinctly producing outwards.
Fruits ovate, with distinct stalk covered with fine hairs.	Fruits oblong, irregular, with indistinct stalk surrounded by bushy hairs.
Exocarp rough and cracked.	Exocarp smooth and glossy.



PLATE 4: A. *Calamus thwaitesii* Becc. & Hook. f., B & D. *Hyphaene dichotoma* (Wight) Furtado, (D. Fruits), C. *Ceropegia attenuata* Hook., E. *Brachystelma malwanense* Yadav & Singh

Map 8: Distribution of *Cryptocoryne cognata*, *Arenga wightii*, *Calamus thwaitesii* and *Hyphaene dichotoma* along Western Ghats.



Cryptocoryne cognata
Schott



Calamus thwaitesii Becc.



Arenga wightii Griff.



Hyphaene dichotoma (Wight)
Furtado

ASCLEPIADACEAE

Brachystelma malwanense Yadav & Singh in Kew Bull. 48 (1). 59 – 61. 1993.

Erect, tuberous, perennial herbs, c 20 cm high. Stems c 0.4 cm in diameter, terete, hispid, unbranched, purple. Leaves simple, opposite, sessile; lamina up to 6.5 x 1 cm, linear-lanceolate, acute at base, entire along margins, acute-acuminate at apex. Flowering axis with internodes; internodes up to 5 cm long, bearing flowers in whorls at each node. Flowering nodes with two opposite, subulate, reduced leaves, c 0.3 cm long, linear-lanceolate, acute, greenish purple. Flowers 2, in the axils of each reduced leaf, sometimes one. Flowers c 1.2 x 0.8 cm, pedicelate, bracteate; bracts c 0.2 cm long, subulate, pale greenish purple; pedicel c 0.2 cm long, puberulous, green. Corolla divided almost to the base, broad at base, tapering toward the apex, up to 0.7 cm long; corolla lobes c 0.4 cm long, pale greenish yellow with purple spots, hairy above, pale green hairs inside, outside pale purplish green, glabrous with recurved margins. Corona biseriate, outer c 0.4 cm in diameter, cupular, five lobed, each divided into two lobes, with acute apex, dark purple at base, pale green with dark purple spots above with white hairs along the margins; inner corona lobes five, acute, linear, dark purple, bent up to stigma, entire. Pollinia minute, oval, yellow, attached to carrier by short caudicles; carrier brown, glabrous. Pistil c 0.2 mm long, style indistinct; stigma pentangular. (Fig. 6 A-E; Plate 4 E).

Fl. & Fr.: March.

Habitat: Open area with sandy soil.

Distribution: Maharashtra (Sindhudurg) & Goa (Jambavali). (Map 9).

Status: (VU)

Notes: This is a new report to the state of Goa and only locality outside type locality from which the species is known. Due to absence of leaves during flowering it is difficult to locate and identify this species in the field. It is closely related to *B. edulis* Coll. & Hemsl. which is known from Myanmar, Thailand and reported recently from Kolhapur (Yadav & Singh 1993) and differs from it in its generally large size and longer flowering internodes, usually four flowered nodes, broader leaves and corolla lobes with purple hairs.

Ceropegia attenuata Hook. Icon. Pl. t. 869. 1852; Hook. f., Fl. Brit. India 4: 67. 1883; Vartak, Enum. Pl. Gomantak 72. 1966; Cooke, Fl. Bombay 2: 239. 1967 (repr. ed.); Santapau, Fl. Khandala 156. 1967; Ansari, Fascicle, Fl. India 16: 9. 1984; Rao, Fl. Goa 2: 262. 1986; Ansari in Nayar & Sastry, Red Data Book Indian Pl. 1: 49. 1987; Kulkarni, Fl. Sindhudurg 257. 1988; Almeida, Fl. Savantwadi 1: 257. 1990; Kothari & Moorthy, Fl. Raigad 233. 1993. *Ceropegia angustifolia* Dalz. in Kew J. Bot. 2: 259. 1850, non Wight 1834.

Annual, erect, tuberous herbs up to 20 cm high; tubers c 3 x 2 cm, pale brown. Stems scabrous, slightly purple. Leaves simple, opposite, decussate, subsessile; petiole c 0.2 cm long; lamina up to 2 x 0.7 cm, linear-oblong-elliptic, acute at base, rough along margins, acute at apex, darkgreen adaxially, pale green abaxially with prominent mid vein, glabrous on both surfaces. Flowers solitary or 2-3 together arising from the axils of the leaves. Pedicel up to 0.7 cm long, scabrous, reddish brown - purple. Bracts c 0.3 cm long, linear, purple. Sepals 5, c 0.6 x 0.1 cm, linear, pale green at base, apex purple. Corolla tube c 2.5 cm long, pale green with purple spots or patches up to 1 cm, dark purple inside, c 0.5 cm broad and up to 0.7 cm

narrow, pale green with brown spots then slightly inflated, green up to 0.5 cm; corolla lobes 5; each lobe up to 2.5 cm long, green at base and outside, inside with purple spots; lobes slightly triangular, concave up to 0.7 cm long, and linear up to 1.7 cm, pale purple, fused at tip. Corona in two whorls; outer whorl of 5 lobes, ca 0.1 x 0.4 cm with ciliate hairs at apex. Inner whorl of 5 lobes, fused at tip, c 0.3 x 0.1 cm. Anthers 6, alternating with innerwhorls, opposite the outer whorl. Follicle up to 6 cm long, linear-lanceolate, glabrous, green. (Fig. 6 F-H; Plate 4 C).

Fl. & Fr.: August – October.

Habitat: On lateritic rocky slopes on plateaus.

Distribution: Maharashtra (Kolhapur, Raigad, Sindhudurg & Thane) & Goa (Loliem, Kalem & Verna). (Map 9).

Status: (LR).

Chromosome number: 22.

Notes: It is distributed in the northern Western Ghats. It is reported in the Red data book as rare (Ansari l.c.). Tubers are edible. Plant shows lot of variation with regard to corolla length and colour.

Ceropegia fantastica Sedgw. in J. Ind. Bot 2: 124. 1921; Vartak, Enum. Pl. Gomantak 72. 1966; Ansari, Fascicle, Fl. India 16: 15. 1984; Rao, Fl. Goa 2: 262. 1986; Nayar & Sastry, Red Data Book Indian Pl. 1: 56. 1987.

Twining, tuberous herbs; tubers subglobose, glabrous with tuberous hairs. Stem glabrous, twining with long internodes. Leaves up to 2.5 cm long, linear-lanceolate, rounded at base, acute at apex, green, sparsely hairy with 3–5 pairs of lateral veins adaxially, pale abaxially with slight purple tinge. Inflorescence a cyme,

4–8 flowered. Peduncle purple with long stiff ciliate hairs. Pedicels glabrous, smooth, pale purple–green. Sepals 5, c 2.5 cm long, glabrous, purple, incurved at the tip. Corolla c 2 cm long, slightly swollen at base, ca 0.5 x 0.5 cm, dark purple, narrow, tube c 1.2 cm long, pale cream with dark purple blotches; corolla lobes 5, c 0.3 cm long, dark purple, glabrous outside, with long stiff ciliate, purple hairs inside, sparsely placed on the the upper half. Corona two lobed, c 0.3 cm long, purple, outer 5 lobes c 0.16 cm long, linear, glabrous, purple, slightly incurved, inner 5 lobes opposite the outer lobes, subclavate, stout, pale purplish brown, with numerous yellow pollinia. Ovary two, c 0.1 cm long, cylindrical, green; style narrow, two fused at tip; stigma truncate, slightly five lobed. (Fig. 6 I-L; Plate 5 A-B).

Fl. & Fr.: August – September.

Habitat: Growing amidst bushes on lateritic plateaus and in open areas in moist deciduous forests.

Distribution: Goa (Loliem, Kalem – Savordem, along the railway track) & Karnataka (Uttar Kannada). (Map 9).

Status: (EN)

Notes: It is known only from type collections from Uttar Kannada of Karnataka and collections from Goa. In the study area it was observed in two localities, one along the national highway in Loliem and other along the railway track between Kalem and Savordem. Both these areas are under constant human activities hence under threat. Its calyx lobes are longer than corolla lobe a character which differentiates it from all other *Ceropegia* species of Western Ghats.

Heterostemma dalzellii Hook. f., Fl. Brit. India 4: 48. 1883; Cooke, Fl. Bombay 2: 232. 1967 (repr. ed.); Rao, Fl. Goa 2: 263. 1986; Kulkarni, Fl. Sindhudurg 261. 1988; Naithani et al., Forest Fl. Goa 426. 1997.

Twiner. Stem terete, puberulous; hairs bending down wards. Leaves simple, opposite, petiolate; petiole c 2 cm long, pale green, puberulous, glandular; glands adaxially placed at the tip of petiole; lamina up to 15 x 6 cm, ovate-oblong, rounded at base, slightly undulate along margins, acuminate at apex, darkgreen with sparsely placed hairs, palegreen, silvery white with prominent 3 pairs of veins abaxially; veins with few glands. Inflorescence leaf axillary cymes. Peduncle very short, stout, pubescent. Bracts 2, stout, acute, pubescent; bracteoles 2, small, linear, acute, green. Pedicels stout, green, puberulous. Calyx teeth 5, triangular, rounded at apex, green, pubescent. Corolla lobes 5, fused slightly below the middle; lobes oblong, acute, yellow. Corona of 5 large lobes, spatulate; lobes projecting horizontally from staminal column, purple. Staminal column very short; pollen yellow; style depressed, pentagonal, yellowish green. Follicles c 6 cm long, straight, glabrous; seeds oblong, margins narrow. (Fig. 6 M-O; Plate 5 C).

Fl. & Fr.: August – September.

Habitat: Open grasslands and amidst bushes.

Distribution: Maharashtra (Poona & Sindhudurg); Goa (Assnora, Bardez, Bhutpal, Canacona, Ordofond & Porvorim). (Map 9).

Status: (R).

Notes: It is restricted to northern Western Ghats. It is closely related to *H. tanjoverensis* Wight & Arn. which is also endemic to peninsular India, from which it differs by its spatulate corona without appendages. As lot of corona variation is seen

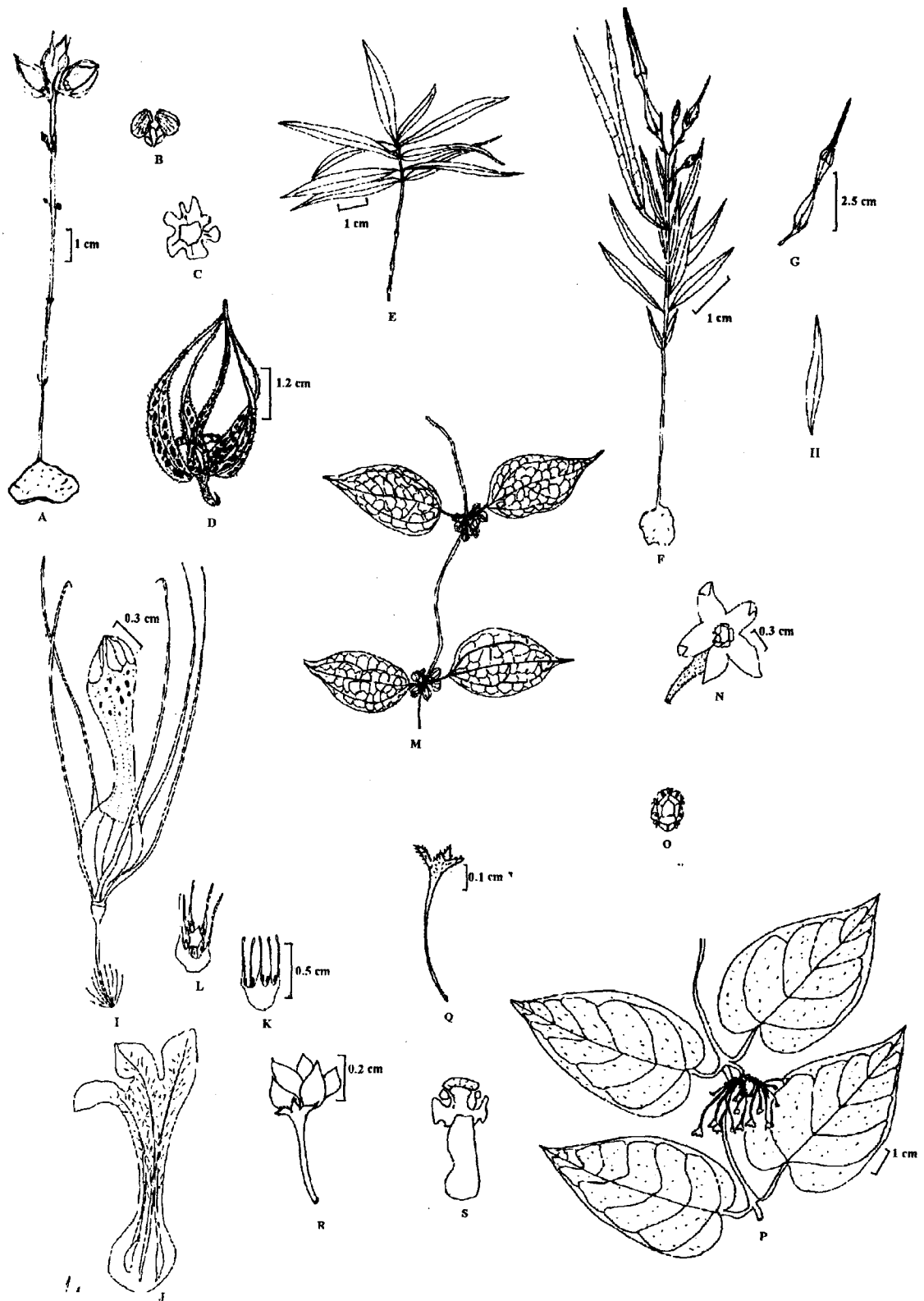
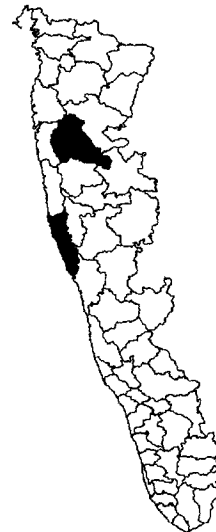
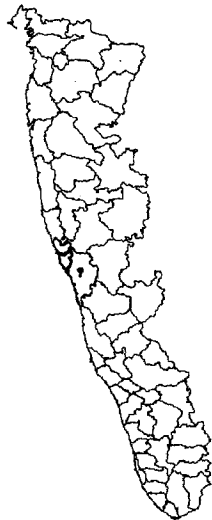
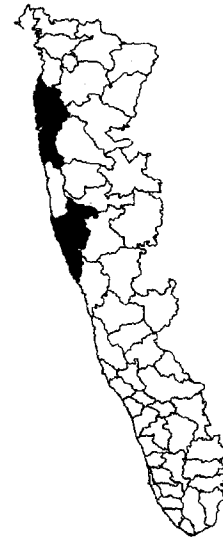
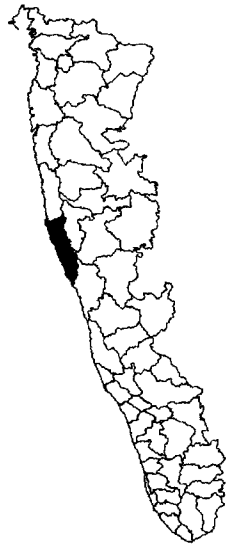


Figure 6: *Brachystelma malwanense* Yadav & Singh: A. Habit; B. Pollinarium; C. Corona; D. Flower; E. Leaves. *Ceropogia attenuata* Hook f.: F. Habit; G. Flower; H. Leaf. *Ceropogia fantastica* Sedgw.: I. Flower; J. L.S of flower; K. & L. Corona. *Heterostemma dalzellii* Hook. f.: M. Habit; N. Flower; O. Corona. *Tylophora dalzellii* Hook f.: P. Habit; Q. Calyx with pedicel; R. Flower; S. V.S. of gynostegium.



PLATE 5: A & B. *Ceropegia fantastica* Sedgw., C. *Heterostemma dalzellii* Hook. f., D. *Tylophora dalzellii* Hook. f, E. *Phyllocephalum tenue* (Clarke) Narayan (inset close up of flower), F. *Phyllocephalum ritchiei* (Hook. f.) Narayan

Map 9: Distribution of *Brachystelma malwanense*, *Ceropegia attenuata*, *Ceropegia fantastica* and *Heterostemma dalzellii* along Western Ghats.



● *Brachystelma malwanense*
Yadav & Singh

○ *Ceropegia fantastica* Sedgw.

● *Ceropegia attenuata* Hook. f.

● *Heterostemma dalzellii* Hook. f.

generally in the family Asclepiadaceae, study of populations of both the species is desirable.

Tylophora dalzellii Hook. f., Fl. Brit. India. 4: 43. 1883; Vartak, Enum. Pl. Gomantak 71. 1966; Cooke, Fl. Bombay 2: 227. 1967 (repr. ed.); Santapau, Fl. Khandala 154. 1967; Bhole, Fl. Saurashtra 30. 1967; Stevens in Saldanha & Nicolson, Fl. Hassan 453. 1976; Yognarasimhan et al., Fl. Chikmagalur 213. 1981; Rao, Fl. Goa 2: 266. 1986; Bole & Pathak, Fl. Saurashtra 2: 74. 1988; Kulkarni, Fl. Sindhudurg 263. 1988; Ramachandran & Nair, Fl. Cannanore 286. 1988; Almeida, Fl. Savantwadi 1: 263. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 284. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 305. 1991; Deshpande et al., Fl. Mahabaleshwar 1: 368. 1993; Kothari & Moorthy, Fl. Raigad 238. 1993; Naithani et al., Forest Fl. Goa 424. 1997. *T. carnos*a Dalz. & Gibs. 150. 1861, non wall. ex Wight 1834.

Perennial twiner with milky latex. Stems glabrous, pubescent when young. Leaves simple, opposite, petiolate; petiole 1.5–2 cm long, pale green–purple, villous; lamina up to 7 x 4 cm, ovate, rounded at base, entire along margins, acute–acuminate at apex, darkgreen with prominent veins, sparsely hairy adaxially, pale green, villous abaxially. Inflorescence leaf axillary, sessile to pedunculate, bracteate cymes in umbells; peduncle c 0.5 cm long, purple, pubescent. Bracts c 0.15 x 0.08 cm, linear–lanceolate, at the insertion of pedicel, hispid, acute, with long hairs along the margins. Pedicel c 0.7 cm long, glabrous. Calyx tube c 0.05 cm long; calyx teeth 5, c 0.1 x 0.05 cm, acute, pale greenish purple, pubescent. Corolla lobes 5, c 0.2 x 0.1 cm, triangular, succulent, purple, glabrous; corona 5 lobed; lobes purple, rounded at base. Pollen

mass minute. Styles 5 lobed, flattened. Follicles c 6.5 cm long, glabrous, faintly striate; seeds ovate-oblong. (Fig. 6 P-S; Plate 5 D).

Fl. & Fr.: August – November.

Habitat: Growing on bushes on lateritic plateaus and open areas.

Distribution: Gujarat (Dangs); Maharashtra (Kolhapur, Nasik, Satara, Sindhudurg & Thane); Goa (Betim, Codal, Goa University Campus, Molem, Netravali, Pernem & Pollem); Karnataka (Chikmagalur, Coorg, Hassan & Uttar Kannada); Kerala (Cannanore & Quilon). (Map 10).

Status: (LR).

Chromosome number: 22 .

Notes: It is distributed throughout Western Ghats. It is closely related to *T. indica* (Burm. f.) Merrill and *T. rotundifolia* Ham. which are distributed in India, Myanmar, Malaya and Sri Lanka and differs from *T. rotundifolia* in much smaller flowers and longer petiole and from *T. indica* by its smaller flowers, shorter sepals and wholly adenate processes.

ASTERACEAE

Phyllocephalum ritchiei (Hook. f.) Narayana in Curr. Sci. 51: 438. 1982; Rao et al. Fl. Indica Enum. Asteraceae 4: 57. 1988; Almedia, Fl. Savantwadi 1: 225. 1990; Uniyal in Hajra et al., Fl. India 13: 341. 1995. *Centrantherum ritchiei* Hook. f., Fl. Brit. India 3: 228. 1881; Cooke, Fl. Bombay 2: 62. 1967 (repr. ed.); Gamble, Fl. Madras 2: 666. 1967 (repr. ed.)

Erect herbs, up to 70 cm high. Stems glabrous, pale green, dichotomously branching; branches purple at base. Leaves simple, petiole arising at the base of each branch; petiole up to 1 cm long, flattened; lamina up to 8 x 3 cm, cuneate at base,

dentate along margins, acute-acuminate at apex, dark green adaxially with stiff hairs spread all over, dense cottony mass abaxially. Inflorescence a head, solitary or in pairs up to 3 cm across. Pedicel up to 1 cm long, sparsely pubescent. Involucral bracts 5, up to 0.8 cm long, cordate at base, acute at apex, glabrous adaxially, pubescent abaxially along the veins. Ligules many, arranged in 2-3 whorls, up to 0.7 cm long, lanceolate, acute at apex, pale yellow or cream coloured at base, purple at tips. Disc florets in the center, pappus unequal, white, ciliate, equalling the corolla tube. Corolla tube up to 0.2 cm long; lobes 5, up to 0.4 cm long, oblong, purple. Stamens 5; anthers white, transparent, 2 celled, break open easily with numerous white pollen. Ovary c 0.2 cm long, ribbed, brown; style up to 0.3 cm long, cream coloured; stigma up to 0.3 cm long, purple. Achenes up to 0.3 cm long, 10 ribbed, oblong, ovoid, brown. (Fig. 7 F-I; Plate 5 F).

Fl. & Fr.: September – October.

Habitat: Near streams and open cut surfaces at slightly higher altitudes in moist deciduous and semievergreen forests.

Distribution: Maharashtra (Sindhudurg); Goa (Netravali, Pednem & Valpoi-Bicholim); Karnataka (Belgaum & Uttar Kannada). (Map 10).

Status: (LR).

Notes: It is restricted to the northern and central Western Ghats. This is a new report to the state of Goa. It is closely related to *P. phyllolaenum* (DC.) Narayana which is also endemic to Western Ghats and differs from it as stated below:

<i>Phyllocephalum ritchiei</i>	<i>Phyllocephalum phyllolaenum</i>
Involucral bracts five, cordate at base.	Involucral bract many, contracted at base.

Phyllocephalum tenue (Clarke) Narayana in Curr. Sci 51: 439. 1982; Rao et al., Fl. Indica. Enum. Asteraceae 57. 1988; Deshpande et al., Fl. Mahabaleshwar 1: 320. 1993; Uniyal in Hajra et al., Fl. India 13: 345. 1995. *Centrantherum tenue* Clarke, Comp. Ind. 4. 1876; Hook. f., Fl. Brit. India 3. 228. 1882; Cooke, Fl. Bomabay 2: 63. 1967 (repr. ed.); Santapau, Fl. Khandala 122. 1967; Arora et al., Bot. South Kanara 37. 1981; Rao, Fl. Goa 2: 227. 1986; Nair & Nayar, Fl. Courtallum 332. 1986.

Erect herbs, up to 1 m high. Stem generally dichotomously branched, pale green with ciliate hairs at the base, young branches purplish green with purple spots. Leaves simple, alternate, lower leaf ⁴ petiolate, upper sessile; lamina up to 8.5 x 4 cm, oblong-elliptic, cuneate at base, serrate along margins with fine bristles, acuminate at apex, dark green with ciliate hairs adaxially, white with cottony hairs abaxially. Heads arising from the leaf axils or terminal, c 1.5 cm across. Involucral bracts 3, outermost c 2.5 x 0.5 cm, linear-lanceolate, green adaxially, white tomentose abaxially with bristles at apex, intermediate bracts smaller than the innermost, green; innermost bracts linear-oblong, acute, pale white with purple tinge. Pappus white, shorter than the corolla tube. Corolla tube c 0.4 cm long, white; lobes 5, c 0.13 cm long, acute, purple. Style c 0.3 cm long, white, stigma two fid, purple. Achenes faintly 10-ribbed, slightly broader at apex, oblong, glabrous. (Fig. 7 J-M; Plate 5 E).

Fl. & Fr.: August -November.

Habitat: On cut surfaces and on lateritic rocks in moist deciduous and semievergreen habitats.

Distribution: Maharashtra (Kolhapur, Satara, Sindhudurg & Thane); Goa (Cotigao, Kerim & Molem); Tamil Nadu (Tirunelveli). (Map 10).

Status: (LR).

Notes: It is discontinuously distributed throughout the Western Ghats as it is not reported from Karnataka & Kerala state, but reported from Tamil Nadu. It is closely related to *P. phyllolaenum* (DC) Narayana which is also endemic to Western Ghats and differs from it as stated below:

<i>Phyllocephalum tenue</i>	<i>Phyllocephalum phyllolaenum</i>
Pappus much shorter than the corolla tube	Pappus equaling the corolla tube.
Outer involucrel bract linear – lanceolate.	Outer involucrel bract leafy, contracted at base.

Senecio belgaumensis (Wight) Clarke, Comp. Ind. 200. 1876; Cooke, Fl. Bombay 2: 111. 1967 (repr. ed.); Rao, Fl. Goa 2: 233. 1986; Kulkarni, Fl. Sindhudurg 227. 1988; Almeida, Fl. Savantwadi 1: 231. 1990; Deshpande et al., Fl. Mahabaleshwar 1: 321. 1993; Kothari & Moorthy, Fl. Raigad 209. 1993; Mathur in Hajra et al., Fl. India 13: 186. 1995. *Madacarpus belgaumensis* Wight, I.c. t. 1152. 1846.

Erect herbs, up to 3 m high. Stem obtusely angled, pubescent. Leaves simple, alternate, petiolate; petiole short; lamina up to 5 x 3 cm, rhomboidal, pubescent adaxially, dense white cottony abaxially, tapering in to very short petiole in lower leaves, auricled at base in upper leaves. Heads yellow, corymbose. Peduncle up to 2 cm long, pubescent, with few scattered bracts; bracts up to 0.2 cm long, linear, pubescent. Pedicel c 0.5 cm long, pubescent. Ligule eight, up to 0.6 x 0.3 cm, linear-oblong, slightly three toothed at apex, middle lobe smaller than the two side lobes. Involucrel bracts hairy, acuminate, green with alternating white. Pappus 0. Corolla tube up to 0.3 cm long, green at base, lobes five, yellow. Anthers fused, c 0.1 cm long, pale brown; filaments very short. Style c 0.2 cm long; stigma two fid. Achene c 0.2 cm long, ribbed, pubescent along the ribs. (Fig. 7 A-E; Plate 6 A).

Fl. & Fr.: October – December.

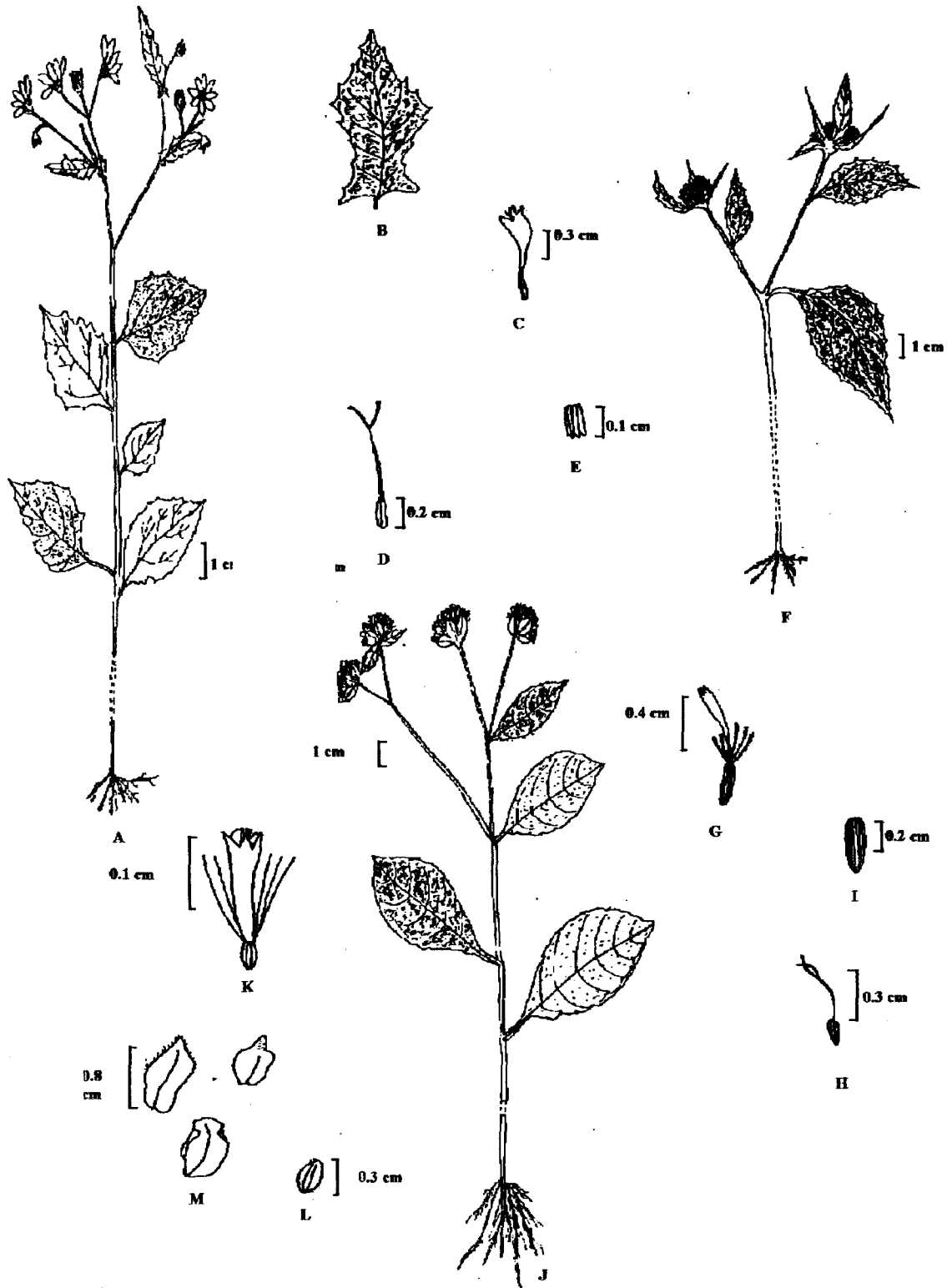
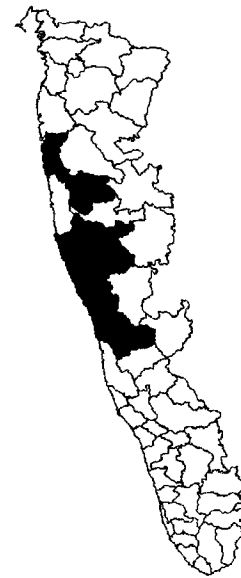
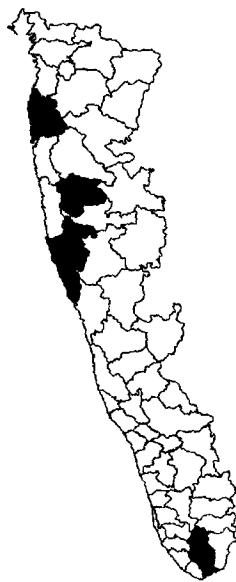
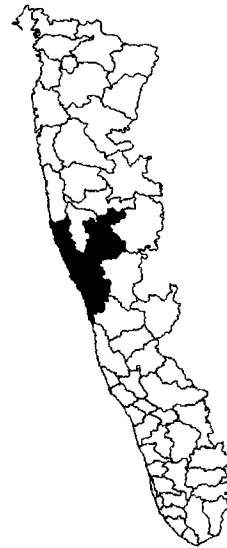
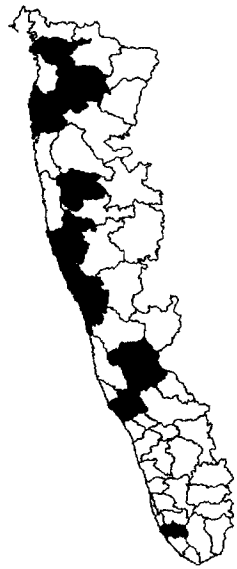


Figure 7: *Senecio belgaumensis* (Wight) Clarke: A. Habit; B. Leaf; C. Flower; D. Pistil; E. Achene. *Phyllocephalum ritchiei* (Hook. f.) Narayana: F. Habit; G. Flower with pappus; H. Pistil; I. Achene. *Phyllocephalum tenue* (Clarke) Narayana: J. Habit; K. Flower with pappus; L. Achene; M. Bracts.

Map 10: Distribution of *Tylophora dalzellii*, *Phyllocephalum ritchiei*, *Phyllocephalum tenue* and *Senecio belgaumensis* along Western Ghats.



● *Tylophora dalzellii* Hook. f.

● *Phyllocephalum ritchiei*
(Hook. f.) Narayan

● *Phyllocephalum tenue*
(Clarke) Narayan

● *Senecio belgaumensis*
(Wight) Clarke

Habitat: On plateaus as well as in clearings of moist deciduous and semi evergreen forests.

Distribution: **Maharashtra** (Kolhapur, Raigad, Satara & Sindhudurg); **Goa** (Dharbandora, Goa University Campus, Molem–Anmod road, Rai & Thivim); **Karnataka** (Belgaum, Shimoga & Uttar Kannada). (Map 10).

Status: (LR).

Notes: It is distributed in the northern and central Western ghats. It can be easily identified in the field as it is the only species without pappus in the study area. It is closely related to *S. bombayensis* Balak. which is distributed in Madya Pradesh, Rajasthan, Gujarat, Maharashtra and Tamil Nadu from which it is differentiated by the absence of pappus.

BALSAMINACEAE

Impatiens kleiniformis Sedgw. in Rec. Bot. Surv. India 6: 351. 1919; Blatter in J. Bombay Nat. Hist. Soc. 36: 311. 1933; Vajravelu in Nair & Henry, Fl. Tamil Nadu 1: 59. 1983; Rao, Fl. Goa 1: 59. 1985; Kulkarni, Fl. Sindhudurg 59. 1988; Saldanha, Fl. Karnataka 2: 254. 1996; Vivekananthan et al. in Hajra et al., Fl. India 4: 164. 1997.

Annual, erect herbs, up to 50 cm high with fibrous roots. Stem succulent, much branched from the base, glabrous, pale greenish yellow with purple spots. Leaves simple, opposite, sessile; lamina up to 19 x 3 cm, linear–lanceolate, cuneate at base, slightly dentate along margins, acute at apex, pubescent, dark green adaxially, glabrous, silvery white with prominent veins abaxially. Flowers in axillary clusters of 2-3 together, c 1.5 cm across. Pedicel up to 2.5 cm long, slender, succulent, green, pubescent; hairs along the the margins. Sepals 2, up to 0.3 cm long, linear, membranous, pale greenish yellow. Standard petals c 0.4 cm long, incurved,

flattened, dentate on back, greenish yellow with purple margins. Wings clawed c 0.7 x 0.5 cm, pinkish purple, lilac at base. Spur, c 1.3 cm long, incurved, pale greenish yellow, apex of the spur broad, slightly boat shaped, pale pink with yellow spots in the center. Anthers cohering, pinkish; filaments lilac, covering the ovary. Ovary c 0.3 cm long, green; stigma sessile, ciliate. Capsules up to 1 cm long, linear, truncate at base, acute at apex. (Fig. 8 A; Plate 6 C).

Fl. & Fr: October - November.

Habitat: Moist, open grassy slopes in moist deciduous and semievergreen forests.

Distribution: **Maharashtra** (Sindhudurg); **Goa** (Ambechagol, Chorla & Keri); **Karnataka** (Belgaum & Uttar Kannada). (Map 11).

Status: (R).

Notes: It is restricted to the northern and central Western Ghats. This species is relatively rare in the state of Goa.

Impatiens pulcherrima Dalz., in Hook. Kew J. Bot 2: 37. 1850; Hook. f., Fl. Brit. India 1: 450. 1879; Cooke, Fl. Bombay 1: 185. 1967 (repr. ed.); Gamble, Fl. Madras 1: 102. 1967 (repr. ed); Rao, Fl. Goa 1: 60. 1985; Kulkarni, Fl. Sindhudurg 60. 1988; Almeida, Fl. Savantwadi 1: 78. 1990; Deshpande et al., Fl. Mahabaleshwar 1: 27. 1993; Kothari & Moorthy, Fl. Raigad 48. 1993; Almeida, Fl. Maharashtra 1: 194. 1996; Saldanha, Fl. Karnataka 2: 256. 1996; Vivekananthan et al. in Hajra et al., Fl. India 4: 198. 1997.

Annual erect herbs, up to 50 cm high with tuberous roots. Stem glabrous, succulent, branching above, pale green, slightly purplish. Leaves simple, alternate, petiolate; petiole up to 1 cm long, reddish purple; lamina up to 7 x 3 cm, oblong-

ovate, membranous, cuneate at base, crenate along margin; margins ciliolate (spinulose), acute-acuminate at apex, dark green, densely pubescent hairy adaxially, glaucous with prominent midvein abaxially; with soft ciliate hairs adaxially. Flowers solitary, axillary, pedicelate; pedicels up to 4 cm long, glabrous. Sepals 2, c 0.3 cm long, linear. Standard petals up to 1 x 1.2 cm, orbicular, bluish pink, notched, spurred with a keel on back. Wings up to 2 x 1 cm, bluish pink. Spur up to 5 cm long, linear, stout, apex boat shaped pinkish. Fruit a capsule, up to 2 cm long, ellipsoid, pubescent, green, glabrous at maturity; fruiting pedicel bending downwards, slightly swollen at base; seeds subglobose, rugose. (Fig. 8 B; Plate 6 E).

Fl. & Fr: November - December.

Habitat: In damp places along mountain slopes in semievergreen forests.

Distribution: Maharashtra (Kolhapur, Raigad, Ratnagiri, Satara & Sindhudurg);

Goa (Bardez, Bhati, Bicholim, on way to Chorla, Tudal, On the way to Harmal beach, Kerim, Paroda, Ponda, Sanguem, Usgao & Verna); Karnataka (Belgaum, Mysore & Uttar Kannada). (Map 11).

Status: (LR).

Notes: It is distributed in the northern and central Western Ghats. It can be grown in the gardens as ornamental plant due to its large flowers. It is closely related to *I. talbotii* Hook.f. and *I. flaccida* Arn. but differs from them as shown below:

<i>I. pulcherrima</i>	<i>I. talbotii</i>	<i>I. flaccida</i>
Flowers solitary, axillary, 2 cm across, pinkish blue.	Flower solitary, 1.5 - 2.5 cm across, pink.	Flowers solitary or in fascicles, 1.5 - 2 cm across, rose purple or pale.
Pedicel c 4 cm long.	Pedicel c 1.2 cm long.	Pedicel c 4.5 cm long.
Spur c 5 cm long.	Spur 2 - 3 cm long.	Spur 3 - 4 cm long.
Fruit pubescent, glabrous at maturity.	Fruit wall pilose or tomentose.	Fruit wall glabrous.
Seeds rugose.	Seeds hirtellous.	Seeds hairy.

BEGONIACEAE

Begonia crenata Dryand. in Trans. Linn. Soc. 1: 162. t. 14. 1791; Clarke in Hook. f., Fl. Brit. India 2: 651. 1879; Vartak, Enum. Pl. Gomantak 57. 1966; Cooke, Fl. Bombay 1: 584. 1967 (repr. ed.); Gamble Fl. Madras 1: 385. 1967 (repr. ed.); Santapau, Fl. Khandala 106. 1967; Shah, Fl. Gujarat 332. 1978; Manilal & Sivarajan, Fl. Calicut 124. 1982; Rao, Fl. Goa 1: 190. 1985; Kulkarni, Fl. Sindhudurg 186. 1988; Almeida, Fl. Savantwadi 1: 191. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 232. 1991; Kumar & Bhattacharyya, J. Econ. Bot. Vol. 16 (3): 566. 1992; Kothari & Moorthy, Fl. Raigad 170. 1993; Deshpande et al., Fl. Mahabaleshwar 1: 260. 1993; Saldanha, Fl. Karnataka 2: 289. 1996. *Begonia minima* Bedd. Ic. Pl. Ind. Or. t. 110. 1874.

Erect herbs with subtuberous roots. Stems very short, succulent, glabrous, reddish. Leaves 3–4, simple, stipulate, petiolate; stipule c 0.3 x 0.1 cm, linear-lanceolate, triangular, acute at apex, glabrous, reddish; petiole c 2 cm long, glabrous, reddish with few scattered glandular hairs; lamina up to 4.5 x 5.2 cm, orbicular, unequally cordate at base, crenate along margins, slightly trilobed; crenate margins with small teeth, acute–obtuse at apex, darkgreen adaxially with sparsely placed stout hairs, silvery white abaxially. Inflorescence a dichotomous bracteate cyme; bracts 2, c 0.12 x 0.07 cm, acute, glabrous, reddish, concave; bracteoles c 0.05 x 0.02 cm, acute; peduncles succulent, reddish with sparsely placed glandular hairs. Staminate flowers: Sepals two, c 0.6 x 0.5 cm, orbicular, rounded at apex, seven nerved at apex, pale pinkish–white with glistening glands. Petals two, c 0.4 x 0.23 cm, oblong-lanceolate, obtuse–acute at apex. Stamens 9–11, fused at base; anthers yellow, dehiscent longitudinally. Pistillate flowers: Perianth segments five, two outer c 0.4 x

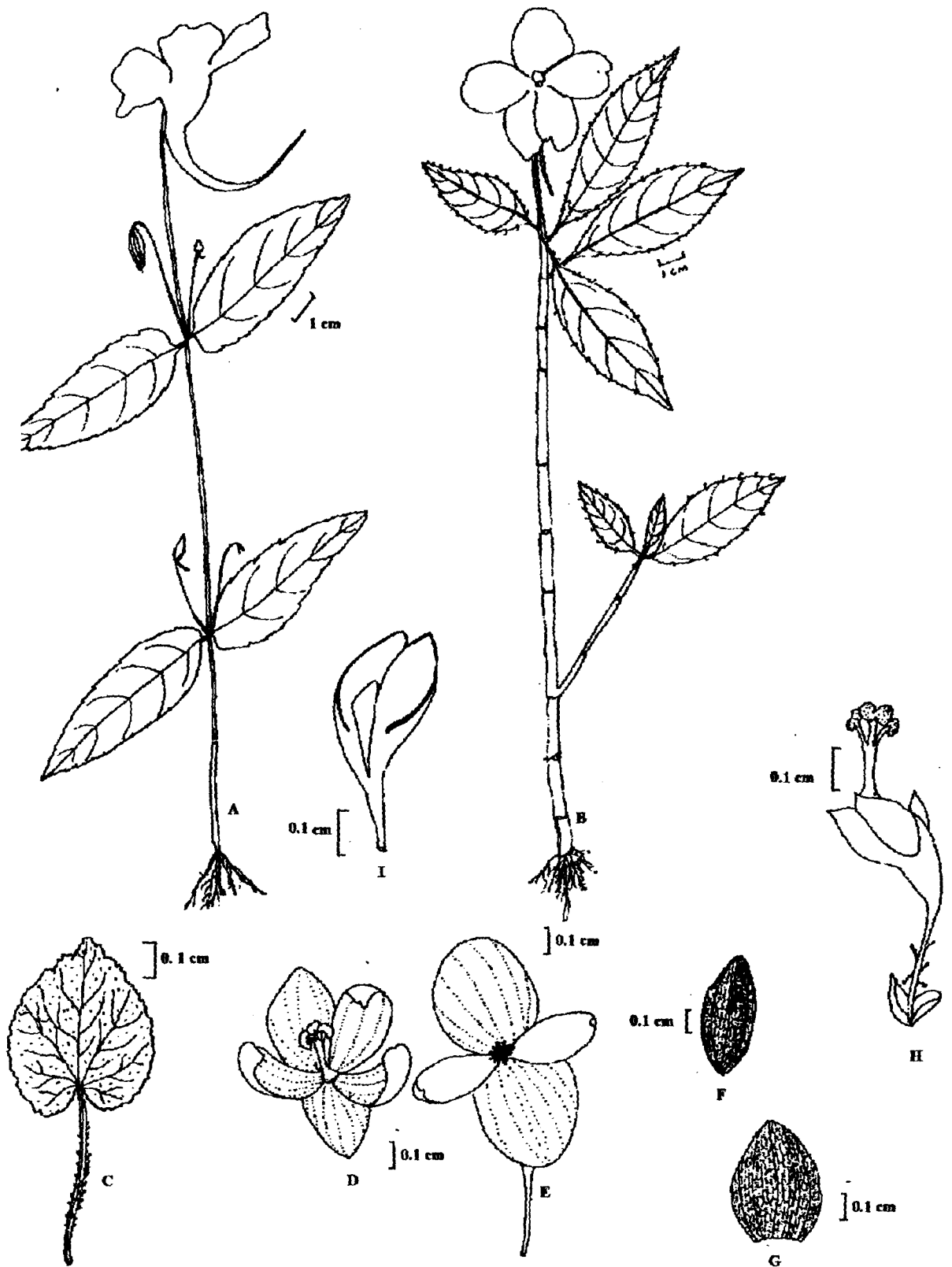


Figure 8: *Impatiens kleiniformis* Sedgw.: A. Habit. *Impatiens pulcherrima* Dalz.: B. Habit. *Begonia crenata* Dryand.: C. Leaf; D. Pistillate flower; E. Staminate flower; F. Sepal; G. Petal; H. Pistil; I. Fruit.



PLATE 6: A. *Senecio belgaumensis* (Wight) Clarke (inset close up of flower), B & D. *Moullava spicata* (Dalz.) Nicolson, C. *Impatiens kleiniformis* Sedgw., E. *Impatiens pulcherrima* Dalz., F. *Begonia crenata* Dryand.

0.3 cm, ovate, obtuse at apex, five nerved, pale pink with glistening glands; inner three, c 0.47 x 0.15 cm long, obtuse at apex, sometimes two lobed, three nerved. Ovary c 0.4 x 0.3 cm, three winged; one wing much shorter than other two, glabrous, pale, greenish red, two celled; style three, fused, up to 0.12 cm long, free up to 0.07 cm; stigma dumbbell shaped, yellow, hairy. Capsules membranous, three winged, wings equal; seeds minute, ellipsoid. (Fig. 8 C-I; Plate 6 F).

Fl. & Fr.: July – October.

Local name: Mutya.

Habitat: On moist and damp lateritic rocks during monsoons.

Distribution: Gujarat; Maharashtra (Kolhapur, Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Bardez, Borim, Cortalim, Molem, Ordofond, Taleigao, Usgao & Verna); Karnataka (Chikmagalur, Mysore, Uttar & Dakshin Kannada); Kerala (Calicut, Kasaragod & Wyanad); Tamil Nadu (Coimbatore). (Map 11).

Status: (LR).

Chromosome number: 56. (2n)

Notes: It is distributed throughout the Western Ghats. Its leaves are valued chiefly for their ornamental foliage purpose. Closely related to *B. canarana* Miq. which is also distributed along the Western Ghats and has unequally winged capsule and cordate leaf base.

BORAGINACEAE

Adelocaryum coelestinum (Lindl.) Brand in Fedde, Repert. 13: 549. 1915 & in Pfreich. 78, f. 8; Santapau, Fl. Khandala 167. 1967; Rao, Fl. Goa 2: 275. 1986; Kulkarni, Fl. Sindhudurg 274. 1988; Keshava Murthy & Yoganarasimhan, Fl. Coorg 292. 1990; Lakshminarasimhan & Sharma Fl. Nasik 313. 1991 Kothari & Moorthy,

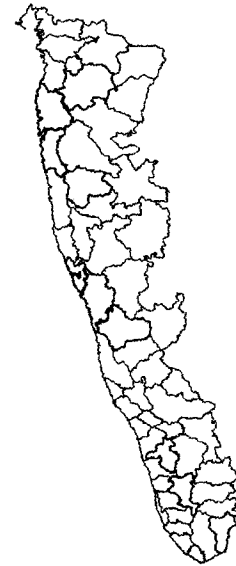
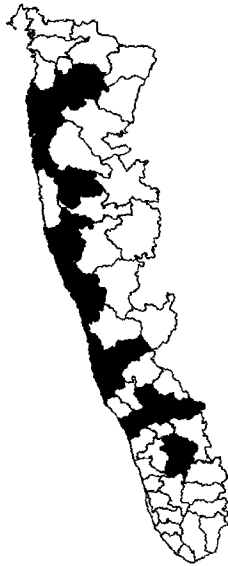
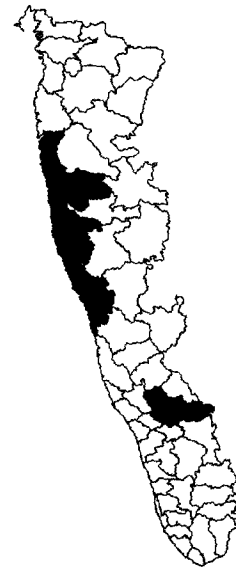
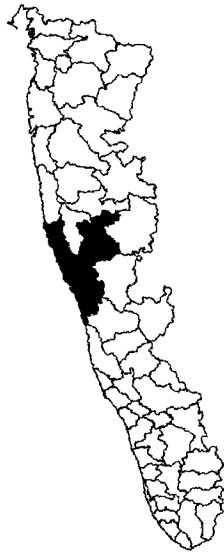
Fl. Raigad 252. 1993; Deshpande et al., Fl. Mahabaleshwar 1: 380. 1993. *Cynoglossum coelestinum* Lindl. in Bot. Reg. 25: t. 36. 1839. *Echinosperrum coelestinum* Wight, Icon. t. 1394, 1850. *Paracaryum coelestinum* Benth. & Hook f. Gen. Pl. 2: 850. 1876; Clarke in Hook, f., Fl. Brit. India 4: 160; Cooke, Fl. Bombay 2: 287. 1967 (repr. ed.); Gamble, Fl. Madras 2: 633. 1967 (repr. ed.).

Erect herbs, up to 1 m high. Stem green to red, pubescent hairy; hair white, appressed, Leaves simple, alternate, subsessile, lower leaves shortly petiolate; lamina up to 15 x 8 cm, oblong-ovate, cuneate at base, ciliate along margins, apiculate at apex, upper leaves much smaller, up to 5 x 4 cm, sessile, darkgreen, scabrous with sparse white hairs adaxially, pale green with prominent veins abaxially, white hairs along the veins; veins slightly reddish. Inflorescence a terminal, dichotomously branched, ebracteate raceme. Pedicels up to 0.2 cm long, pale green, hairy. Sepals five, ovate-oblong, up to 0.3 x 0.1 cm, pale green, hairy, ciliate along margins. Corolla tube up to 0.3 cm long, pale blue; lobes five, up to 0.3 x 0.2 cm, suborbicular, spreading with small bilobed or notched scales at the mouth of the corolla tube, pale blue with dark center. Stamens five; filaments five c 0.1 cm long, white; anthers five, c 0.1 cm long, yellowish black, included inside the corolla tube. Ovary four lobed, pale greenish yellow; style c 0.2 cm long, pale green; stigma capitate. Fruit up to 0.5 x 1 cm, pyramidal with prominent margins; margins bristly, hooked; nutlets four, broadly ovate, acute. (Plate 7 C).

Fl. & Fr.: September - November.

Habitat: In cool places in moist deciduous and semievergreen forests.

Map 11: Distribution of *Impatiens kleiniformis*, *Impatiens pulcherrima*, *Begonia crenata* and *Adelocaryum coelestinum* along Western Ghats.



● *Impatiens kleiniformis* Sedgw.

● *Impatiens pulcherrima* Dalz.

● *Begonia crenata* Dryand.

○ *Adelocaryum coelestinum* (Lindl.)

Distribution: Maharashtra (Nasik, Raigad, Satara & Thane); Goa (Dinarai forest & Molem); Karnataka (Shimoga & Uttar Kannada); Kerala (Idukki & Palghat); Tamil Nadu (Kanniyakumari, Nilgiris & Travancore). (Map 11).

Status: (R).

Note: It is discontinuously distributed throughout the Western Ghats. Although distributed throughout the Western Ghats it is quite rare in the study area. It is related to *A. malabaricum* Clarke from which it differs by its pale blue corolla and included stamens.

CAESALPINIACEAE

Moullava spicata (Dalz.) Nicolson in Manilal, Bot. & Hist. Hort. Malab. 184. 1980; Yoganarasimhan et al., Fl. Chikmagalur 217. 1981; Manilal & Sivarajan, Fl. Calicut 98. 1982; Saldanha, Fl. Karnataka 1: 392. 1984; Ramachandran & Nair, Fl. Cannanore 167. 1988; Almeida, Fl. Savantwadi 1: 155. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 172. 1990; Vajravelu, Fl. Palghat 183. 1990; Deshpande et al., Fl. Mahabaleshwar 1: 207. 1993; Kothari & Moorthy, Fl. Raigad 127. 1993; Naithani et al., Forest Fl. Goa 243. 1997. *Caesalpinia spicata* Dalz. in Hook J. Bot. Kew Gard. Misc 3: 90. 1851. *Wagatea spicata* (Dalz.) Wight, Ic. t. 1995. 1853; Hook. f., Fl. Brit. India 2: 273. 1878; Vartak, Enum. Pl. Gomantak 46. 1966; Cooke, Fl. Bombay 1: 443. 1967(repr. ed.); Gamble, Fl. Madras 1: 281. 1967 (repr. ed); Santapau, Fl. Khandala 78. 1967; Gandhi in Saldanha & Nicolson, Fl. Hassan 225. 1976; Arora et al., Bot. South Kanara 28. 1981; Rao, Fl. Goa 1: 148. 1985; Kulkarni, Fl. Sindhudurg 145. 1988. *Caesalpinia digyna* Graham, Cat. Pl. Bombay. 60.1839, non Rottl. 1830.

Woody straggler. Stem woody, purple, slightly powdery with sharp recurved spines or prickles. Leaves compound; rachis c 11 cm long, purple with seven pairs of leaflets; petiole c 0.2 cm long with two recurved prickles abaxially; leaflets c 3.5 x 1.7 cm, obovate, unequal at base, entire along margins, obtuse at apex, dark green, shining adaxially, pale green with prominent midrib abaxially. Inflorescence a terminal spicate raceme, up to 1 m high. Flowers bracteate, bracts c 0.5 cm long, linear, acute, scarlet when young; peduncle very short, stout. Calyx tube c 0.5 cm long, campanulate, bright orange - scarlet with sticky fluid; calyx teeth five, c 0.7 x 0.4 cm, spatulate, incurved, scarlet sometimes tips pale yellow, succulent or membranous, pubescent. Petals five, c 1 x 0.2 cm, linear, spatulate, yellow, pubescent, inserted at the base of the calyx tube. Stamens 9-10; filaments pubescent, broad, flattened at base, inserted at the base of the calyx tube; anthers brownish black. Ovary enclosed inside the calyx tube, flattened, pubescent, pale green; style flattened, greenish yellow; stigma two. Pods c 5 cm long, purple, incurved, pubescent or velvety when young, linear-oblong, swollen above the seeds otherwise flattened; seeds 3- 4, obovoid-oblongoid. (Fig. 9 A-E; Plate 6 B-D).

Fl. & Fr.: November - January.

Local name: Vagati.

Habitat: On bushes on plateaus, open areas and moist deciduous forests along the Ghats.

Distribution: Gujarat; Maharashtra (Raigad, Satara, Sindhudurg & Thane); Goa (Bambolim, Chandranath, Codal, Cortalim, Molem, Rashol & Verna); Karnataka (Belgaum, Chikmagalur, Coorg, Hassan, Mysore, Shimoga, Uttar & Dakshin

Kannada); **Kerala** (Calicut, Cannalore, Kasaragod, Mallapuram, Palghat & Wyanad).
(Map 12).

Status: (LR).

Notes: This is a monotypic genus and it has adapted itself very well to the various environmental conditions. The inflorescence is showy and attract insects and birds for pollination. Pods are similar to *C. digyna* Rott. which is distributed from W. Peninsula-Himalaya. Ahmedullah and Nayar (1986) reported it for Uttar Kannada, Shimoga and Wyanad, at lower altitudes but its distribution extends up to Gujarat.

CAPPARACEAE

Capparis rheedii DC., Prodr. 1: 246. 1824; Vartak, Enum. Pl. Gomantak 61. 1966; Nicolson in Bull. Bot. Surv. India 17: 161. 1975; Srinivasan in Henry et al., Fl. Tamil Nadu 1: 14. 1983; Saldanha, Fl. Karnataka 1: 314. 1984; Nair & Nayar, Fl. Courtallum. 89. 1986; Raghavan in Nayar & Sastry, Red Data Book Indian Pl. 1: 107. 1987; Raghavan in Fl. India 2: 286. 1993; Mohanan & Henry, Fl. Thiruvananthapuram 55. 1994; Almeida, Fl. Maharashtra 47. 1996; Sasidharan & Sivarajan, Fl. Thrissur 40. 1996; Naithani et al. , Forest Fl. Goa 49. 1997. *C. heyneana* Wall. ex Wight & Arn. Prodr. 25. 1834; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1: 174. 1872; Cooke, Fl. Bombay 1: 48. 1967 (repr. ed.); Gamble, Fl. Madras 1: 45. 1967 (repr. ed.). *C. baducca* auct. non Linn. 1753.

Erect shrubs, up to 5 m tall; young branches with brown tomentum, glabrous, scabrid at maturity. Leaves simple, alternate, petiolate, stipulate; stipules modified in to spines; spines very small, straight; petioles c 0.7 cm long, flattened; lamina up to 10 x 3.7 cm, elliptic-lanceolate, acute at base, entire along margins, acute at apex

coriaceous, dark green, glabrous, shining adaxially with four pair of lateral nerves, young leaves with brown tomentum. Flowers solitary, axillary, pedicelate, c 7.5 cm across; pedicel c 2.5 cm long, tomentose brown when young, glabrous at maturity. Sepals four, outer two c 1.2 x 0.6 cm, sparsely pubescent, brown, villous, white on the inside margins; inner two c 1.5 x 0.6 cm, pale white, tomentose, pale green inside. Petals four, c 3.5 cm long, upper two obovate, pale blue – greyish white, upper pair with a yellow blotch at the base. Stamens 80 – 100; filaments long, exerted. Berry c 4 cm long, ovoid. (Fig. 9 G-J; Plate 7 A-B).

Fl. & Fr.: March – May.

Habitat: In semievergreen forests.

Distribution: Goa (Molem – Anmod, Colem & Tamdi surla); **Karnataka** (Uttar & Dakshin Kannada); **Kerala** (Cannanore, Kasaragod, Palghat, Thrissur, Trichur & Tirvananthapuram); **Tamil Nadu** (Kanniyakumari, Quilon & Tirunelveli). (Map 12).

Status: (LR).

Notes: It is restricted to semi evergreen forests of southern Western Ghats. It is reported as rare in the Red Data book (Raghavan, l.c.), but it was observed to be quite common in the semievergreen forests of Goa. Its flowers are showy and the plant can be grown in gardens as an ornamental. It is closely related to *C. brevispina* which is distributed in Peninsular India and Sri Lanka and differs from it as stated below:

<i>Capparis rheedii</i>	<i>Capparis brevispina</i>
Leaf base acute.	Leaf base cuneate.
Petals pale blue changing to white with yellow blotches at the base of upper pair.	Petal oblong, creamy yellow, upper two with orange – yellow blotches at base.

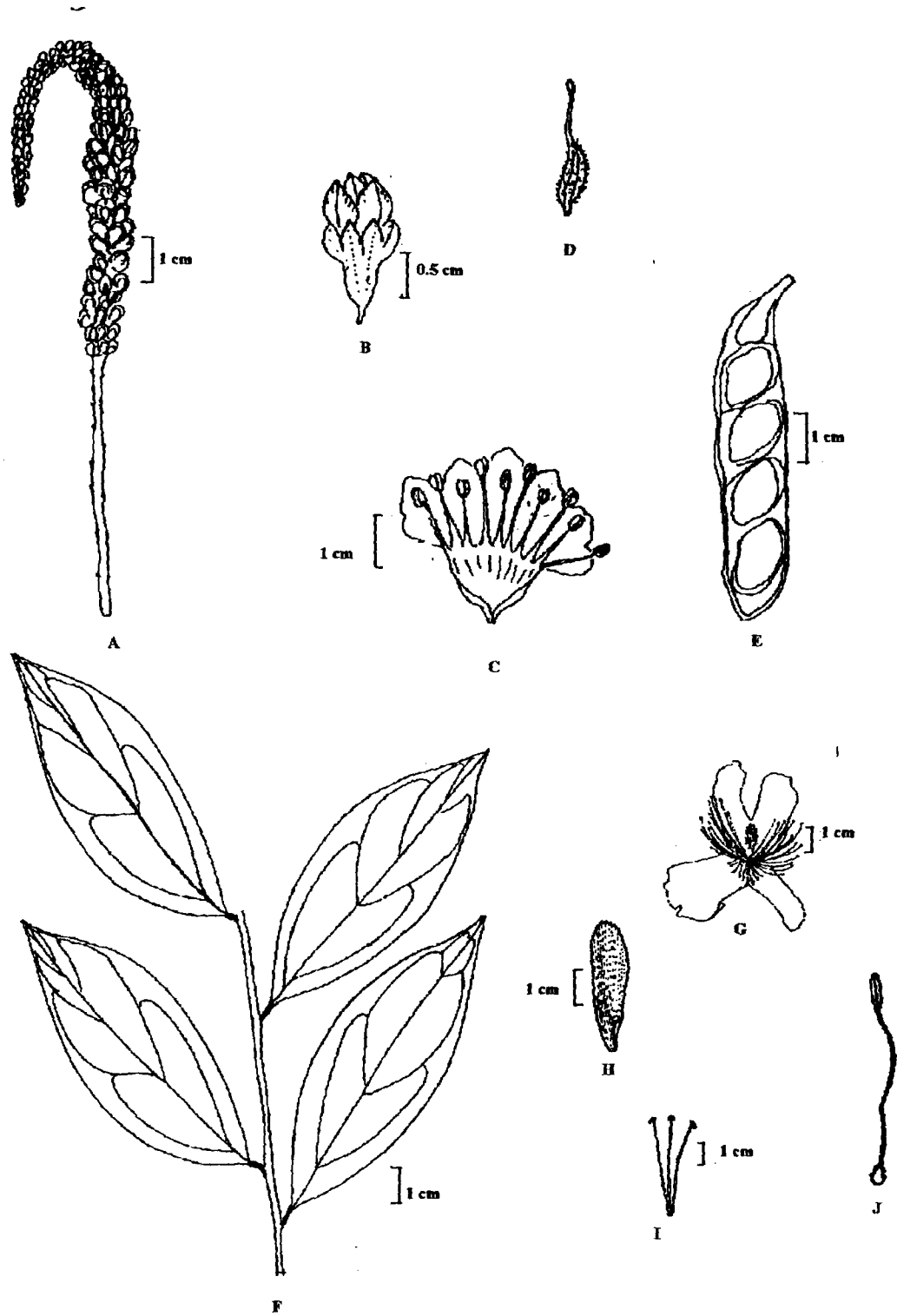


Figure 9: *Moullava spicata* (Dalz.) Nicolson : A. Inflorescence; B. Flower; C. L.S of flower; D. Pistil; E. Pod. *Capparis rheedii* DC.: F. Leaves; G. Flower; H. Petal; I. Stamens; J. Pistil.

CLUSIACEAE

Calophyllum calaba L. Sp. pl. 514. 1753; Sasidharan & Sivarajan, Fl. Thrissur 51. 1996. *Calophyllum apetalum* Willd. in Ges. Naturf. Freunde Berlin. Mag. Neuesten Entdeck. Gesammten Naturk. 5: 79. 1811. p.p; Vartak, Enum. Pl. Gomantak 26. 1966; Gandhi in Saldanha & Nicolson, Fl. Hassan 124. 1976; Arora et al., Bot. South Kanara 14. 1981; Ramamurthy in Nair & Henry, Fl. Tamil Nadu 1: 27. 1983; Saldanha, Fl. Karnataka 1: 202. 1984; Rao, Fl. Goa 1. 28. 1985; Kulkarni, Fl. Sindhudurg 35. 1988; Almeida, Fl. Savantwadi 1: 53. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 57. 1990; Vajravelu, Fl. Palghat 69. 1990; Singh in Fl. India 3: 88. 1993; Mohanan & Henry, Fl. Thiruvananthapuram 69. 1994; Naithani et al., Forest Fl. Goa 69. 1997. *C. decipiens* Wight, Ic. t 106. 1839 & Ill. Ind. Bot. 1: 128. 1840, non Thwaites, 1858; Gamble, Fl. Madras. 1: 54. 1967 (repr. ed). *C. spurinum* Chois. in Dc. Mem. Soc. Phys. Hist. Nat. Paris 1: 229. 1823. *C. wightianum* Wall. ex Planch. & Triana in Ann. Sci. Nat. Bot. Ser 4. 15: 256. 1861; Anderson in Hook. f., Fl. Brit. India 1: 274. 1874; Cooke, Fl. Bombay 1: 86. 1967 (repr. ed.). *C. calaboides* G. Don, Gen. Hist. 1: 622. 1831.

Medium sized trees, up to 25 m high; bark scaly, yellowish grey. Leaves simple, opposite, decussate, petiolate; petiole c 1 cm long, flattened, pale greenish yellow; lamina up to 7.5 x 3.5 cm, obovate-oblong, coriaceous, cuneate at base, undulate along margins, rounded at apex, glabrous, dark green and shining adaxially, pale green, and striately penninerved abaxially. Inflorescence a raceme, up to 4 cm long, arising from the nodes of fallen leaves; racemes pale greenish yellow, bracteate; bracts caducous, boat shaped. Pedicel c 0.7 cm long, pale greenish yellow. Sepals four, outer two, c 0.5 x 0.3 cm, ovate, white, inner two opposite the outer two, c 0.6 x

0.4 cm, boat shaped, white, many nerved. Petals absent. Stamens numerous; filaments c 0.3 cm long, filiform, yellowish-brown; anthers c 0.15 cm long, yellow, cylindrical. Ovary c 0.3 x 0.3 cm, globose, green; style c 0.35 cm long, twisted; stigma peltate, margins undulate. Drupe c 1 cm across, ellipsoid, smooth, red at maturity. (Fig. 10 A-D; Plate 7 D-F).

Fl. & Fr.: October – March.

Local name: Lahan Umdi.

Habitat: Along the river banks and semievergreen forests.

Distribution: **Maharashtra** (Raigad, Ratnagiri & Sindhudurg); **Goa** (Colem & Netravali); **Karnataka** (Belgaum, Chikmagalur, Coorg, Hassan, Uttar & Dakshin Kannada); **Kerala** (Idukki, Palghat, Thrissur & Thiruvananthapuram); **Tamil Nadu** (Coimbatore & Tirunelveli). (Map 12).

Status: (LR).

Notes: It is distributed throughout Western Ghats. This is the only species of *Callophyllum* without petals and hence distinct from all others in the Western Ghats. Wood is strong and is used in boat making; fruits are edible; sun dried kernels yield greenish yellow oil, having a characteristic odour and bitter taste.

Garcinia indica (Dupetite - Thouars) Choiss. in DC. Prodr. 1: 561. 1824; Anderson in Hook f., Fl. Brit. India 1: 261. 1874; Vartak, Enum. Pl. Gomantak 25. 1966; Cooke, Fl. Bombay 1: 80. 1967 (repr. ed.); Gamble, Fl. Madras 1: 53. 1967 (repr. ed); Santapau, Fl. Khandala 1: 13. 1967; Rao, Fl. Goa 1: 29. 1985; Saldanha, Fl. Karnataka 1: 206. 1984; Kulkarni, Fl. Sindhudurg 36. 1988; Almeida, Fl. Savantwadi 1: 54. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 59. 1990; Kothari &

Moorthy, Fl. Raigad 22. 1993; Deshpande et al., Fl. Mahabaleshwar 1: 79. 1993; Singh in Sharma et al., Fl. India 3: 113. 1993; Almeida, Fl. Maharashtra 1: 87. 1996; Naithani et al., Forest Fl. Goa 66. 1997. *Brindonia indica* Dupetit - Thouars in Diet. Sci. Nat. 5: 340. 1804. *G. purpurea* Roxb. Fl. Ind. 2: 624. 1832.

Medium sized trees, up to 15 m high. Stem woody, greyish black. Leaves simple, opposite, petiolate; petiole c 0.5 cm long, glabrous, succulent; lamina up to 12 x 5 cm, ovate-oblong, cuneate at base, entire along the margins, acute-obtuse at apex, dark green adaxially, pale green abaxially, glabrous on both the surfaces, midrib prominent. Staminate flowers in terminal or axillary fascicles, shortly pedicelate, arising on the branches at nodes; pedicel succulent, green, flattened. Sepals 4, two outer, two inner, c 0.5 x 0.5 cm, spatulate, succulent, green. Petals 4, c 0.5 x 0.4 cm, ovate, yellow, succulent, emarginate. Stamens numerous; filaments short; anthers two celled, dehiscing longitudinally. Pistillate flowers: Solitary, sessile, staminodes in four bundles; each bundle with 2–7 stamens; filaments short, thick. Ovary 4–8 celled, stigma sessile. Fruit globose, not furrowed, purple, seeds 5–8 compressed, embedded in pulp. (Fig. 10 E; Plate 7 E-G).

Fl. & Fr.: November – March & January – August.

Local name: Bhirand.

Habitat: Open areas, plateaus and moist deciduous forests.

Distribution: Maharashtra (Kolhapur, Satara, Sindhudurg & Thane), Goa (Butpal, Canacona, Goa University Campus, Jamad forest near Nanorem, Margao, Nadquem & Ordofond); Karnataka (Coorg, Uttar & Dakshin Kannada), Kerala (Wyanad). (Map 12).

Status: (LR)

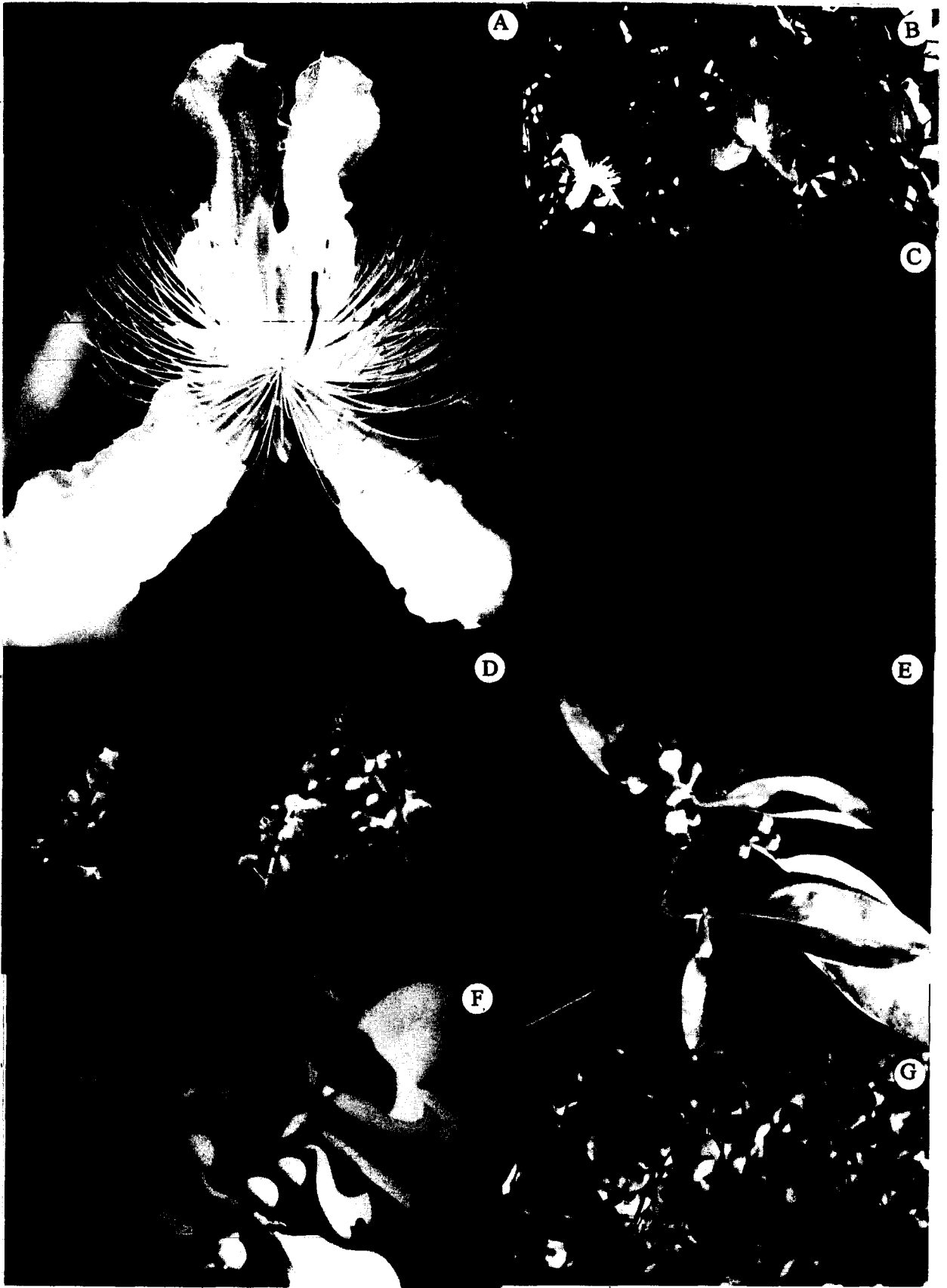
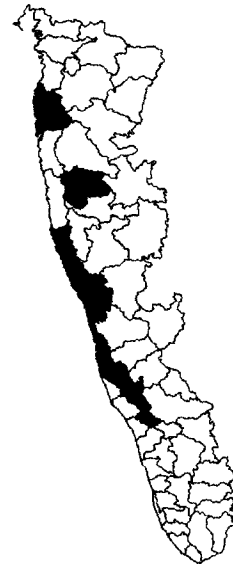
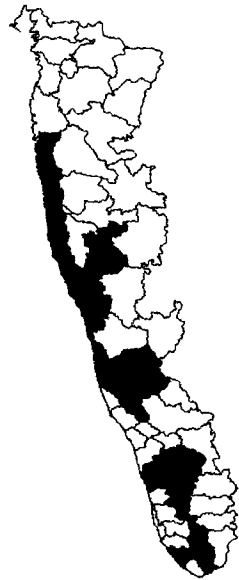
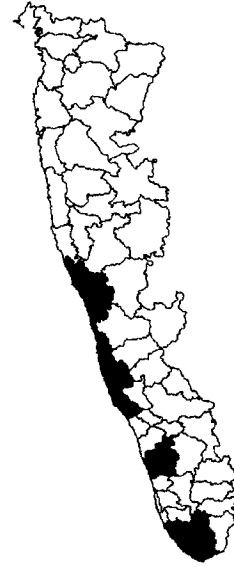
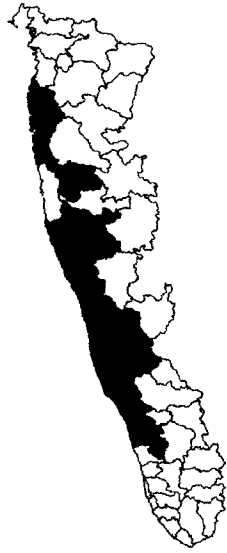


PLATE 7: A & B. *Capparis rheedii* DC., C. *Adelocaryum coelestinum* (Lindl.) Brand, D & F. *Calophyllum calaba* Linn. (D. Flowers, F. Fruits), E & G. *Garcinia indica* (Dupetite - Thouars) Choiss (E. Flowers, G. Fruits)

Map 12: Distribution of *Moullava spicata*, *Capparis rheedii*, *Callophyllum calaba* and *Garcinia indica* along Western Ghats.



● *Moullava spicata* (Dalz.)
Nicolson

● *Callophyllum calaba* Linn.

● *Capparis rheedii* DC.

● *Garcinia indica* (Dupetite -
Thouars) Choiss.

Chromosome number: 48; 54.(2n)

Notes: It is distributed in the northern and central Western Ghats. It is used mainly as Kokam, prepared by drying the outer rind, soaking it repeatedly in the juice of the pulp and sun dried. It is used as garnish to give an acid flavor to the curries and also for preparing cooling syrup during the hot months. The fruit is antihelmentic and cardio tonic, useful in piles, dysentery, tumors, pain, heat complain. A syrup of the fruit is given in bilious infection. Root is astringent. Seeds yield valuable fat called Kokum butter. It is mainly used as edible fat and as an adulterant to ghee. The fat is also suitable for candle and soap making. It is also suitable for ointment purposes. It is used locally for fissures of the lip, hands etc. The cake left after extraction of oil is used as manure. This species is grown for its economic value. It is also introduced into France and Mauritius.

Garcinia talbotii Raiz. ex Santapau, Rec. Bot. Surv. India 16 (1): 14. 1960 (ed.2); Raiz. in Indian Forester 93: 754. 1967; Santapau, Fl. Khandala 14. 1967; Gandhi in Saldanha & Nicolson, Fl. Hassan 126. 1976; Ramamurthy in Nair & Henry, Fl. Tamil Nadu 1: 28. 1983; Saldanha, Fl. Karnataka 1: 207. 1984; Rao, Fl. Goa 1: 29. 1985; Deshpande, in Nayar & Sastry, Red Data Book Indian Pl. 1: 302 1987; Kulkarni, Fl. Sindhudurg 36. 1988; Deshpande et al., Fl. Mahabaleshwar 1: 79. 1993; Kothari & Moorthy, Fl. Raigad 23. 1993; Singh in Sharma et al., Fl. India 3: 127. 1993; Almeida, Fl. Maharashtra 88. 1996. *Xanthochymus ovalifolius* Graham, Cat. Bombay Pl. 26. 1839, non Roxb. 1832. *G. malabarica* Talbot in J. Bombay Nat. Hist. Soc. 11: 234. t. 1. 1897, non. Dest. 1792; Gamble, Fl. Madras 1: 53. 1957 (repr. ed.). *G. ovalifolia* (Graham.) Hook. f., var. *macrantha* T. Anders in Hook f., Fl. Brit. India 1:

269. 1874. *G. spicata* (Hook. f.) var. *macrantha* vesque in DC. Monogr. Phan. 8: 311. 1893; Cooke, Fl. Bombay 1: 83. 1967 (repr. ed.). *Garcinia ovalifolia* Graham, Cat. Bombay Pl. 26. 1839.

Trees. Branches angular, green, branching dichotomously. Leaves simple, opposite, petiolate; petiole thick, succulent, ligule; petiole c 2 cm long, succulent thick, angled; lamina up to 20 x 10.5 cm, obovate–elliptic, cuneate at base, entire along margins, obtuse–acute at apex, dark green adaxially, pale green abaxially, midvein prominently, thick with 20–25 pairs of lateral veins, anastomosing and forking prominently on both surfaces. Staminate flowers in spikes; spikes triangular. Pedicel c 0.5 cm long, stout. Sepals 5, outer two slightly more succulent, inner three unequal in size, rounded c 0.3 cm long. Flowers c 0.9 cm across. Petals 5, obovate, c 0.7 cm long, slightly cuneate at base, rounded at apex, white. Stamens 5; filaments five, c 0.6 cm long, flattened with 9–0 anthers; anthers two celled, filaments altering with five fleshy glands. Pistillate flowers not observed. (Fig. 10 F-I).

Fl. & Fr.: December – May.

Local name: Tavir.

Habitat: Small patch of evergreen forest at 680 m altitude in a Sacred groove.

Distribution: Maharashtra (Satara, Sindhudurg & Thane); Goa (Vageri hills); Karnataka (Belgaum, Hassan, Mysore, Shimoga, Uttar & Dakshin Kannada); Tamil Nadu (Coimbatore). (Map 13).

Status: (R).

Notes: It is distributed discontinuously throughout the Western Ghats. Almeida (1983) considered it as conspecific to *G. spicata*. It is closely related to *G. spicata* Hook. f. which is distributed in India (Assam, Meghalaya, Orissa, Andhra Pradesh,

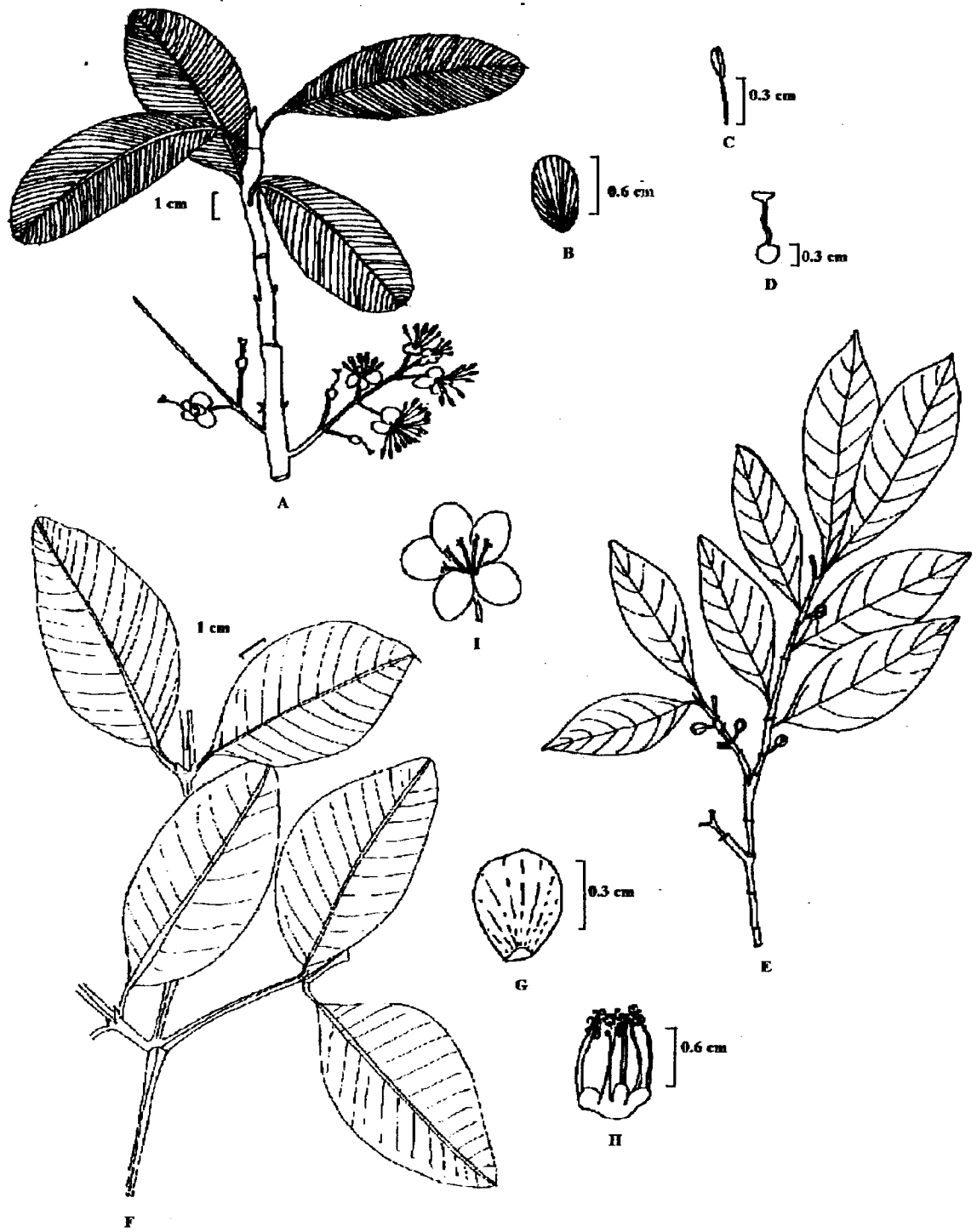


Figure 10: *Calophyllum calaba* Linn.: A. Habit; B. Tepal; C. Stamen; D. Pistil. *Garcinia indica* (Dupetite - Thouars) Choiss. E. Habit. *Garcinia talbotii* Raiz. ex Santapau: F. Habit; G. Petal; H. Androphore with anthers; I. Staminate flower.

Karnataka, Kerala and Tamil Nadu) and Sri Lanka but differs by its thick, plaited, lobed disk and three lobed stigma.

COMMELINACEAE

Murdannia versicolor (Dalz.) Brueckner in Engler & Prantl, *Planzenf.* 15A: 173. 1930; Santapau in *J. Bombay Nat. Hist. Soc.* 52: 658. 1954 & Saldanha, *Fl. Khandala* 286. 1967; Gamble, *Fl. Madras* 3: 48. 1967 (repr. ed.); Rao, *Fl. Goa* 2: 448. 1985; Kulkarni, *Fl. Sindhudurg* 464. 1988; Karthikeyan et al., *Fl. Ind. Enum. Mono.* 129. 1989; Almeida, *Fl. Savantwadi* 2: 48. 1990; Deshpande et al., *Fl. Mahabaleshwar* 2: 612. 1995; Lakshminarasimhan in Sharma et al., *Fl. Maharashtra Monocot.* 177. 1996. *Aneilema versicolor* Dalz. in Hooker's *J. Bot. Kew Gard. Misc* 3: 136. 1851; Hook. f., *Fl. Brit. India* 6: 378. 1892; Cooke, *Fl. Bombay* 3: 298. 1967 (repr. ed.).

Prostrate herbs with dense fibrous roots. Stems clasping, 5–7 nerved, hispid, succulent, hollow. Leaves alternate, leaf sheath c 0.7 x 0.4 cm, succulent with long furrow, hispid; lamina up to 3.5 x 1.5 cm, flat, oblong–lanceolate, entire along margins, acute–acuminate at apex, hispid with 5–7 nerves. Inflorescence axillary cymes; cymes 1-3 flowered, c 0.6 cm across. Pedicels filiform, jointed in the middle or solitary. Sepals 3, c 0.32 x 0.18 cm, truncate at base, entire along margins, obtuse at apex, concave, glabrous, green with midvein inside, sparsely hairy outside. Petals 3, alternating with sepals, c 0.4 x 0.3 cm, orbicular, pale yellowish brown-ocher, entire along margins, apex obtuse – apiculate, rounded. Stamens 3, alternating with staminodes; filaments c 0.23 cm long, flat, broad at base, narrowing towards tip, pale brown with long filiform hairs arising from the base; hairs pale brown; anthers 3, dark blue, dehiscing longitudinally with connective; connectives orbicular. Staminodes 3, alternating with stamens; filaments 3, c 0.15 cm, pale brown. Staminodes sagittate,

three lobed, yellow. Ovary three celled, globose, glabrous, stout c 0.11 x 0.8 cm green; style c 0.08 cm long, stout, purple; stigma small. Fruit a capsule, c 0.32 x 0.2 cm, three lobed with persistent calyx. (Fig. 11 A-E; Plate 8 A).

Fl. & Fr.: August – October.

Habitat: Fields and in water stagnating open areas on plateaus and fields.

Distribution: **Maharashtra** (Kolhapur, Pune, Satara, Sindhudurg & Thane); **Goa** (Goa University Campus & St Cruz); **Karnataka** (Coorg & Shimoga); **Kerala** (Kasaragod). (Map 13).

Status: (LR).

Notes: Petals and anthers are with blue dye. The ocher coloured petals turn blue when teased. It was considered to be rare and distributed from Mahableshwar to Coorg, but it was observed that it is distributed from Thane to Kasaragod and is quite common. It is closely related to *M. wightii* Rao & Kammathy which is also endemic to Western Ghats and differs from its ochre coloured petals and hairy filaments.

CYPERACEAE

Fimbristylis dauciformis Govind. in Proc. Indian Acad. Sci. 76: 181. 1972; Karthikeyan et al., Fl. Ind. Enum. Mono. 51. 1989; Cook, Aqua. Wetland Pl. India 140. 1996.

Erect herbs with fibrous roots, up to 30 cm high. Leaves tufted, flattened; leaf sheath many nerved, truncate, winged; blade up to 20 x 0.3 cm, flat, green, glabrous, acute-acuminate at apex, scabrous at tip. Inflorescence compound, lax. Involucral bracts c 1.2 cm long, linear-slightly scabrid along margins not enclosing the inflorescence. Culms tufted, five angled, glabrous, smooth, green. Primary ray c 2 cm

long, flattened, angled, green, solitary, secondary rays c 0.5 cm long. Spikelets c 0.2 cm long, oblong-cylindrical, acute, chestnut brown, rachilla c 0.3 cm long, winged. Glumes c 0.8 cm long, concave, membranous, glabrous, straw coloured rounded, minutely mucronate, margins hyaline, keel prominent, three nerved. Stamens three; filaments pale brown. Ovary three angled, pale straw coloured, stipitate, obconcave, c 0.03 cm long; style three angled, straw coloured, c 0.07 cm long; stigma three, shorter than style, brown, hairy. Nut three angled with transverse parallel cell. (Fig. 11 F-J; Plate 8 B).

Fl. & Fr.: July – December.

Habitat: Open marshy areas on plateaus and fields.

Distribution: Goa (Colem, Goa University Campus, Pernem & Nirankarichi rai);

Kerala (Anakayam, Poringalkuthu & Sholayar). (Map 13).

Status: (LR).

Notes: This species is reported for the first time outside the state of Goa. It is closely related to *F. crystallina* Govind. which is distributed in Assam and Tamil Nadu and differs from it as stated below:

<i>Fimbristylis dauciformis</i>	<i>F. crystallina</i>
Leaf blade up to 0.3 cm wide.	Leaf blade up to 0.15 cm wide.
Culms robust, up to 30 cm long.	Culms fine, up to 20 cm long.
Spikelet solitary; glumes 0.8 cm long.	Spikelet paired; glumes 0.2 cm long.

Fimbristylis lawiana (Boeck.) Kern in Reinwardtia 4: 96. 1956; Karthikeyan et al., Fl. Ind. Enum. Mono. 53. 1989; Kothari & Moorthy, Fl. Raigad 447 1993; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 311. 1996. *Scirpus lawianus* Boeck in Linnea 36: 497. 1869 – 1870. *Fimbristylis digitata* Boeck. in Flora

61: 35. 1875; Clarke in Hook. f., Fl. Brit. India 6: 648. 1893; Cooke, Fl. Bombay 3: 398. 1967 (repr. ed.).

Erect herbs, up to 15 cm high, bulbous base with fibrous roots. Stem slender, striate, subquadrangular. Leaves 2-3, linear, filiform, arising from bulbous base; sheath c 1.5 cm long, truncate at apex; lamina up to 10 cm long, linear, entire along margins, acute at apex. Inflorescence a terminal head, with 4-5 spikelets arranged in cluster; spikelets c 1.5 cm long, oblong, pale white. Bracts 2, ovate, unequal, acute. Glume c 0.4 x 0.17 cm, obovate, cucullate, scarious except on back, back with 5-6 nerves, keels producing a sharp spine at tip; rachilla winged. Stamens 3, arising from base of ovary; filaments c 0.3 cm long, flattened, white, membranous. Nuts 0.1 cm, slightly obovoid, 5-6 angled, with parallel ribs, pale white; angles sharp. Style c 0.3 cm long, brown, glabrous, slightly swollen at base; stigma 3, bending downwards, shorter than style; style slightly swollen at base. (Fig. 11 K-N; Plate 8 C-D).

Fl. & Fr.: July – August.

Habitat: Open hard rocky crevices on plateaus and open grass lands.

Distribution: Gujarat (Dangs); Maharashtra: (Raigad & Thane); Goa (Cotigao, Loliem & Verna); Karnataka (Belgaum). (Map 13).

Status: (LR).

Notes: It sprouts with the onset of monsoon and the whole area gets covered with it and appears white. Its habitat is restricted to open plateaus and grass lands of the northern Western Ghats. It is a new record to the state of Goa.

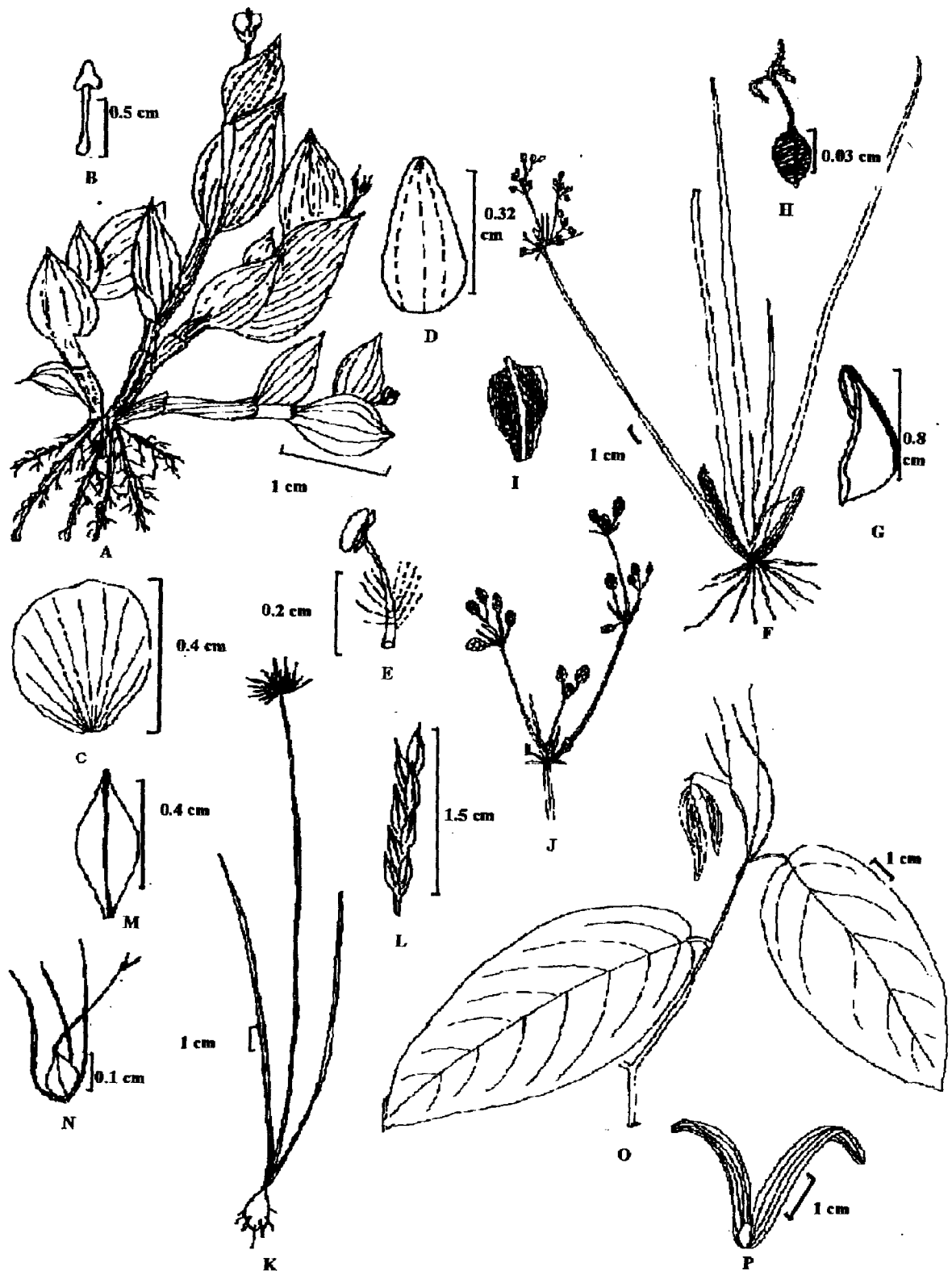
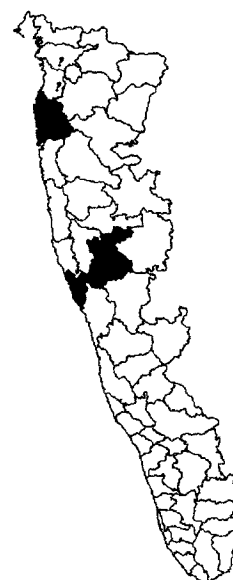
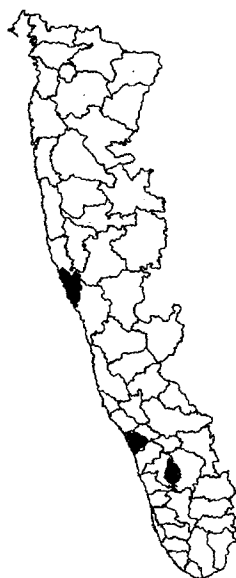
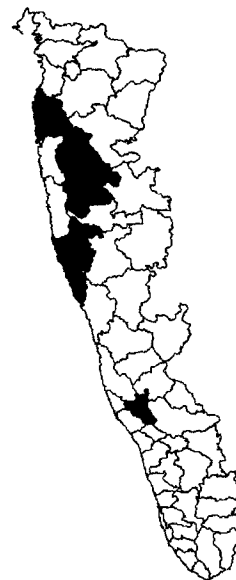
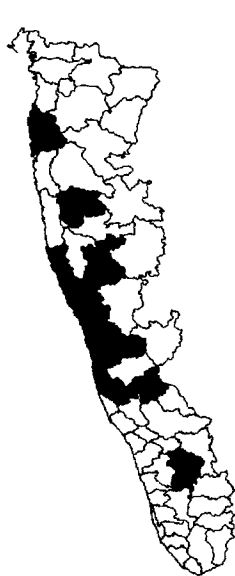


Figure 11: *Murdannia versicolor* (Dalz.) Brueckner: A. Habit; B. Staminode; C. Petal; D. Sepals; E. Stamen. *Fimbristylis dauciformis* Govind.: F. Habit; G. Glume; H. Fruit; I. Nut; J. Inflorescence. *Fimbristylis lawiana* (Boeck.) Kern K. Habit; L. Inflorescence; M. Glume; N. Fruit. *Hopea ponga* (Dennst.) Mabberley: O. Habit; P. Fruit.



PLATE 8: A. *Murdannia versicolor* (Dalz.) Brueckner, B. *Fimbristylis dauciformis* Govind., C & D. *Fimbristylis lawiana* (Boeck.) Kern, E & G. *Hopea ponga* (Dennst.) Mabberley (E. Fruits, G. Flowers), F. *Diospyros angustifolia* (Miq.) Kosterman.

Map 13: Distribution of *Garcinia talbotii*, *Murdannia versicolor*, *Fimbristylis dauciformis* and *Fimbristylis lawiana* along Western Ghats



***Garcinia talbotii* Raiz.**
ex Santapau



Fimbristylis dauciformis
Govind.



***Murdannia versicolor* (Dalz.)**
Brueckner



Fimbristylis lawiana
(Boeck.) Kern

DIPTEROCARPACEAE

Hopea ponga (Dennst.) Mabberley in *Taxon* 28: 587. 1979; Arora et al., *Bot. South Kanara* 14. 1981; Manilal & Sivarajan, *Fl. Calicut* 42. 1982; Ramamurthy in Nair & Henry, *Fl. Tamil Nadu* 1: 30. 1983; Saldanha, *Fl. Karnataka* 1: 194. 1984; Subramaniam et al., *Fl. Palghat* 16. 1987; Ramachandran & Nair, *Fl. Cannanore* 58. 1988; Vajravelu, *Fl. Palghat* 74. 1990; Janardhanam in Sharma et al. *Fl. India* 3: 231. 1993; Mohanan & Henry, *Fl. Thiruvananthapuram* 75. 1994; Almeida, *Fl. Maharashtra* 1: 93. 1996; Sasidharan & Sivarajan, *Fl. Thrissur* 56. 1996; Naithani et al., *Forest Fl. Goa* 70. 1997. *Artocarpus ponga* Dennst. *Schluess. Hort. Ind. Malab.* 15, 18, 30. 1818. *Hopea wightiana* Wall. ex Wight & Arn. *Prodr.* 85. 1834; Hook. f., *Fl. Brit. India* 1: 309. 1874; Vartak, *Enum. Pl. Gomantak* 26. 1966; Cooke, *Fl. Bombay* 1: 91. 1967 (repr.ed); Gamble, *Fl. Madras* 1: 59. 1967 (repr.ed); Gaertner in Saldanha & Nicolson, *Fl. Hassan* 118. 1976; Rao, *Fl. Goa* 1: 30. 1985.

Trees, up to 12 m high, young branches pubescent, glabrous at maturity. Leaves simple, opposite, petiolate; petiole c 1.2 cm long, velvety; lamina up to 14 x 5 cm, oblong to oblong-ovate, rounded at base, entire along margins, obtuse-subacute at apex, glabrous with 7–10 pairs of lateral nerves. Inflorescence an axillary panicle, sometimes 4–6 panicles from the same leaf axil, much shorter than the leaves. Bracts c 0.25 cm long, lanceolate. Pedicel c 0.1 cm long. Calyx lobes ovate, obtuse. Petals c 0.4 cm long, oblong, acute, yellow with red tinge, abaxially pubescent, ciliate. Stamens ten; filaments dilated at base; anthers ovate, with a long filiform appendage. Ovary three celled; styles short. Nuts c 1 cm long, ovoid, apiculate, glabrous, enclosed by accrescent calyx, two lobes developed into long crimson wings; wings c 5 cm long, oblong-obovate, 7–9 nerved. (Fig. 11 O-P; Plate 8 E-G).

Fl. & Fr.: February – April.

Habitat: Along the banks of rivers and streams in the forests.

Distribution: Goa (Butpal, Canacona near Kodol Village, Codal–Ambacha gol, Kawaliyan forest near Nanorem, Mattandongar–Netravali, Nadquem & Tamdi surla); **Karnataka** (Belgaum, Hassan, Shimoga, Uttar & Dakshin Kannada); **Kerala** (Calicut, Cannanore, Kasaragod, Kottayam, Palghat, Thrissur & Thiruvananthapuram); **Tamil Nadu** (Tirunelveli). (Map 14).

Status: (LR).

Notes: It grows luxuriantly along the river banks. The wood is used for beams, rafters, posts and pillars in construction work and is an excellent fuel. It is closely related to *H. glabra* Wight & Arn. which is distributed in Western Peninsula and differs from it as stated below:

<i>Hopea ponga</i>	<i>Hopea glabra</i>
Branches softly pubescent, glabrous at maturity.	Branches glabrous.
Lateral nerves 10 pairs.	Lateral nerves 8 pairs.
Panicles 4-6 together, shorter than leaves.	Panicles 1 – 3 together, equalling the leaves.

EBENACEAE

Diospyros angustifolia (Miq.) Kosterman, Ceylon J. Sci. 12: 106. 1977; Saldanha, Fl. Karnataka 1: 335. 1984; Naithani et al., Forest Fl. Goa 377. 1997. *Maba angustifolia* Miq., Anal. Bot. India 3: 13. 1852. *Maba nigrescens* Dalz., in Dalz. & Gibson, Bombay Fl. 142. 1861; Clarke in Hook. f., Fl. Brit. India 3: 55. 1882. p.p; Dalgado, Fl. Savantvadi 111. 1898; Vartak, Enum. Pl. Gomantak 67. 1966; Cooke, Fl. Bombay 2: 1967 (repr. ed.); Gamble, Fl. Madras 2: 540. 1967 (repr. ed.); Rao, Fl. Goa 2: 249. 1986. *Diospyros nigrescens* (Dalz.) Saldanha in Saldanha & Nicolson, Fl.

Hassan 197. 1976; Arora et al., Bot. South Kanara 13. 1981; Deshpande et al., Fl. Mahabaleshwar 1: 344. 1993.

Small trees, up to 6 m high, clothed with ferruginous pubescent hair when young. Leaves simple, alternate, petiolate; petiole c 0.27 cm long, densely fulvously, brown; lamina up to 3 x 1.2 cm, oblong-lanceolate, acute at base, undulate along margins, coriaceous, glabrous adaxially, fulvously hairy on the mid rib abaxially. Staminate flowers: 3–4 merous, on short 2–5 flowered cymes. Calyx tube c 0.3 cm, densely fulvously hairy; lobes 3 – 4, c 0.25 cm long, triangular, acute. Corolla tube c 0.8 cm long, white; lobes 3–4, obovate, obtuse, densely hairy abaxially. Stamens 4–9, glabrous; filaments slender; anthers c 0.2 cm long. Rudimentary ovary hairy. Pistillate flowers: 1–3 merous. Calyx tube c 0.4 cm long, fulvously hairy; lobes broadly ovate or subcoriaceous. Corolla tube c 0.6 cm long, oblong, rounded at apex. Ovary three celled, hairy. Fruit ellipsoid, clothed with fulvous silky hairs when young. (Fig. 12. A-C; Plate 8 F).

Fl. & Fr.: March – May.

Habitat: Found along the streams in moist deciduous to evergreen forests.

Distribution: **Maharashtra** (Sindhudurg & Thane); **Goa** (Codal–Ambechagol, Molem – Anmod); **Karnataka** (Dakshin Kannada & Hassan); **Tamil Nadu** (Madurai). (Map 14).

Status: (LR).

Notes: This species is discontinuously distributed throughout the Western Ghats. It is interesting to note that although there is rich forest in Kerala, this species has not been reported from Kerala.

Diospyros paniculata Dalz. in Hooker's J. Bot. Kew Gard. Misc. 4: 109. 1852; Clarke in Hook. f., Fl. Brit. India 3: 570. 1882; Dalgado, Fl. Savantvadi 112. 1898; Vartak, Enum. Pl. Gomantak 68. 1966; Cooke, Fl. Bombay 2: 163. 1967 (repr. ed.); Gamble, Fl. Madras 1: 544. 1967 (repr. ed.); Sharma et al., Biol. Mem 2 (1 & 2): 86. 1977; Saldanha, Fl. Karnataka 1: 340. 1984; Rao, Fl. Goa 2: 248. 1986; Bhargavan in Henry et al., Fl. Tamil Nadu 2: 67. 1987; Ramachandran & Nair, Fl. Cannanore 265. 1988; Vajravelu, Fl. Palghat 269. 1990; Mohanan & Henry, Fl. Thiruvananthapuram 280. 1994; Sasidharan & Sivarajan, Fl. Thrissur 271. 1996; Naithani et al., Forest Fl. Goa 369. 1997.

Trees, up to 10 m high; branches smooth, glabrous, round, young branches angular, softly hairy; hairs black. Leaves simple, petiolate; petiole c 1 cm long, stout green, transversely ribbed; lamina up to 17.5 x 5.5 cm, oblong-lanceolate, cuneate at base, entire along margins, obtusely acute at apex, dark green, thick, coriaceous with less prominent veins adaxially, pale green, glabrous with prominent veins abaxially. Staminate flowers in cymes in the axils of scaly leaves, c 4 cm long, hairy; three flowers surrounded by a bract; bract c 1 x 0.6 cm, ovate, the two lateral flowers surrounded by bracteoles; bracteoles c 0.2 x 0.2 cm, ovate, hairy, green. Pedicel c 0.6 cm long, stout, hairy; hairs black. Calyx tube c 0.1 cm long, stout, cylindrical; lobes five, c 0.6 x 0.3 cm, divided to the base, lanceolate, foliaceous with a raised ridge on the innerside, surrounded by black soft hairs, lobes rounded at apex. Corolla tube c 0.6 cm long, swollen at base, five angled, white with black hairs on the margin; corolla lobes five, c 1 x 0.4 cm, rounded at apex, with prominent midrib, lobes twisted, densely black hairy outside, glabrous inside. Stamens 20, enclosed inside the corolla tube; filaments short, c 0.15 cm long; anthers c 0.4 cm long, apiculate, white. Pistillate

flowers, solitary, axillary. Ovary four celled; style two, shortly lobed. Fruits with persistent calyx, c 3 x 2.5 cm, hairy; hairs black. (Fig. 12 D-H; Plate 9 A-B).

Fl. & Fr.: March – April.

Local name: Kurikoomar.

Habitat: Evergreen and semievergreen forests.

Distribution: Goa (Molem – Anmod & Nadquem village); **Karnataka** (Shimoga, Uttar & Dakshin Kannada); **Kerala** (Cannanore, Palghat, Pathanamthitta, Thrissur & Tiruvananthapuram); **Tamil Nadu** (Coimbatore & Nilgiri). (Map 14).

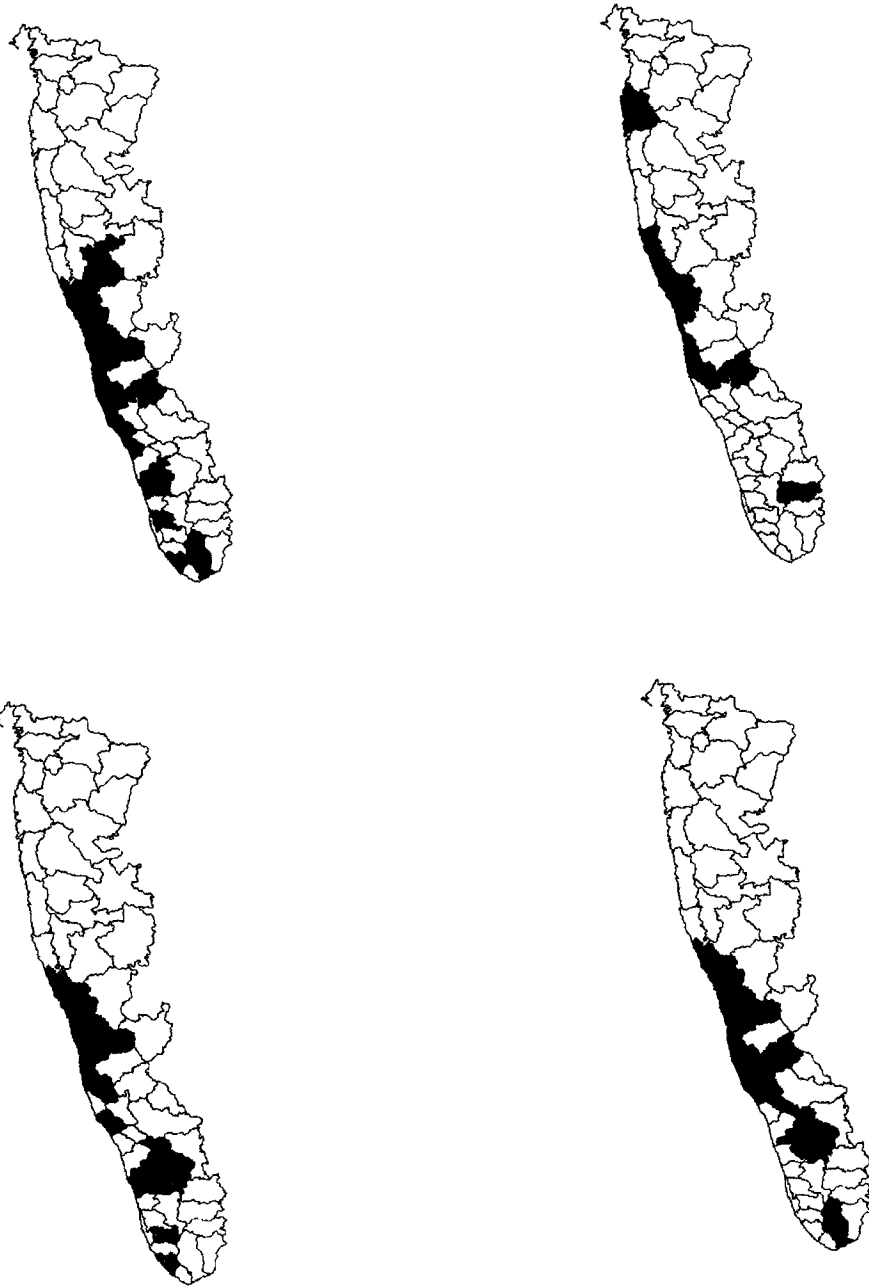
Status: (LR).

Notes: Leaves are used as fish poison. Dried and powdered fruits are applied to heal burns. Decoction of the fruit is used in gonorrhoea, biliousness and blood poisoning. Powdered bark is used for rheumatism and ulcers. It is found commonly in the study area.

Diospyros pruriens Dalz. in Hooker's J. Bot. Kew Gard. Misc. 4: 110. 1852; Clarke in Hook. f., Fl. Brit. India 3: 553. 1882; Cooke, Fl. Bombay 2: 162. 1967 (repr. ed.); Gamble, Fl. Madras 1: 544. 1967 (repr. ed); Saldanha in Saldanha & Nicolson, Fl. Hassan 197. 1976; Sharma et al., Biol. Mem 2 (1 & 2): 86. 1977; Arora et al., Bot. South Kanara 39. 1981; Saldanha, Fl. Karnataka 1: 340. 1984; Rao, Fl. Goa 2: 248. 1986; Bhargavan in Henry et. al., Fl. Tamil Nadu 2: 67. 1987; Subramaniam et al., Fl. Palghat 76. 1987; Ramachandran & Nair, Fl. Cannanore 265. 1988; Manilal, Fl. Silent valley 168. 1988; Keshava Murthy & Yoganarasimhan, Fl. Coorg 268. 1990.

Small trees, up to 7 m high; young branches hirsute, densely hairy, pale greenish black, bark scaly. Leaves simple, alternate, petiolate; petiole c 0.5 cm long,

Map 14: Distribution of *Hopea ponga*, *Diospyros angustifolia*, *Diospyros paniculata* and *Diospyros pruriens* along Western Ghats.



- *Hopea ponga* (Dennst.)
Mabberley
- *Diospyros paniculata* Dalz.

- *Diospyros angustifolia* (Miq.)
Kosterman
- *Diospyros pruriens* Dalz.

densely hairy; hairs brown; lamina up to 10 x 3.7 cm, elliptic-oblong, rounded-truncate at base, entire along margins, acuminate at apex, dark green, hairy when young, becoming glabrous or sparsely hairy at maturity with prominent hairs along the mid vein adaxially, abaxially pale green, densely hairy on the veins; hirsute, pale brown. Staminate and Pistillate flowers not observed. Calyx persistent in fruits, c 0.5 x 0.2 cm, linear, green, hirsute. Fruits c 3 x 2.5 cm, ovoid, broad at base, conical at apex, pale brown or straw coloured with dense stinging hairs. (Fig. 12 I; Plate 9 C).

Fl. & Fr.: April – May.

Habitat: In semievergreen and evergreen forests, usually along streams.

Distribution: Goa (Tamdi surla & Matachi rai near Palem); Karnataka (Coorg, Hassan, Shimoga, Uttar & Dakshin Kannada); Kerala (Cannanore, Kasaragod, Palghat & Wyanad); Tamil Nadu (Coimbatore, Nilgiri & Tirunelveli). (Map 14).

Status: (LR).

Notes: This species is closely related to *D. saldanhae* Kostermnn a newly described species which is also endemic to Western Ghats, but differs by its smaller, narrow leaves with rounded to truncate base, longer hair, long peduncle, small fruits with linear, green, hirsute persistent perianth lobes. Ramesh & Pascal (1997) consider it to be a vicarious species and believe that *D. pruriens* has been replaced by *D. saldanhae* in regions with prolonged dryness. But in the study area both the species are observed.

Diospyros saldanhae Kosterman in J. Bombay Nat. Hist. Soc. 74: 326. 1977; Saldanha in Saldanha & Nicolson, Fl. Hassan 870. 1978; Yoganarasimhan et al., Fl. Chikmagalur 197. 1981; Saldanha, Fl. Karnataka 1: 341. 1984; Ramachandran &

Nair, Fl. Cannanore 266. 1988; Keshava Murthy & Yoganarasimhan, Fl. Coorg 268. 1990; Naithani et al., Forest Fl. Goa 374. 1997.

Trees, up to 10 m high; branches hirsute, intermixed with bristles, bark dark coloured. Leaves simple, alternate, subsessile; petiole c 0.3 cm long, softly hirsute; lamina up to 8 x 3.8 cm, oblong-ovate, rounded-subcordate at base, entire along margins; margins with soft hirsute hairs, acute – acuminate at apex, dark green with sparsely placed hirsute hairs adaxially when young, glabrous at maturity, pale green with prominent midvein, densely placed hirsute hairs abaxially. Staminate flowers in cymes, c 3 cm long, softly hirsute. Pedicel c 0.5 cm long. Sepals four, c 0.4 x 0.2 cm, oblong, truncate at base, ciliate, rounded at apex, densely hirsute abaxially. Corolla tube c 0.6 cm long, densely hirsute, white, lobes four, c 0.7 cm long, twisted lanceolate, glabrous adaxially, hirsute abaxially. Stamens 12, variable in size, inserted inside the corolla tube. Pistillate flowers not observed. (Fig. 12 J-L; Plate 9 D).

Fl. & Fr.: March – May.

Habitat: Found along streams in semievergreen forests.

Distribution: Goa (on the way to Anmode, Goa-Karnataka boarder); **Karnataka** (Chikmagalur, Coorg, Hassan, Shimoga & Uttar & Dakshin Kannada); **Kerala** (Cannanore & Wyanad); **Tamil Nadu** (Nilgiris). (Map 15).

Status: (LR).

Notes: It is a new report to the State of Goa. Ahmedullah & Nayar (1986) mentioned it to be restricted to Hassan district. Now it is observed that the distribution is extended from Goa to Kerala. It is closely related to *D. pruriens* Dalz. and differs from it as stated under *D. pruriens*.



PLATE 9. A & B. *Diospyros paniculata* Dalz. (A. Flowers, B. Fruits), C. *Diospyros pruriens* Dalz, D. *Diospyros saldanhae* Kostermen, E. *Eriocaulon cuspidatum* Dalz., F. *Eriocaulon dalzellii* Koern.

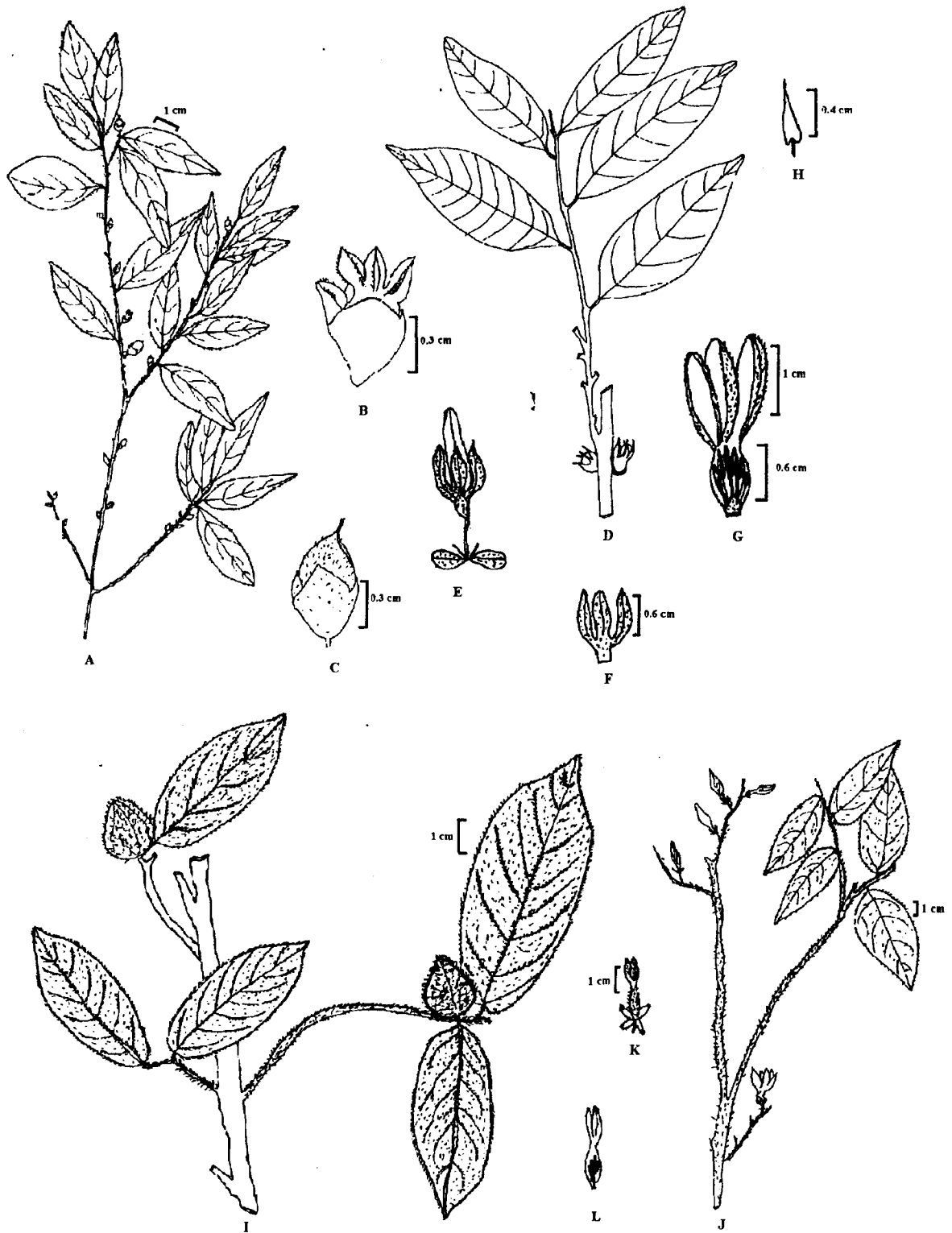


Figure 12: *Diospyros angustifolia* (Miq.) Kosterman: A. Habit; B. Corolla lobes; C. Fruit with persistent calyx. *Diospyros paniculata* Dalz.: D. Habit; E. Flower; F. Calyx; G. L.S of flower; H. Anther. *Diospyros pruriens* Dalz.: I. Habit. *Diospyros saldanhae* Kostermen: J. Habit; K. Flower; L. L.S of flower.

ERIOCAULACEAE

Eriocaulon cuspidatum Dalz. in Hook. Kew J. Bot. 3: 281. 1851; Hook. f., Fl. Brit. India 6: 581. 1893; Fyson in J. Indian Bot. 2: 317. t. 38. 1921; Cooke, Fl. Bombay 3: 359. 1967 (repr.ed.); Kulkarni & Desai in J. Bombay Nat. Soc. 69: 233. 1972; Rao, Fl. Goa 2: 458. 1986; Karthikeyan et al., Fl. Ind. Enum. Mono. 249. 1989; Ansari & Balakr. Eriocaul. India 29. f. 6. 1994; Bhat in Pandeys Taxonomy & Biodiversity 131. 1995; Cook, Aqua. Wetland Pl. India 191. 1996; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 249. 1996.

Annual erect herbs. Leaves up to 2.7 x 0.4 cm, cespitose, linear-oblong, rounded, cuspidate at apex, 7-9 nerved. Scape up to 16 cm long, sulcate; sheath c 8 cm long, obliquely split at apex. Involucral bracts c 0.2 cm long, obovate, obtuse at apex, concave, glabrous, white. Floral bracts similar to involucral bracts. Staminate flowers: Sepals two, c 0.14 cm long, lanceolate, acute, concave, winged, puberulous adaxially. Corolla tube c 0.15 cm long; lobes small, unequal, hairy, with black gland. Stamens six; anthers black. Pistillate flowers: Sepals two, c 0.2 cm long, elliptic-lanceolate, acute, hairy, with crest like wing on back. Petals three, unequal, linear-lanceolate, villous, towards tip, with black gland. Ovary three lobed; style forked in to three, filiform. Seeds c 0.07 x 0.05 cm, oblong, smooth with transversely elongated cells, appendages 1-2. (Fig. 13 A-E; Plate 9 E).

Fl. & Fr.: August – November.

Habitat: Puddles on lateritic plateaus.

Distribution: Maharashtra (Kolhapur, Raigad, Ratnagiri, Satara, Sindhudurg & Thane); Goa (Chimbel, Marmagoa, Nuvem hills, Tudal & Verna plateau); Karnataka (Dakshin Kannada). (Map 15).

Status: (LR).

Notes: It is restricted to northern and central Western Ghats. It is associated with *E. reductum* Rhuland and *E. eurypeplon* Koern. in the study area. It is closely related to *E. fysonii* Ansari & Balakr. which is also endemic to Western Ghats and differs from it as stated below:

<i>Eriocaulon cuspidatum</i>	<i>Eriocaulon fysonii</i>
Involucral bracts not exceeding the heads.	Involucral bracts distinctly exceeding the heads.
Sepals of staminate flower not keeled.	Sepals of staminate flower keeled.
Seeds truncate at apex.	Seeds dilated at apex.

Eriocaulon dalzellii Koern. in *Linnaea* 27: 605. 1856; Hook. f., *Fl. Brit. India* 6: 580. 1892; Cooke, *Fl. Bombay* 3: 355. 1967 (repr. ed.); Kulkarni & Desai in *J. Bombay. Nat. Hist. Soc.* 69: 234. 1972; Rao, *Fl. Goa* 2: 458. 1986; Kulkarni, *Fl. Sindhudurg* 473. 1988; Karthikeyan et al., *Fl. Ind. Enum. Mono.* 77. 1989; Almeida, *Fl. Savantwadi* 2: 61. 1990; Ansari & Balakr. *Eriocaul. India* 166. 1994; Deshpande et al., *Fl. Mahabaleshwar* 2: 623. 1995; Cook, *Aqua. Wetland Pl. India* 192. 1996; Lakshiminarasimhan in Sharma et al., *Fl. Maharashtra Monocot.* 251. 1996. *E. rivulare* Dalz. in Hooker's. *Kew J. Bot.* 3: 280. 1851, non G. Don ex. Bth. 1849; Fyson in *J. Indian Bot.* 3: 14, t. 46. 1922; Cooke, *Fl. Bombay* 3: 355. 1967 (repr. ed.).

Submerged aquatic herbs with tap root, fibrous roots numerous. Leaves up to 8 x 0.2 cm, linear, filiform, slightly broad at base, green, 7–8 nerved. Scape 15–18 cm long, green, glabrous, with 7–8 transverse ridges, twisted. Sheath up to 3 cm long, 9–10 ribbed, mouth oblique, 2–3 toothed, glabrous, green; tooth silvery white at apex. Heads hemispherical, 0.5 cm across, pale white. Involucral bracts c 0.23 x 0.08 cm, glabrous, white. Floral bracts c 0.22 x 0.07 cm, acute–acuminate at apex, membranous, white with white hairs at apex. Staminate flowers: Sepals 3, c 0.2 cm

long, fused, linear, palegreen, membranous, with numerous white hairs at apex. Petals 3, one slightly longer than the other two, membranous, white with black gland and dense white hairs at apex. Stamens numerous; anthers white. Pistillate flowers: Sepals 3, free, linear, filiform, membranous, stiff hairs at apex. Petals 3, spatulate, slightly broad at apex, white, hairy at apex and with a black gland. Ovary three lobed; style long, filiform; stigma three lobed. Seeds globose, smooth up to 0.04x 0.03 cm; cells of seed coat transversely elongated, appendages absent. (Fig. 13 F-J; Plate 9 F).

Fl. & Fr.: August – November.

Habitat: Flowing streams.

Distribution: Maharashtra (Kolhapur, Pune, Ratnagiri, Satara, Sindhudurg & Thane); Goa (Bicholim; Kalem, Molem, Ordofond - Canacona; Sanguem); Karnataka (Belgaum & Shimoga). (Map 15).

Status: (LR).

Notes: *Eriocaulon dalzellii* is restricted to the northern and central Western Ghats. It is found growing submerged in water. Its roots were observed to be spreading horizontally, which may be due to water current. It is closely related to *E. fulvatile* Trim. which is distributed in India along Western Ghats and Sri Lanka and differs from it as stated below:

<i>Eriocaulon dalzellii</i>	<i>Eriocaulon fluviatile</i>
Scapes many.	Scape solitary.
Heads hemispherical.	Heads globose.
Involucral bracts scarious, obtuse-cuneate, oblong.	Involucral bracts roundish-oval.
Sepals linear, slender.	Sepals linear-spathulate.
Petals ciliate, with flexous hairs.	Petals membranous, tipped with scanty white, hairs.

Eriocaulon eurypeplon Koern. in *Linnaea* 27: 685. 1856; Hook f., *Fl. Brit. India* 6: 585. 1893; Fyson in *J. Indian Bot.* 3: 17. 1922; Cooke, *Fl. Bombay* 3: 363. 1967 (repr. ed.); Karthikeyan et al., *Fl. Ind. Enum. Mono.* 129. 1989; Ansari & Balakr. *Eriocaul. India* 86. 1994; Cook, *Aqua. Wetland Pl. India* 194. 1996; Lakshminarasimhan in Sharma et al., *Fl. Maharashtra Monocot.* 268. 1996. *Eriocaulon vanheurckii* Muell. – Arg. in van Heurck. obs. 2: 98. 1870; Sant. in *Rec. Bot. Surv. India* 16 (1): 297. 1967; Rao, *Fl. Goa* 2: 459. 1986. *Eriocaulon bombayanum* Ruhl. in *Engl. Pflanzenr.* 4 (30): 104. 1903. *Eriocaulon indicum* Moldenke in *Phytologia* 3: 163. 1949. *Eriocaulon vanheurckii* Muell. – Arg. *minima* Moldenke, in *Phytologia* 84. 1955. *Eriocaulon karalense* Ansari et al., *J. Econ. Tax. Bot.* 11: 235. 1987.

Herbs up to 12 cm long, with fibrous roots. Leaves up to 10 x 1 cm, linear-lanceolate, acute at apex, green with numerous nerves. Scape up to 12 cm long, quadrangular, slightly winged, green; sheath up to 5 cm long, acute at apex with oblique mouth, green. Heads hard, blackish white; involucre bracts c 0.12 x 0.1 cm, orbicular, acuminate at apex, pale white–blackish white, with stiff white hairs at apex. Floral bracts c 0.14 x 0.08 cm, rhomboidal, acute–acuminate at apex, leathery, black with stiff white hairs at apex. Staminate flowers: Sepals two, rarely three, c 0.07 x 0.04 cm, narrow at base, winged on margins, obtuse at apex, keeled, black with stiff white hairs on the tip of keel. Petals three, minute, with white hair at tip. Anthers black, two celled. Pistillate flowers: Sepals two, c 0.6 x 0.03 cm, keeled on back, same as the male flowers. Petals three, c 0.07 cm long, filiform, hairy, without black gland. Ovary three celled, green; stigma three, green. Seeds c 0.06 x 0.35 cm, cells transversely elongate, appendages 1-2 from the middle of transverse wall. (Fig. 13 K-O; Plate 10 C).

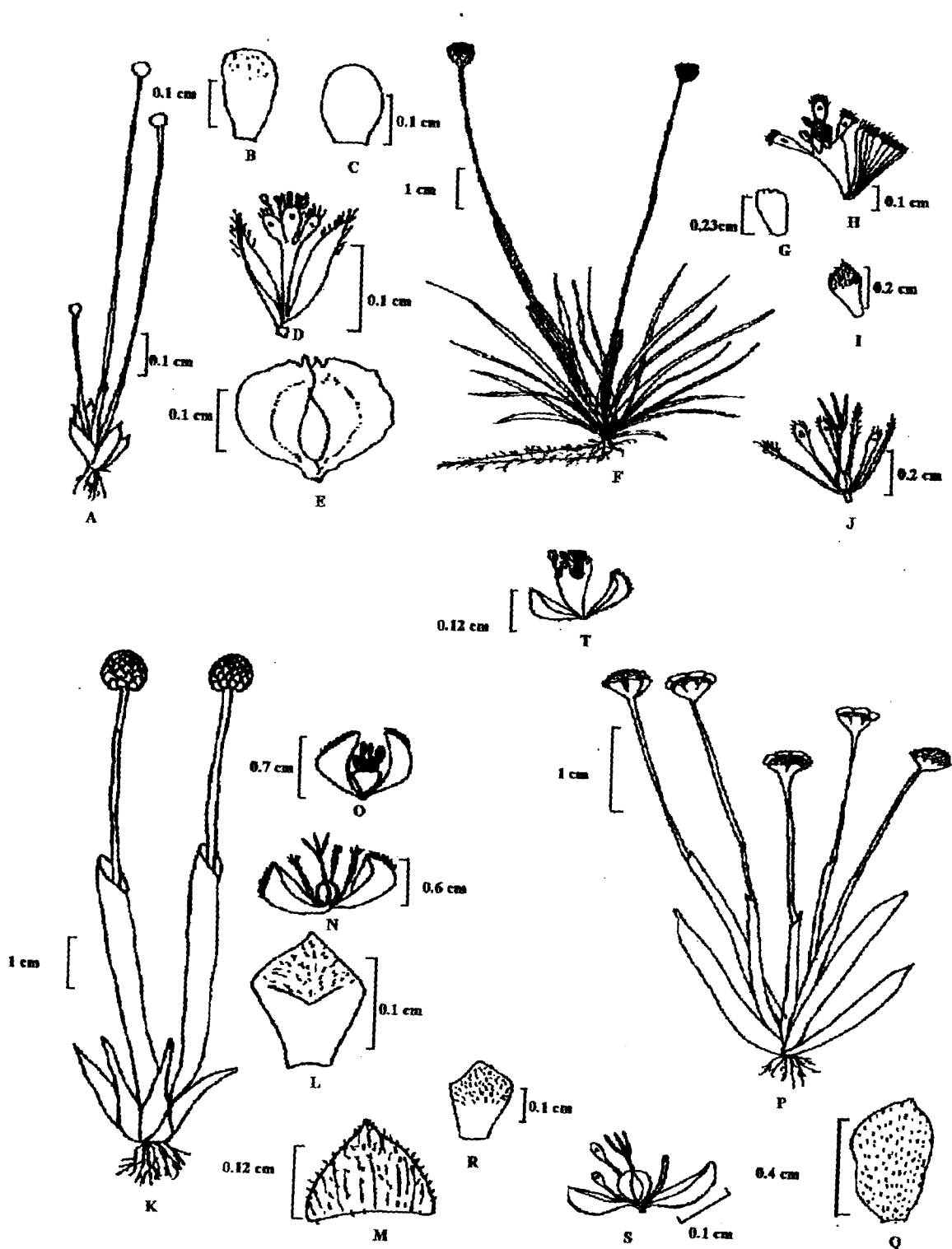
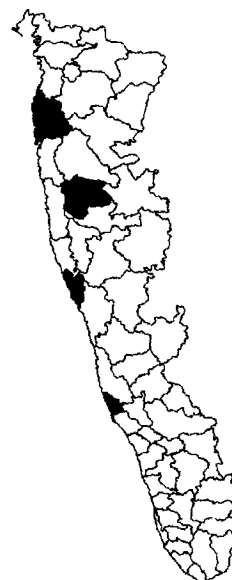
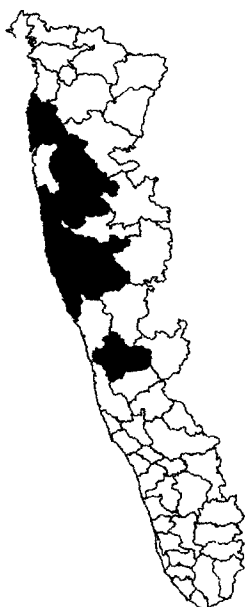
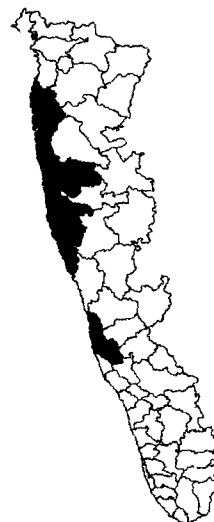
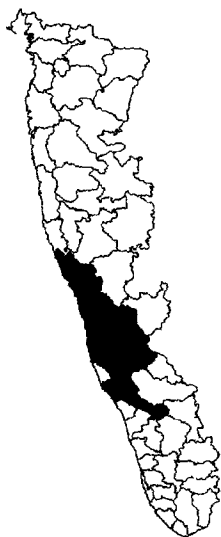


Figure 13: *Eriocaulon cuspidatum* Dalz.: A. Habit; B. Involucre bract; C. Floral bract; D. Staminate flowers; E. Pistillate flowers. *Eriocaulon dalzellii* Koern.: F. Habit; G. Involucre bract; H. Staminate flower; I. Floral bract; J. Pistillate flower. *Eriocaulon eurypeplon* Koern.: K. Habit; L. Involucre bract; M. Floral bract; N. Pistillate flower; O. Staminate flower. *Eriocaulon fysonii* Ansari & Balakr.: P. Habit; Q. Involucre bract; R. Floral bract; S. Pistillate flower; T. Staminate flower.

Map 15: Distribution of *Diospyros saldanhae*, *Eriocaulon cuspidatum*, *Eriocaulon dalzellii* and *Eriocaulon eurypeplon* along Western Ghats.



F ● *Diospyros saldanhae*
Kosterm.

● *Eriocaulon dalzellii*
Koern.

● *Eriocaulon cuspidatum* Dalz.

● *Eriocaulon eurypeplon* Koern.

Fl. & Fr.: July -September.

Habitat: Margins of the puddles in marshy or water logging areas on hard lateritic plateaus.

Distribution: **Maharashtra:** (Satara & Thane); **Goa** (Cotigao, Goa University Campus & Loliem); **Kerala** (Kasaragod). (Map 15).

Status: (LR).

Notes: It is distributed in the northern and central Western Ghats. It is one of the most commonly observed *Eriocaulon* species on the plateaus. Though it shows great variation in size it is distinct in having loose sheath covering the peduncle which holds water and prevents it from desiccation during temporary dry period.

Eriocaulon fysonii Ansari & Balakr. Fam. Eriocaul. Ind 89, f. 28. 1994; Cooke, Aqua. & Wetland Pl. India 195. 1996; Lakshminarshimhan in Sharma et al., Fl. Maharashtra Monocot. 752. 1996. *E. cuspidatum* Dalz. var. *bracteata* Fyson in J. Indian 2: 318. 1921.

Succulent herbs, up to 14 cm long. Leaves up to 3 x 0.6 cm, oblong, cuspidate, slightly broad at base, succulent, green. Scape up to 12 cm long, erect, glabrous, green with long longitudinal ridges and furrows; sheath up to 5 cm long, glabrous, green, oblique at apex. Heads white to straw colored, enclosed by involucre bracts; involucre bracts c 0.4 cm long, obovate-oblong, chartaceous, obtuse, glabrous, green. Floral bracts c 0.2 x 0.08 cm, obovate, cuneate at apex, with white ciliate hair at apex. Staminate flowers: Sepals 2, c 0.12 cm, keeled, spatulate, acute at apex; keels with white hair at apex. Petals 3, minute, unequal, sparsely hairy; hairs white with black gland; anthers black, oblong. Pistillate flowers: Sepals 2, c 0.1 cm long, spatulate,

concave, keeled with white ciliate hairs at tip. Petals 3, unequal in size, larger one c 0.1 cm long, rarely hairy at apex, with black glands, two smaller c 0.07 & 0.06 cm, oblanceolate, obtuse at apex, white with black glands at apex. Ovary sessile, ovoid; style c 0.04 cm long, straw colored; stigma three fid. Seeds c 0.07 x 0.04 cm, oblong-ovoid with transversely elongate cells, appendages solitary or absent. (Fig. 13 P-T; Plate 10 A-B).

Fl. & Fr.: August - November.

Habitat: Marshy places and puddles on the plateaus.

Distribution: **Maharashtra** (Ratnagiri & Sindhudurg); **Goa** (Chimbel, Cotigao, Loliem, Canacona, Margao & Verna); **Karnataka** (Uttar Kannada). (Map 16).

Status: (LR).

Notes: This species is a new report to the state of Goa. It is restricted to northern Western Ghats and is closely related to *E. cuspidatum* Dalz. which is also endemic to Western Ghats and distributed in Goa and differ from it as discussed under *E. cuspidatum*.

Eriocaulon lanceolatum Miq. ex Koernick in *Linnaea* 27: 656. 1856; Hook. f., *Fl. Brit. India* 6: 577. 1893; Fyson in *J. Indian Bot.* 2: 266, t. 23. 1921; Cooke, *Fl. Bombay* 3: 357. 1967 (repr. ed.); Kulkarni, *Fl. Sindhudurg* 474. 1988; Karthikeyan et al., *Fl. Ind. Enum. Mono.* 78. 1989; Ansari & Balak. *Eriocaul. India* 29. f. 6. 1994; Bhat, in Pandey, *Taxonomy & Biodiversity* 132. 1995; Cooke *Aqua. Wetland Pl. India* 196. 1996. *Eriocaulon lanceolatum* Miq. ex Koernick var. *pilosum* Moldenke in *Phytologia* 3: 164. 1949; Sant. in *Rec. Bot. Surv. India* 16 (1): 296. 1967; Karthikeyan

et al., Fl. Ind. Enum. Mono. 78. 1989; Almeida, Fl. Savantwadi 2: 63. 1990; Lakshminarashimhan in Sharma et al., Fl. Maharashtra Monocot. 257. 1996.

Erect tufted herbs. Leaves simple, oblong–lanceolate; lamina up to 2.5 x 0.6 cm, oblong–lanceolate, glabrous, many nerved, hairy along the margins, acute to acuminate at apex; sheath up to 3 cm long, glabrous, succulent, green, obliquely acute at apex. Scape up to 11 cm long, finely hairy. Heads c 0.6 cm across, white; involucre bract c 0.2 x 0.2 cm, obtuse at apex, hairy. Floral bract c 0.17 x 0.06 cm, oblong, triangular at apex, membranous, hairy at tip. Staminate flowers: Shorter than Pistillate flowers. Sepals 3 lobed, fused, c 0.13 cm, obtuse at apex, glabrous. Petals 3, very short with a black gland in the center. Anthers black, two celled. Pistillate flowers: Sepals 3, one slightly bigger than the other two, c 0.15 long, keeled, papery white with white ciliate hairs along the margins, other c 0.13 cm long, white with ciliate hairs. Petals 3, c 0.12 cm long, membranous, white with ciliate hairs at tip, black gland in the center. Ovary c 0.03 cm long, oblong–ellipsoid. Seeds c 0.06 x 0.035 cm, cells of seed coat transversely elongate, appendages solitary, from the center of transverse radial walls. (Fig. 14 A-E).

Fl. & Fr.: July – February.

Habitat: Open marshy areas and puddles on lateritic plateaus.

Distribution: Maharashtra (Sindhudurg & Thane); Goa (Molem); Karnataka (Uttar & Dakshin Kannada); Kerala (Kasaragod). (Map 16).

Status: (LR).

Notes: It is new report to the state of Goa. It is distributed in the northern and central Western Ghats. It is closely related to *E. sericans* which is distributed in Myanmar and differs from it as stated below:

<i>E. lanceolatum</i>	<i>E. sericans</i>
Leaves narrowly oblong-lanceolate.	Leaves shortly subulate
Scapes many, slender, not grooved.	Scapes 1-2, slender, four grooved.
Involucral bracts small, pale, quadrate or obovate.	Involucral bracts oblong, pale yellow, rounded.
Pistillate flowers sessile.	Pistillate flowers pediceled.

Eriocaulon redactum Rhuland in Engl. Pflanzenr. 13: 113. 1903; Ansari & Balak.

Eriocaul. India 181. f. 65. 1994; Bhat in Pandey, Taxonomy & Biodiversity 132. 1995.

Herbs, up to 8 cm long, acaulescent, with fibrous roots. Leaves up to 1.5 cm long, apiculate, glabrous, succulent, green. Peduncle up to 8 cm long, glabrous, green. Sheath up to 1.5 cm long, glabrous, ovate, acute. Heads c 0.2 cm across, white-pale grey; involucral bracts c 0.14 x 0.8 cm, oblong-obovate, obtuse-truncate at apex, slightly lobed, chartaceous, glabrous, greyish white with black spots or patches. Floral bracts c 0.16 cm long, oblanceolate, acute, chartaceous, glabrous, grey. Staminate flowers: Sepals ovate, forming spathe, not lobed, acute, slightly serrate along margins with ciliate hairs; hairs white. Stipe of corolla c 0.07 cm; petals 3, small, white-cream, coloured slightly ciliate on margins with prominent black glands. Stamens 6; anthers white, globose. Pistillate flowers: Pedicels minute. Sepals 1-2 branched, arising from the pedicel, c 0.5 cm long. Petals absent. Ovary c 0.05 cm long, oblong-ovoid; style c 0.15 cm long; stigma 3. Seeds c 0.05 cm long, oblong, ellipsoid, golden brown, obtuse at one end, apiculate, dark brown at other end. Cells of seed coat transversely elongate, appendages absent. (Fig. 14 F-K; Plate 10 D).

Fl. & Fr.: July - September.

Habitat: In puddles on rocky plateaus.

Distribution: Goa (Cotigao & Goa University Campus); Karnataka (Dakshin Kannada); Kerala (Thiruvananthapuram). (Map 16).

Status: (R).

Notes: It is new report to the State of Goa. It is discontinuously distributed along the Western Ghats. It is closely related to *E. cinerium* R. Br. which is widely distributed in India and in other tropical countries but differs from it as stated below:

<i>E. redactum</i>	<i>E. cinerium</i>
Floral bracts oblanceolate.	Floral bracts linear-elliptic.
Spathe of staminate flowers sparsely hairy at apex; pistillate sepal reduced to branched hairs.	Spathe of staminate flowers glabrous; pistillate sepals linear-subulate.
Heads greyish-white.	Heads black.
Receptacle columnar, glabrous – villous	Receptacle ovoid, glabrous or sparsely hairy.
Involucral bracts grayish white with black spots.	Involucral bracts black.
Sepals ovate, acute, connate into spathe, not lobed, hyaline, sparsely hairy towards apex.	Sepals obovate, connate into spathe, three lobed with acuminate lobes, glabrous, black.
Seeds oblongoid-ellipsoid, obtuse, purple.	Seeds ovoid-ellipsoid, pale yellow.

Eriocaulon stellulatum Koern. in *Linnaea* 27: 620. 1856; Hook. f. *Fl. Brit. India* 6: 579. 1893; Fyson in *J. Indian Bot.* 2: 317. 1921; Cooke, *Fl. Bombay* 3: 359. 1967 (repr. ed.); Kulkarni & Desai in *J. Bombay Nat. Hist. Soc.* 69: 233. 1972; Rao, *Fl. Goa* 2: 489. 1986; Ansari & Balak., *Eriocaul. India* 39. 1994; Bhat in Pandey, *Taxonomy & Biodiversity* 132. 1995; Lakshminarasimhan in Sharma et al., *Fl. Maharashtra Monocot.* 265. 1996.

Annual herbs, up to 15 cm long. Leaves up to 4.2 x 0.7 cm, broadly linear, tapering from the base to the tip, many nerved, flat, glabrous. Scape up to 15 cm long, slender, sulcate with sparsely placed hairs; sheaths up to 2.7 cm long, obliquely split, with long acuminate tip, slightly hairy at base. Heads stellately

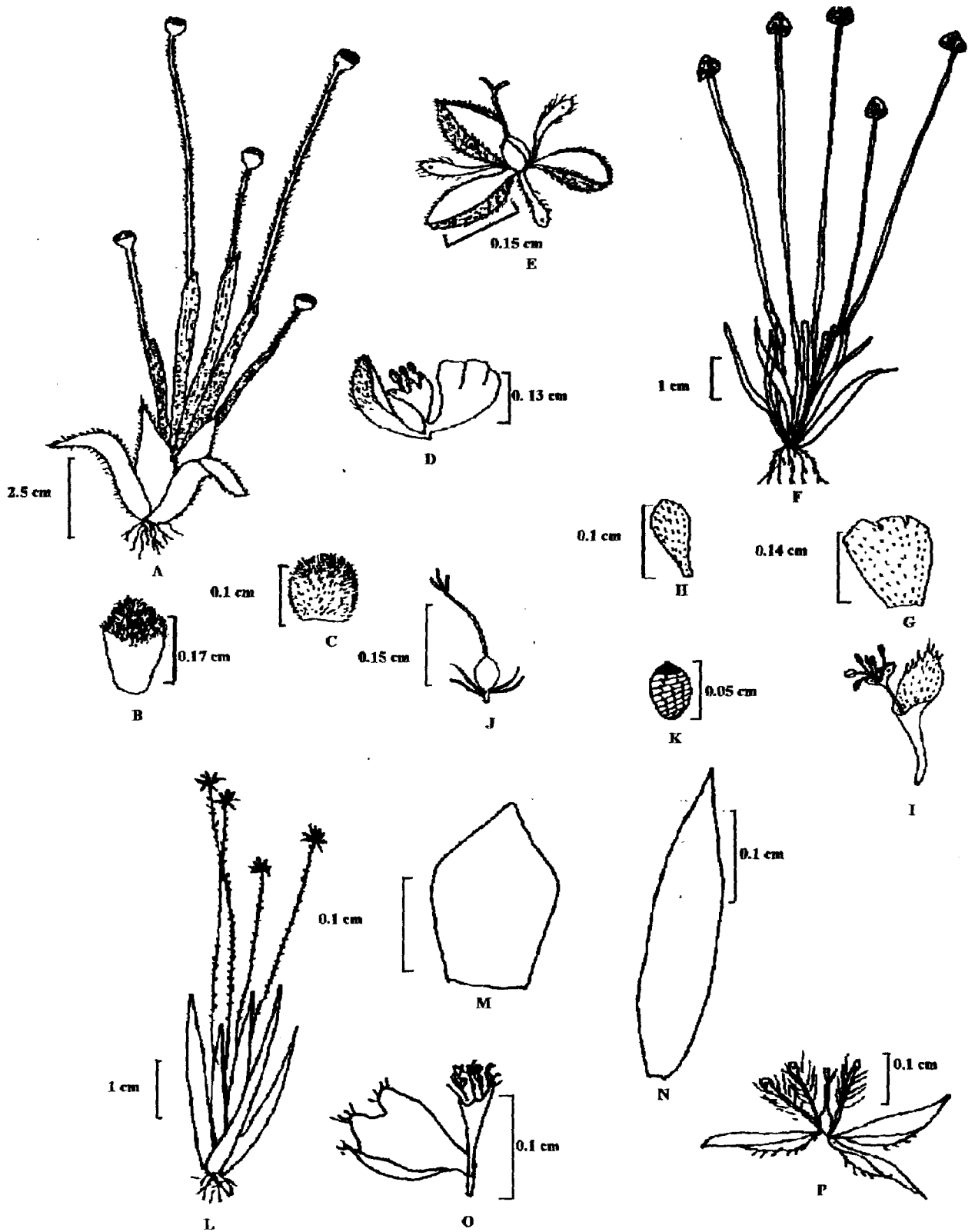
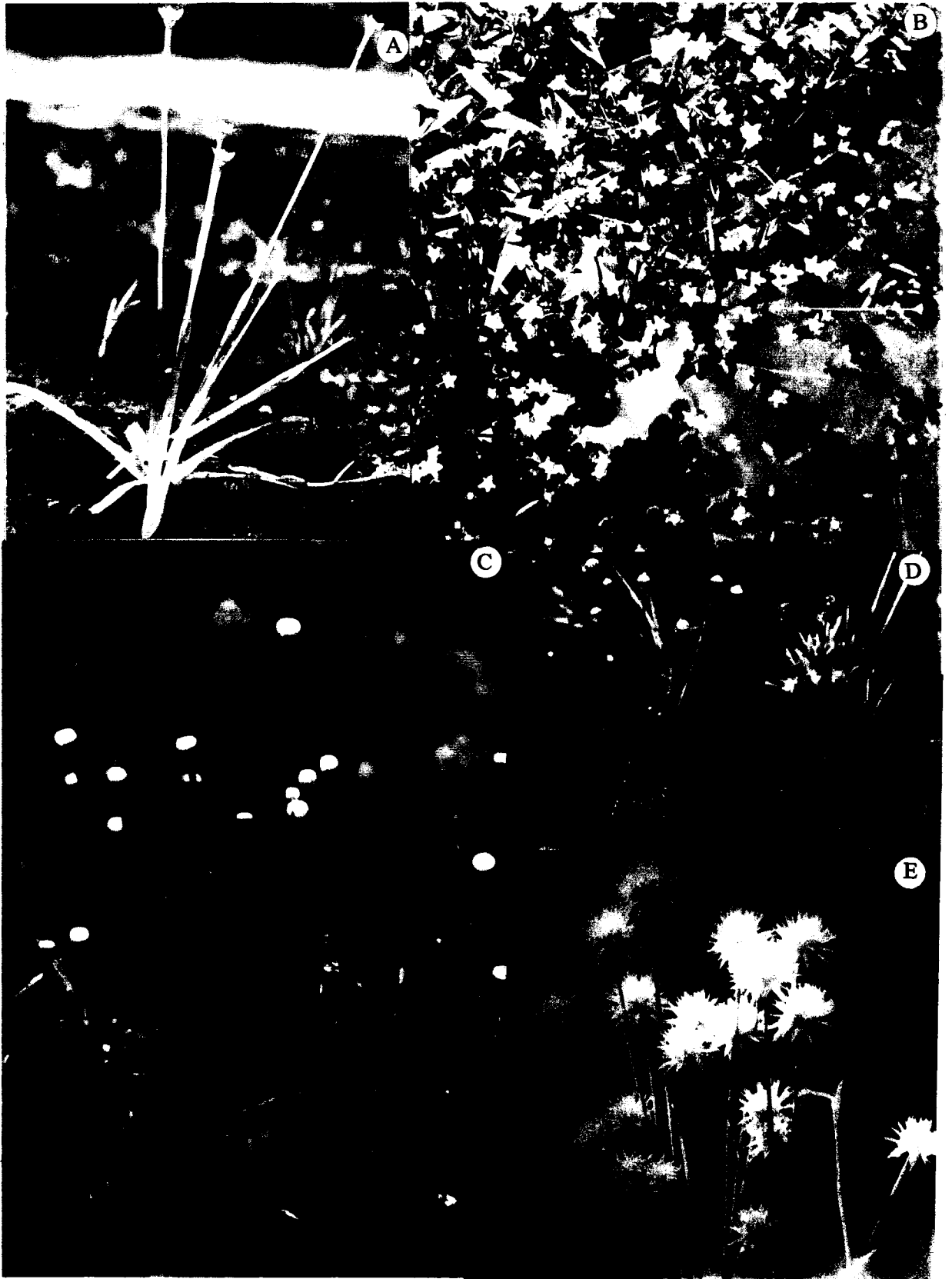
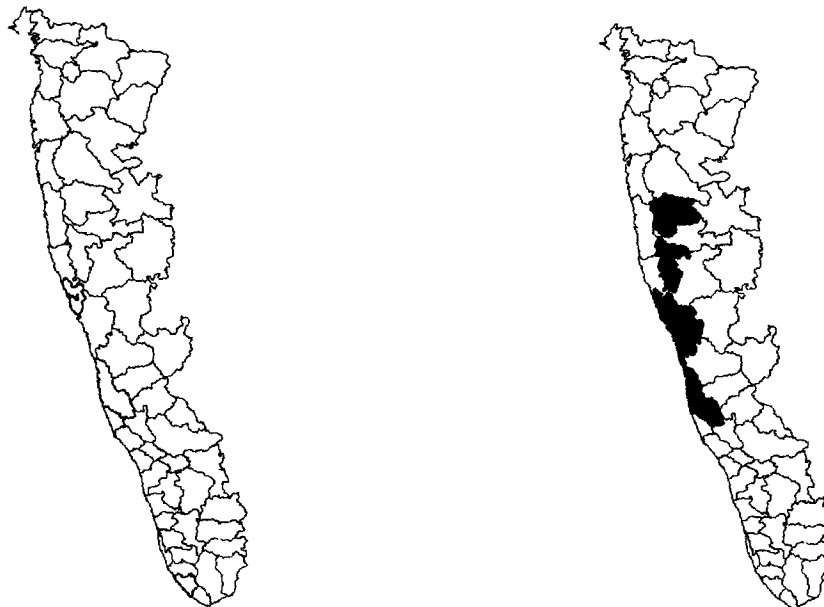


Figure 14: *Eriocaulon lanceolatum* Miq. ex Koernick: A. Habit; B. Floral bract; C. Involucral bract; D. Staminate flower; E. Pistillate flower. *Eriocaulon redactum* Rhuland: F. Habit; G. Involucral bract; H. Floral bract; I. Staminate flower; J. Pistillate flower; K. Seed. *Eriocaulon stellulatum* Koern.: L. Habit; M. Involucral bract; N. Floral bract; O. Staminate flower; P. Pistillate flower.



**PLATE 10: A & B. *Eriocaulon fysonii* Ansari & Balakr., C. *Eriocaulon eurypeplon* Koem.,
D. *Eriocaulon redactum* Rhuland, E. *Eriocaulon stellulatum* Koem.**

Map 16: Distribution of *Eriocaulon fysonii*, *Eriocaulon lanceolatum*, *Eriocaulon redactum* and *Eriocaulon stellulatum* along Western Ghats.



● *Eriocaulon fysonii* Ansari & Balakr.

● *Eriocaulon lanceolatum* Miq. ex Koernick

○ *Eriocaulon redactum* Rhuland

● *Eriocaulon stellulatum* Koern.

echinulate, glabrous, white. Involucral bracts c 0.34 cm long, ovate, acuminate, glabrous. Floral bracts c 0.4 cm long, lanceolate, hyaline, glabrous, stellately spreading, exceeding the heads, receptacle pilose. Staminate flowers: Slightly stipitate. Sepals two, slightly connate at base, c 0.15 cm long, obovate, acute at apex, glabrous, hyaline. Corolla tube c 0.1 cm long, petals three, minute, unequal, with dark spot in the center. Stamens six; anthers black. Pistillate flowers: Sessile. Sepals three, c 0.1 cm long, ovate, recurved, cuneately winged, glabrous, white. Petals three, c 0.05 cm long, obtuse, hairy with black gland. Ovary sessile, three lobed; style branched, filiform. Seeds c 0.3 cm long, globosely ellipsoid, smooth, brown; cells of seed coat transversely elongate. (Fig. 14 L-P; Plate 10 E).

Fl. & Fr.: November – December.

Habitat: Near wet rocky open places in semievergreen forests.

Distribution: Maharashtra (Kolhapur & Satara); Goa (Molem – Anmod, Ravanacho dongar & Surla); Karnataka (Uttar Kannada & Dakshin Kannada); Kerala (Malabar). (Map 16).

Status: (R).

Notes: It is discontinuously distributed along the Western Ghats. It distinctly differ from other species of *Eriocaulon* by it's setellulate hairs.

EUPHORBIACEAE

Bruxanellia indica Dennst. ex Kostel, Allg. Med – Pharm. Fl. 5: 200. 1836; Nicolson et al. An Interpret. Van Rheed. Hort. Malab. 108. 1988; Naithani et al., Forest Fl. Goa 550. 1997. *Blachia denudata* Benth. in J. Linn. Soc. 17: 226. 1880; Hook. f., Fl. Brit. India 5: 403. 1887; Cooke, Fl. Bombay 3: 100. 1967 (repr. ed.); Arora et al., Bot.

South Kanara 53. 1981; Rao, Fl. Goa 2: 328. 1986; Kulkarni, Fl. Sindhudurg 390. 1988; Almeida, Fl. Savantwadi 1: 377. 1990; Deshpande et al., Fl. Mahabaleshwar 2: 529. 1993; Saldanha, Fl. Karnataka 2: 120. 1996; Sasidharan & Sivirajan, Fl. Thrissur 396. 1996. *Blachia andamanica* (Kurz.) Hook. f. subsp. *demudata* (Benth.) Balakr. & Chakrab. in Proc. Ind. Acad. Sci. (Plant Sci.) 99: 571. 1989.

Shrubs, up to 3 m high; bark smooth, glabrous, pale brown. Leaves simple, alternate, petiolate; petiole up to 2 cm long, glabrous, green; lamina up to 15 x 5 cm oblong-lanceolate, glabrous, smooth, rounded at base, slightly undulate along margins, obtusely acuminate at apex, with 7-8 pairs of nerves. Inflorescence a terminal raceme up to 3 cm long glabrous, green. Staminate flowers at the top of the raceme, female at base. Staminate flowers: Pedicel c 1 cm long, glabrous, green. Sepals 5, c 0.2 x 0.3 cm, suborbicular, acute at apex, pale green, recurved (bending downwards). Petals 5, c 0.1 x 0.2 cm, alternating the sepals, white. Disk gland scale like, c 0.1 cm long, slightly trilobed. Stamens 12-15 or numerous; filaments c 0.2 cm long, flattened, white; anthers orbicular, flat horeshoe shaped, on the margins of connective. Pistillate flower: Pedicel c 0.7 cm long, stout, green, glabrous. Sepals 4-5, c 0.3 x 0.2 cm somewhat pendulate, green, acute at apex. Petals 0. Ovary c 0.2 cm long, cylindrical, glabrous. Styles 3, c 0.2 cm, 2 fid. Capsules c 1 x 1.5 cm, ellipsoid, glabrous, green, 3 lobed with persistent styles. (Fig. 15 A-C; Plate 11 A).

Fl. & Fr.: October – March.

Habitat: Moist deciduous, semievergreen and evergreen forests.

Distribution: Maharashtra (Kolhapur, Ratnagiri & Sindhudurg); Goa (Chorla, Caranzalem & Molem-Anmod); Karnataka (Hassan, Mysore, Uttar & Dakshin Kannada); Kerala (Thrissur). (Map 17).

Status: (LR).

Notes: It is distributed almost throughout the Western Ghats. Balakrishnan and Chakrabrathy (l.c.) treated this species as subspecies to *B. andamanica* (Kurz) Hook. f. It is closely related to *B. andamanica* subsp. *andamanica* which is distributed in Andaman islands, north east India, Bangladesh, Myanmar, Indo-China, Thailand, Malaya, Borneo, Philippines and Celebes. Though, *Blachia denudata* Benth. has been treated as a variety under *B. andamanica* by Balakr. & Chakrab. (l.c.), in the present work it is being treated as a distinct species under *Bruxanellia* following Nicolson (l.c.).

<i>Bruxanellia indica</i>	<i>Blachia andamanica</i>
Ovary glabrous.	Ovary densely pubescent.
Common in moist deciduous to evergreen forests.	Common in tropical beach forest or mixed land forest on sandy or clayed soil.

Dimorphocalyx glabellus Thw. var. **lawianus** (Hook. f.) T. Chakrab. & Balakr. Proc. Indian Acad. Sci. (Plant Sci.) 100 (5): 296. 1990; Saldanha, Fl. Karnataka 2: 130. 1996. *Dimorphocalyx lawianus* (Muell. – Arg.) Hook. f., Fl. Brit. India 5: 404. 1887; Cooke, Fl. Bombay 3: 101. 1967 (repr. ed.); Gamble, Fl. Madras 2: 935. 1967 (repr. ed.); Santapau, Fl. Khandala 248. 1967; Arora et al., Bot. South Kanara 54. 1981; Chandrabose in Henry et al., Fl. Tamil Nadu 2: 226. 1987; Kulkarni, Fl. Sindhudurg 394. 1988; Almeida, Fl. Savantwadi 2: 381. 1990; Kothari & Moorthy, Fl. Raigad 364. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 532. 1995; Sasidharan & Sivarajan, Fl. Thrissur 400. 1996; Naithani et al., Forest Fl. Goa 553. 1997. *Trigonostemon lawianus* Muell- Arg. in Linnaea 34: 212. 1865.p.p., non Nimmo

1839. *Dimorphocalyx glabellus* Bedd. in Trans. Linn. Soc. London 25: 225, t. 26.
1866, non Thw. 1864.

Monoecious or dioecious small trees or shrubs, much branched; branches with lenticels. Leaves simple, alternate, petiolate; petiole c 1 cm long; lamina up to 14 x 6.5 cm, elliptic – lanceolate, rounded at base, margins shallowly dentate, obtusely acuminate at apex, dark green, shining adaxially, pale green abaxially, veins alternate, rounded on the margins, with 8–10 pairs of lateral veins. Staminate flowers usually solitary in the axil of the fallen leaves, c 1 cm across; pedicel c 0.2 cm long, stout. Calyx tube c 0.2 x 0.4 cm, lobes 5, unequal; 3-lobes c 0.5 cm long, linear, rounded–obtuse at apex, some times notched, glabrous, green, rarely sparse long hairs at the apex, two lobes c 0.2 cm long, obtuse. Petals 5, c 0.7 x 0.25 cm, obtuse at apex, white. Stamens arranged in three rows, outer five fused only at the base, column very short; filament c 0.12 cm long, stout white; anthers two celled; middle with long staminal column; filaments five; innermost two. Pistillate flowers: Solitary, rarely two–three on long peduncle; bracts c 0.1 cm long. Sepals unequal c 2 x 1 cm, obovate with parallel veins, white at base, green above, acute–rounded at apex. Ovary c 0.3 x 0.2 cm on a ring with long ciliate hairs; style three, c 0.2 cm long; stigma two lobed, c 0.3 cm long, sparsely hairy. Capsule up to 2 cm long, villous. (Fig. 15 D-G; Plate 11 B).

Fl. & Fr.: January – April.

Habitat: In semievergreen forests.

Distribution: Maharashtra (Raigad, Ratnagiri, Satara, Sindhudurg & Thane); Goa (Molem – Anmod); Karnataka (Mysore, Uttar & Dakshin Kannada); Kerala (Thrissur); Tamil Nadu (Coimbatore, Nilgiris & Tirunelveli). (Map 17).

Status: (LR).

Notes: It is distributed throughout Western Ghats. It is closely related to *D. glabellus* Thw. var. *glabellus* which is distributed from South India to Sri Lanka, but differs from it as stated below:

<i>D. glabellus</i> var. <i>lawiana</i>	<i>D. glabellus</i> var. <i>glabellus</i>
Leaves obtusely acuminate, up to 14 x 6.25 cm.	Leaves obtuse or acute, up to 12.5 x 5 cm.
Fruiting calyx elliptic-oblong or lanceolate, 1.25–2.5 cm long, without glandular pits.	Fruiting calyx obovate, obtuse, 0.6–1.25 cm long with glandular pits on back near the tip.
Capsules up to 2 cm long, villous, scarcely lobed.	Capsule up to 1.75 cm long, slightly hispid, shortly lobed.

Drypetes venusta (Wight) Pax & Hoffm. in Engler, Pflanze 81: 268. 1922; Sharma et al., Biol. Mem 2 (1 & 2): 129. 1977; Chandrabose in Henry et al. Fl. Tamil Nadu 2: 226. 1987; Subramaniam et al., Fl. Palghat 117. 1987; Kulkarni, Fl. Sindhudurg 395. 1988; Saldanha, Fl. Karnataka 2: 132. 1996. *Astylis venusta* Wight, Ic. 1992. 1853. *Hemicyclia venusta* (Wight) Thw. in Hooker's J. Bot. Kew Gard. Misc. 7: 272. 1855; Hook. f., Fl. Brit. India 5: 339. 1887; Cooke, Fl. Bombay 3: 87. 1967 (repr. ed); Gamble, Fl. Madras 2: 909. 1967 (repr. ed).

Medium sized trees, up to 7 m, bark smooth; branches slender, drooping, glabrous. Leaves simple, alternate, petiolate; petiole c 0.5 cm long; lamina up to 12 x 3.6 cm, elliptic, oblong, acute at base, some times unequal sided, entire along margins, acuminate at apex. Flowers axillary; staminate flowers in fascicles; pistillate flowers solitary. Staminate flowers: Pedicels c 0.5 cm long. Sepals four, c 0.35 cm long, broadly ovate, obtuse at apex, pubescent abaxially. Stamens 7, surrounding a fleshy crenulate disk; filaments c 0.2 cm long; anthers c 0.12 cm long, oblong. Pistillate flowers: Pedicel c 0.5 cm long, sepals as in staminate flowers. Ovary on a

fleshy flat, disc; style absent; stigma c 0.25 cm long, orbicular, sessile. Fruit c 1.5 x 1 cm, orbicular. (Fig. 15 H; Plate 12 A).

Fl. & Fr.: November – February.

Habitat: Evergreen and semievergreen forests.

Distribution: Maharashtra (Kolhapur & Thane); Goa (Gaodongri, Molem–Anmod & Vagheri hills); Karnataka (Uttar Kannada); Kerala (Palghat); Tamil Nadu (Coimbatore & Nilgiri). (Map 17).

Status: (LR).

Notes: It is new report to the state of Goa. It is distributed discontinuously along the Western Ghats. It is closely related to *D. wightii* (Hook. f.) Pax & Hoffm. which is distributed in Nilgiris and differs from it as stated below:

<i>D. venusta</i>	<i>D. wightii</i>
Leaves elliptic-oblong, obtusely acute, up to 12 cm long, with 10-15 pairs of lateral veins.	Leaves lanceolate, obtusely acuminate, the point often twisted, up to 9 cm long, with 8 pairs of lateral veins.

Euphorbia notoptera Boiss. in DC. Prodr. 15 (2): 26. 1862; Hook. f. Fl. Brit. India 5: 247. 1887; Vartak, Enum. Pl. Gomantak 92. 1966; Cooke, Fl. Bombay 3: 61. 1967 (repr. ed.); Gamble, Fl. Madras 3: 892. 1967 (repr. ed.); Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 339. 1976; Rao, Fl. Goa 2: 388. 1986; Kulkarni, Fl. Sindhudurg 397. 1988; Almeida, Fl. Savantwadi 2: 385. 1990; Deshpande et al., Fl. Mahabaleshwar 2: 537. 1995; Saldanha, Fl. Karnataka 2: 139. 1996.

Annual erect or creeping herbs, up to 30 cm long. Stems smooth, cylindrical, dichotomously branched, reddish brown with long internodes up to 10 cm long. Leaves simple, opposite, stipulate, petiolate; stipule c 0.1 cm long, brown, caducous; petiole up to 0.2 cm long, glabrous; lamina up to 3 x 1 cm, linear-

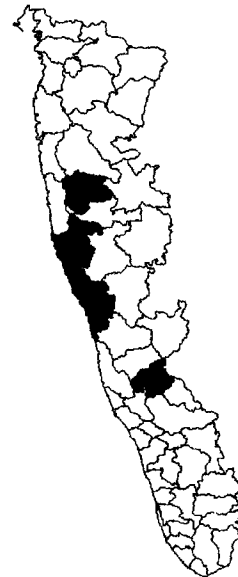
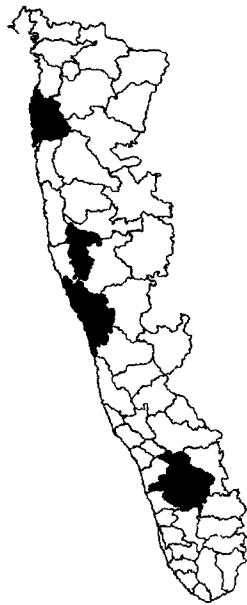
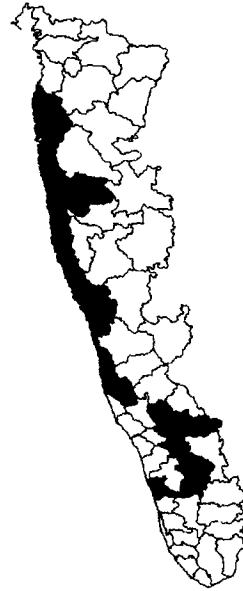
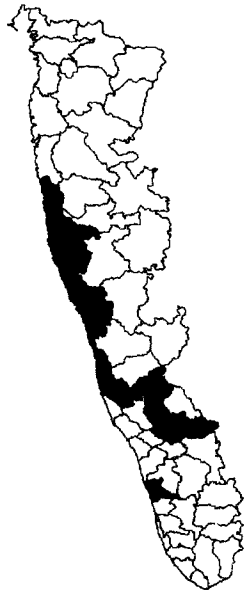


Figure 15: *Bruxanellia indica* Dennst.: A. Leaf; B. Pistillate flower; C. Staminate flower. *Dimorphocalyx glabellus* Thw., var. *lawianus* (Hook. f.) T. Chakrab. & Balakr.: D. Habit; E. Staminate flower; F. Pistillate flower; G. Stamens. *Drypetes venusta* (Wight) Pax & Hoffm.: H. Habit. *Phyllanthus talbotii* Sedgwick: I. Branch; J. Leaf; K. Bracts and bractioles; L. Staminate flower; M. Pistillate flower; N. Fruit; O. Bract. *Euphorbia notoptera* Boiss.: P. Habit; Q. Flower; R. Fruit.



PLATE 11: A. *Bruzanellia indica* Dennst. ex Kostel, B. *Dimorphocalyx glabellus* Thw., var. *lawianus* (Hook. f.) T. Chakrab. & Balakr., C & D. *Euphorbia notoptera* Boiss., E & F. *Phyllanthus talbotii* Sedgwick (F. Fruits)

Map 17: Distribution of **Bruxanellia indica**, **Dimorphocalyx glabellus** var. **lawianus**, **Drypetes venusta** and **Euphorbia notoptera** along Western Ghats.



● **Bruxanellia indica** Dennst. ex
Kostel

● **Drypetes venusta** (Wight)
Pax & Hoffm.

● **Dimorphocalyx glabellus** Thw., var.
lawianus (Hook. f.) T. Chakrab. &
Balakr.

● **Euphorbia notoptera** Boiss.

oblong, subcordate at base, margins slightly serrulate, acute at apex, nerves inconspicuous adaxially dark green, glabrous, abaxially pale green. Involucre solitary, axillary as well as terminal, up to 1 cm long, stalked; stalk up to 0.3 cm long, reddish green, involucre campanulate with 4 floral leaves; floral leaves c 0.2 x 0.3 cm, pinkish white, glandular; glands oblong, 4 lobed, basely attached to the floral leaves. Staminate flowers numerous, stalked, c 0.1 cm; anthers bilobed, yellow with brown tinge; staminodes numerous, white, hairy. Pistillate flowers solitary, stalks exerted from the centre. Ovary trilocular; ovules solitary; styles 3, up to 0.1 cm long, yellowish brown; stigma bifid, brown. Capsule c 0.2 cm, globose, grooved, green, 3 cocci with 2 narrow wings each; seeds four angled, black. (Fig. 15 P-R; Plate 11 C-D).

Fl. & Fr.: September - November.

Habitat: On lateritic plateaus in open or amidst bushes.

Distribution: **Maharashtra** (Kolhapur, Satara & Sindhudurg); **Goa** (Agonda, Chimbhel plateau, Darbandora, Molem, Honda, Ordafond, Patiem, Porvorim, Taleigao & Verna);

Karnataka (Hassan & Uttar Kannada). (Map 17).

Status: (LR).

Notes: It is a new report to the state of Goa. It is closely related to *E. concanensis* Janarthanam & Yadav, a newly described species from Sindhudurg district of Maharashtra and differs from it in having wings on capsule.

Phyllanthus talbotii Sedgwick in J. Indian Bot. Soc. 2: 124. 1921; Singh & Kulkarni in Nayar & Sastry, Red Data Book Indian Pl. 3: 124. 1990.

Plants monoecious, up to 1.5 m high, woody at base, branched; flowering branches up to 15 cm long, hirsute. Leaves alternate, distichous, stipulate, petiolate; stipules two, c 0.15 x 0.05 cm, glabrous, or sparsely ciliate along margins, several empty stipules at base of flowering branches; empty stipules not in pairs. Petiole c 0.05 mm long, hairy. Lamina up to 1.2 x 0.4 cm, oblong, oblique at base, entire or minutely ciliate along margins, secondary veins inconspicuous, glabrous. Staminate flowers: Pedicel c 0.2 cm long, thin, c 0.02 cm thick throughout, glabrous. Flowers up to 0.45 cm across, glands 4, alternating the sepals. Sepals 4, two outer, two inner, c 0.2 x 0.15 mm, ovate, subequal, acute, inner dentate along margins, membranous except midrib. Stamen 4, transversely dehiscent, c 0.1 cm long; anthers c 0.04 cm across. Pistillate flowers: Bracts 1 at base of pedicel, ovate, coarsely serrate. Pedicel tapering at base, c 0.3 cm long, c 0.1 cm diameter at apex, hirsute. Bracteoles 1, c 0.1 x 0.1 cm, broadly ovate, acuminate-caudate at apex. Sepals 6, c 0.2 x 0.12 cm, ovate, entire, obtuse at apex. Ovary c 0.1 x 0.1 cm, broadly ovoid, compactly echinate, pubescent on surface, 6 lobed. Style embedded short; stigma 6 in three groups, approximate to ovary, glands at base dominant. Capsule c 0.3 x 0.35 cm, broadly ovoid, three lobed, surface echinate, puberulous, sepals persistent; capsule six seeded, three lobes c 0.1 cm, three faced, black, curved, with thin striations running along the testa. (Fig. H-O; Plate 11 E-F).

Fl. & Fr.: August – October.

Habitat: Found in river beds and river banks.

Distribution: Goa (Sanguem & Colem); Karnataka (Mysore, Shimoga, Uttara Kannada). (Map 18).

Status: (R).

Notes: This is a new record to the state of Goa and thus extending the distribution of this species along the W. Ghats. It is restricted to central Western Ghats. It is reported in the Red Data book as rare by Singh & Kulkarni (l.c.). After its first publication there is no mention about this species in the literature till Raghavan (1967) collected it from Agumbe, Karnataka. Hence its status has been mentioned as Vulnerable by Singh & Kulkarni (l.c.). In the present study it is commonly observed along the river banks. It is closely related to *P. lawii* Graham, which is distributed in Belgaum to Wyanad and Bihar and differs by its woody branches and in having four stamens.

FABACEAE

Crotalaria filipes Benth. in Hooker's Lond. J. Bot. 2: 475. 1843; Vartak, Enum. Pl. Gomantak 40. 1966; Cooke, Fl. Bombay 1: 312. 1967 (repr. ed.); Gamble, Fl. Madras 1: 206. 1967 (repr. ed); Santapau, Fl. Khandala 52. 1967; Shah, Fl. Gujarat 194. 1978; Saldanha, Fl. Karnataka 1: 433. 1984; Rao, Fl. Goa 1: 107. 1985; Kulkarni, Fl. Sindhudurg 109. 1988; Almeida, Fl. Savantwadi 1: 123. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 153. 1991; Sanjappa, Legumes of India 120. 1992; Deshpande et al., Fl. Mañabaleshwar 1: 166. 1993; Kothari & Moorthy, Fl. Raigad 90. 1993.

Prostrate herbs. Stem much branched, slender, filiform with white appressed hairs. Leaves simple, petiolate; petiole up to 0.3 cm long, pale green, hairy; lamina up to 2 x 0.7 cm, ovate-oblong, rounded at base, ciliate along margins, obtuse at apex, dark green adaxially, pale green abaxially with long sparsely placed filiform hairs on both surfaces. Inflorescence an axillary, bracteate raceme; bracts linear, ciliate along the margins, acute at apex; pedicel up to 0.4 cm long, with filiform hairs; bracteoles minute. Calyx tube up to 0.2 cm long, campanulate; teeth 5, upper 2, lower 3 up to 0.3

cm long, triangular, acute at apex, ciliate along the margins, palegreen with purple ting. Petals 5, standard up to 0.4 x 0.3 cm, orbicular, bright yellow with minute purple lines; wings 2 up to 0.2 cm long, yellow; keels up to 0.4 cm long, pale yellow to cream coloured. Stamens 10, deflexed; filaments up to 0.4 cm long, white; anthers yellow. Style up to 0.4 cm long with long appressed hairs; hairs white, silky, deflexed; stigma capitate. Pods, c 2 cm long, inflated, oblong, glabrous, palegreen with purple lines, rounded at apex with a long beak; seeds 8-10, kidney shaped, shining green when young. (Fig. 16 A-H; Plate12 E).

Fl. & Fr.: September – November.

Habitat: On open lateritic plateaus.

Distribution: Gujarat (Bulsad, Dangs, Kutch & Saurashtra); Maharashtra (Ahmednagar, Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Arvalam, Butpal, Chimbhel, Goa University Campus, Mercedes & Satari); Karnataka (Gulbarga, Shimoga, Uttar & Dakshin Kannada). (Map 18).

Status: (LR).

Chromosome number: 16. (2n)

Notes: It is distributed in the northern and central Western Ghats and is closely related to *C. prostrata* Roxb. which is distributed throughout India, Sri Lanka, Nepal, Indonesia and Pakistan and differs from it as stated below:

<i>Crotalaria filipes</i>	<i>Crotalaria prostrata</i>
Leaves ovate-cordate, prominently nerved, sparsely hairy.	Leaves ovate-oblong, not prominently nerved, densely appressed hirsute.
Peduncles filiform.	Peduncles slender.
Pods 8-10 seeded, shortly stalked.	Pods 16-20 seeded, nearly sessile.

Crotalaria lutescens Dalz. in Hooker's. J. Bot. Kew Gard. Misc 2: 34. 1850; Hook. f. Fl. Brit. India 2: 74. 1876; Vartak, Enum. Pl. Gomantak 40. 1966; Cooke, Fl.

Bombay 1: 318. 1967 (repr. ed.); Gamble, Fl. Madras 1: 207. 1967 (repr. ed.); Saldanha, Fl. Karnataka 1: 436. 1984; Rao, Fl. Goa 1: 108. 1985; Kulkarni, Fl. Sindhudurg 110. 1988; Ansari & Thothathri in Nayar & Sastry, Red Data Book Indian Pl. 2: 113. 1988; Almeida, Fl. Savantwadi 1: 124. 1990. Sanjappa, Legumes of India 123. 1992. *C. peduncularis* Dalz. & Gib. Bombay Fl. 55. 1861, non Graham 1839.

Erect undershrubs, up to 1 m high; stem much branched, obtusely angled, greenish purple, pubescent along the margins. Leaves simple, alternate, exstipulate, subsessile; lamina up to 6 x 4 cm, elliptic-oblong, cuneate at base, ciliate along the margins, rounded-apiculate at apex, dark green, glabrous adaxially, pale green with white appressed hairs abaxially. Inflorescence a terminal lax raceme up to 35 cm long; peduncle pubescent along the margins. Flowers pedicelate, bracteate; bract c 0.3 cm long, pubescent, purple. Pedicel up to 1.5 cm long, slender, pubescent. Calyx tube up to 0.2 cm long, campanulate, purple; teeth 5, upper 2, lower 3, c 1 cm long, acute, lanceolate, green, pubescent. Petals 4; standard c 2 cm long, ovate, acute, yellow with purple streaks spreading outside; wings up to 0.5 cm long; keels incurved, up to 2 cm long, hairy outside. Stamens isodiadelphous; filaments up to 1.5 cm long, slender, white; anthers purple. Style up to 2 cm long, bearded below the stigma; stigma capitate. Pods up to 3.5 cm long, glabrous, oblong, inflated; seeds numerous. (Fig. 16 I-N; Plate 12 B-D).

Fl. & Fr.: September - November.

Habitat: On open lateritic plateaus.

Distribution: Goa (Bardez, Butpal, Goa University Campus, Nagoa, Ordofond & Valpoi); Maharashtra (Kolhapur & Sindhudurg); Karnataka (Belgaum, Uttar & Dakshin Kannada). (Map 18).

Status: (LR).

Notes: Flowers bloom in the evening and are fluorescent yellow. They attract solitary bees for pollination. It is distributed in the northern and central Western Ghats. It is closely related to *C. peduncularis* Graham which is endemic to Niligiri and differs from it as stated below:

<i>Crotalaria lutescens</i>	<i>Crotalaria peduncularis</i>
Bracts linear, minute.	Bracts ovate, large.
Calyx teeth linear-lanceolate, with filiform tips	Calyx teeth lanceolate, acuminate.
Racemes lax, 6–15 flowered; flowers large.	Racemes 12-20 flowered; flowers small.
Leaves elliptic-oblong.	Leaves linear.

Derris heyneana (Wight & Arn.) Benth. in Miq., Pl. Jungh. 1: 252. 1852; Vartak, Enum. Pl. Gomantak 45. 1966; Cooke, Fl. Bombay 1: 432. 1967 (repr. ed.); Gamble, Fl. Madras 1: 273. 1967 (repr. ed.); Bennet. Indian J. Forestry 1: 23. 1978; Thothathri, Fascicle, Fl. India 8: 21. 1982; Saldanha, Fl. Karnataka 1: 448. 1984; Kulkarni, Fl. Sindhudurg 116. 1988; Almeida, Fl. Savantwadi 1: 129. 1990; Sanjappa, Legumes of India 146. 1992; Naithani et al., Forest Fl. Goa 206. 1997. *Pongamia heyneana* Wight & Arn. Prodr. 263. 1834, non Graham, 1831. *Derris heyneana* (Wight & Arn.) Benth. var. *paniculata* Baker in Hook. f., Fl. Brit. India 2: 244. 1878. *Derris bakeri* Thothathri, Bull. Bot. Surv. India 3: 187. 1962; Rao, Fl. Goa 1: 112. 1985.

Woody climber, branches glabrous. Leaves compound, up to 15 cm long; rachis glabrous, striate; petiole c 3 cm long; leaflets 5–7, up to 4.3 x 3 cm, elliptic, oblong- obovate, glabrous, subcoriaceous, rounded at base, bluntly acuminate, reticulately veined, with 6–8 pairs of veins. Inflorescence an axillary panicle, up to 13.5 cm long, arranged in distinct corymbose of 3–10 flowers along rufous pubescent

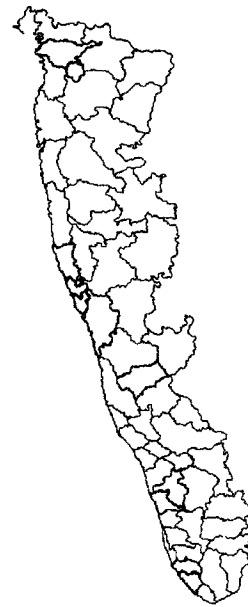
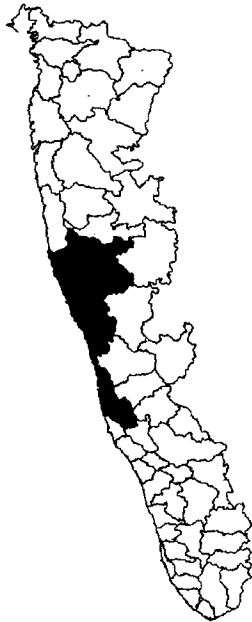
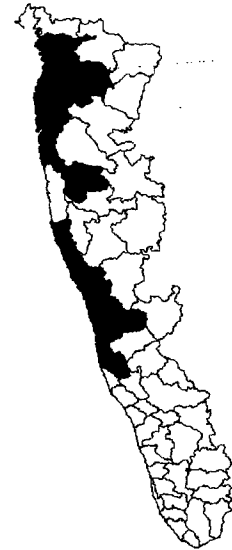
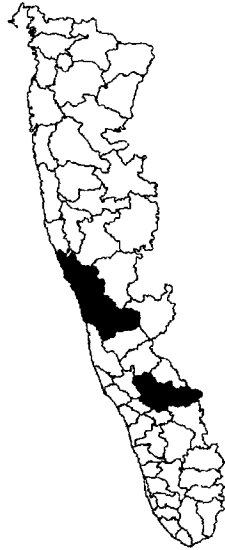


Figure 16: *Crotalaria filipes* Benth. : A. Habit; B. Flower; C. Calyx; D. Standard; E. Keel; F. Lateral; G. Pistil; H. Stamens. *Crotalaria lutescens* Dalz.: I. Habit; J. Flower; K. Standard; L. Lateral; M. Stamens; N. Pod. *Derris heyneana* (Wight & Arn.) Benth.: O. Habit; P. Calyx; Q. Flower; R. Stamens.



**PLATE 12: A. *Drypetes venusta* (Wight) Pax & Hoffm., B. *Crotalaria lutescens* Dalz.
C. *Derris heyneana* (Wight & Arn.) Benth., D. *Malanopus sprefus* on *Crotalaria lutescens*, E.
Crotalaria filipes Benth.**

Map 18: Distribution of *Phyllanthus talbotii*, *Crotalaria filipes*, *Crotalaria lutescens* and *Derris heyneana* along Western Ghats.



● *Phyllanthus talbotii* Sedgwick

● *Crotalaria filipes* Benth.

● *Crotalaria lutescens* Dalz.

○ *Derris heyneana* (Wight & Arn.)
Benth.

rachis. Pedicels slender, usually longer than calyx; bracteoles two, on the pedicel a little below the calyx, alternate, ovate-oblong, subacute. Calyx c 0.3 cm long, clothed with reddish brown pubescence, mouth ciliate, teeth obscure. Corolla c 0.8 cm long; standard c 0.6 cm long, suborbicular, emarginate, without callosities at base, pale pink; keel glabrous. Stamens monadelphous. Ovary silky; ovules usually four. Pods up to 5 x 2.4 cm, reticulately veined, glabrous, winged on both sutures, wing of the upper suture c 0.6 cm, lower suture c 0.3 cm broad. (Fig. 16 O-R; Plate 12 C).

Fl. & Fr.: March – April.

Habitat: Found in semievergreen forests.

Distribution: Gujarat; Maharashtra (Sindhudurg); Goa (Molem-Anmod); Karnataka (Chikmagalur & Uttar Kannada); Kerala (Palghat, Quilon, Thrissur & Trivandrum). (Map 18).

Status: (LR).

Notes: It is discontinuously distributed throughout Western Ghats. Its distribution in Gujarat is based on Sanjappa (l.c). It is closely related to *D. thothathrii* Bennett which is also endemic to Western Ghats from which it differs by its axillary panicles and incurved keels.

Geissaspis tenella Benth. in Flora 32: 559. 1849; Hook. f. Fl. Brit. India 2: 141. 1876; Cooke, Fl. Bombay 1: 354. 1967 (repr. ed.); Gamble, Fl. Madras 1: 229. 1967 (repr. ed.); Santapau, Fl. Khandala 57. 1967; Gandhi in Saldanha & Nicolson, Fl. Hassan 25. 1976; Manilal & Sivarajan, Fl. Calicut 82. 1982; Saldanha, Fl. Karnataka 1: 465. 1984; Rao, Fl. Goa 1: 121. 1985; Kulkarni, Fl. Sindhudurg 125. 1988;

Almeida, Fl. Savantwadi 1: 135. 1990; Sanjappa, Legumes of India 18. 1992; Kothari & Moorthy, Fl. Raigad, 108. 1993; Cook, Aqua. Wetland Pl. India 209. 1996.

Annual trailing herbs, up to 20 cm long; roots thick; stem slender, glabrous, purple; internodes c 3 cm long. Leaves compound; rachis c 0.7 cm long; leaflets two, pinnate; stipules medifixed, c 0.3 x 0.1 cm, oblong-ovate, ciliate along the margins, pale green, margins slightly purple, veins arising from the center and spreading outwards; Leaflets four; petiole c 0.1 cm long, cream; leaflets obovate, cuneate at base, entire along the margins, rounded-truncate at apex, slightly apiculate, glabrous, dark green adaxially, pale green abaxially, slightly purplish along the margins. Inflorescence an axillary bracteate raceme; raceme up to 3 cm long. Peduncle up to 1.7 cm long, glabrous. Bracts c 0.4 x 0.5 cm, oblong -orbicular, dentate along the margins, hairy; hairs stiff mucronate. Pedicel c 0.2 cm long, slender, purplish green. Calyx c 0.3 cm long, linear, membranous. Standard c 0.4 cm long, slightly orbicular, yellow with brown center; keels incurved; wings oblique. Stamens monadelphous; filaments c 0.3 cm long, white, filiform; anthers uniform, yellow. Ovary with 2 ovules; style incurved; stigma minute yellow. Pods with 1 -2 joints, up to 1 cm long, rounded on one side. Seeds two, one in each joint, dark brown, orbicular. (Fig. 17 A-I; Plate 13 A).

Fl. & Fr.: July – November.

Habitat: On lateritic plateaus with little soil.

Distribution: **Gujarat** (Surat); **Maharashtra** (Kolhapur, Raigad, Sindhudurg & Thane); **Goa** (Butpal, Goa University campus, Netravali, Ordofond & Porvorim); **Karnataka** (Hassan, Uttar & Dakshin Kannada); **Kerala** (Calicut). (Map 19).

Status: (LR).

Notes: It is a dominant annual on plateaus during the monsoons. It shows variation in the flower color (yellow–purple) within the same population. It is distributed in northern and central Western Ghats and is closely related to *G. cristata* Wight & Arn. which is widely distributed, from plains of Western peninsula, Sri Lanka to Pegu and differs from it as stated below:

<i>Geissaspis tenella</i>	<i>Geissaspis cristata</i>
Flowers as long as the bracts.	Flowers much shorter than the bracts.
Bracts c 0.4 cm, oblong–orbicular.	Bracts c 1.5 cm long, reniform.

Indigofera dalzellii Cooke, Fl. Bombay 1: 331. 1902; Saldanha, Fl. Karnataka 1: 470. 1984; Sanjappa in J. Econ. Tax. Bot. 5: 1031. 1984; Rao, Fl. Goa 1: 124. 1985; Kulkarni, Fl. Sindhudurg 127. 1988; Almeida, Fl. Savantwadi 1: 136. 1990; Sanjappa, Legumes of India 188. 1992; Deshpande et al., Fl. Mahabaleshwar 1: 182. 1993; Hajra et al., Fascicles Fl. India 21: 1995. *Indigofera triquetra* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 2: 36. 1850, non Meyer 1836; Baker in Hook. f., Fl. Brit. India 2: 93. 1876.

Annual prostrate herbs; roots tuberous, woody; stem greenish purple, slightly flattened, hairy. Leaves simple, alternate, stipulate, petiolate; stipules 2, c 0.5 cm long, ciliate, silvery white; petiole c 0.1 cm long; lamina up to 1.9 x 1 cm, oblong-elliptic, base acute, entire along margins, apex apiculate, green, sparsely hairy adaxially, whitish silvery green with closely placed hairs abaxially. Inflorescence an axillary raceme with 20–25 flowers, pedicel c 0.1 cm long. Bracts c 0.2 cm long. Calyx tube c 1 cm long, campanulate, silvery white, hairy; teeth 5, c 0.2 cm long, triangular. Petals pinkish purple; standard orbicular, winged petal with spur attached to it, keel petals two. Stamens diadelphous; anthers apiculate; connective extending beyond the anther, white; filaments free at tips, purplish pink at base, white at tip

and center. Style greenish white; stigma capitate, green. Pod up to 1.5 cm long, tetragonus, elongated, glabrous, ribbed, beak pointed, with persisting calyx. (Fig. 17 J-O Plate 13 B).

Fl. & Fr.: July - September.

Habitat: Growing extensively on hard lateritic rocks on plateaus.

Distribution: **Maharashtra** (Kolhapur, Satara & Sindhudurg); **Goa** (Bicholim, Nagoa, Taleigao, Usgao & Verna Plateau); **Karnataka** (Shimoga, Uttar & Dakshin Kannada). (Map 19).

Status: (LR).

Notes: It is observed that this species last throughout the monsoon as it is having thick rootstock. It is distributed in northern and central Western Ghats and found to be very common on plateaus in the study area. This species is reported from Rajasthan (Nair & Koshi, 1963) but so far no specimen of this species from Rajasthan could be traced in any of the herbarium (Hajra, l.c.). It is closely related to *I. cordifolia* Heyne ex Roth. which is distributed throughout India, Afghanistan, Baluchistan & N. Australia (Hajra l.c.) and differs from *I. cordifolia* as stated below:

<i>Indigofera dalzellii</i>	<i>Indigofera cordifolia</i>
Leaves oblong-elliptic, sparsely hairy above, hairy beneath; stipules subulate.	Leaves broadly ovate-cordate, hairy on both surfaces but dense beneath; stipules setaceous.
Flowers 20-25 in racemes, corolla pink.	Flowers in dense subsessile 4-8 flowered heads; corolla bright red.
Pods tetragonus, beaked, glabrous.	Pods cylindric, oblong, densely pubescent.

Spatholobus purpureus Benth. ex Baker in Hook. f., Fl. Brit. India 2: 194. 1876; Cooke, Fl. Bombay 1: 395. 1967 (repr. ed.); Gamble, Fl. Madras 1: 253. 1967 (repr. ed.); Arora et al., Bot. South Kanara 26. 1981; Saldanha, Fl. Karnataka 1: 494. 1984;

Ramachandran & Nair, Fl. Cannanore 155. 1988; Almeida, Fl. Savantwadi 1: 144. 1990; Vajravelu, Fl. Palghat 173. 1990; Sanjappa, Legumes of India 252. 1992; Deshpande et al., Fl. Mahabaleshwar 1: 192. 1993; Sasidheran & Sivarajan, Fl. Thrissur 154. 1996. *Butea purpurea* (Benth. ex Baker) Blatt. J. Indian Bot. Soc. 8: 137. 1929; Vajravelu in Nair & Henry, Fl. Tamil Nadu 1: 93. 1983.

A liana. Leaves trifoliolate; rachis up to 4.5 cm long, swollen at the base; stipules small caducous; petiole c 1 cm long, stout; leaflets three, terminal leaf largest, up to 14 x 7 cm, equilateral; lateral leaves up to 11.5 x 5.2 cm, unequal sided, obovate-oblong, entire along margins, acuminate obtuse at apex. Inflorescence terminal as well as axillary, much branched panicles. Pedicel c 0.3 cm long, filiform; bracts and bracteole caducous, linear, purple. Calyx c 0.3 x 0.2 cm, finely pubescent; teeth five, upper two connate except at tip, obtuse at apex. Standard petal c 0.5 x 0.4 cm including the claws, broadly ovate, purple with a long claw; wings two, sparsely hairy along the margins, purple; keels c 0.4 cm long, purple. Ovary c 0.25 cm long, pubescent, purple; style incurved, glabrous; stigma capitate. Stamens diadelphous. Pods at the end of terminal racemes; fruiting pedicel c 0.5 cm long; pod up to 9 x 2 cm long, rounded at both ends, thickened on one side, other flattened, undulate, pale greenish purple, glabrous, reticulately veined, one seeded; seed at the end of the pod. (Fig. 17 P-V; Plate 13 C-D).

Fl. & Fr.: November - January.

Habitat: Evergreen forests.

Distribution: Gujarat; Maharashtra (Satara & Sindhudurg); Goa (Molem - Anmod); Karnataka (Shimoga, Uttar & Dakshin Kannada); Kerala (Cannanore, Palghat, Thrissur & Wyanad), Tamil Nadu (Coimbatore). (Map 19).

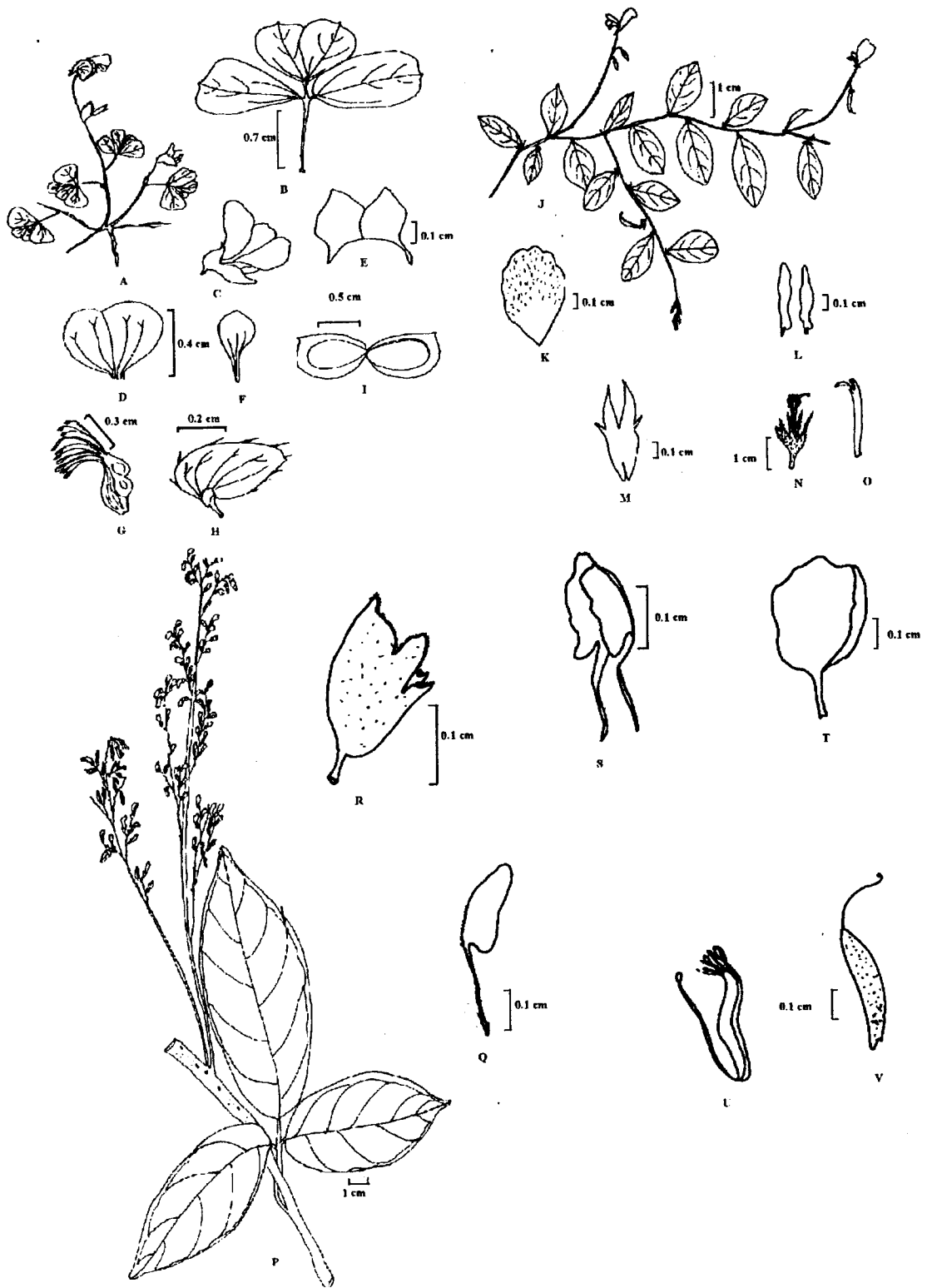


Figure 17: *Geissaspis tenella* Benth.: A. Habit; B. Leaflet; C. Flower; D. Standard; E. Keel; F. Lateral petal; G. Stamens; H. Bract; I. Pod. *Indigofera dalzellii* Cooke: J. Habit; K. Standard; L. Lateral petals; M. Keel; N. Pistil with calyx; O. Stamens. *Spatholobus purpureus* Benth.: P. Habit; Q. Lateral R. Calyx; S. Keel; T. Standard; U. Stamens; V. Pistil.

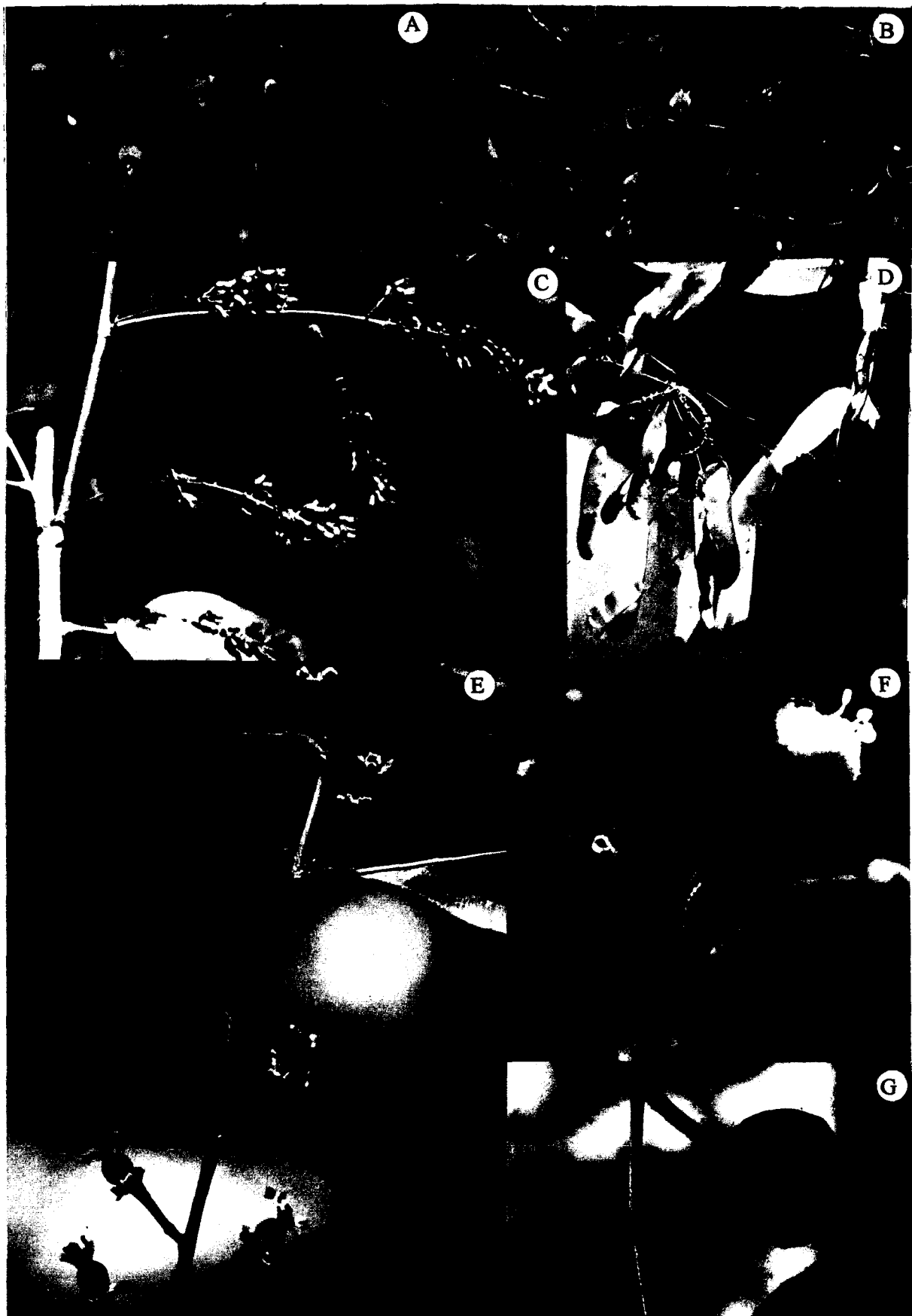


PLATE 13: A. *Geissaspis tenella* Benth., B. *Indigofera dalzellii* Cooke, C & D. *Spatholobus purpureus* Benth. ex Baker (C. Flowers, D. Fruits), E, F & G. *Hydnocarpus pentandra* (Buch. - Ham.) Oken (E. Pistillate Flowers, F. Staminate Flowers, G. Fruits)

Status: (R).

Notes: It is a new report to the state of Goa. It may be closely related to *S. acuminata* Benth. which is distributed from Andaman to Myanmar, Thailand, Laos and Malesia from which it differs by its purple flowers.

FLACOURTIACEAE

Hydnocarpus pentandra (Buch. - Ham.) Oken, Allg. Natuargesch. 3 (2): 1381. 1841; Nair & Nayar, Fl. Courtallum 79. 1986; Kulkarni, Fl. Sindhudurg 30. 1988; Ramachandran & Nair, Fl. Cannanore 50. 1988; Vajravelu, Fl. Palghat 61. 1990; Almeida, Fl. Savantwadi 1: 48. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 1990; Mitra in Fl. India 2: 422. 1993; Mohanan & Henry, Fl. Thiruvananthapuram 62. 1994; Almeida, Fl. Maharashtra 66. 1996; Sasidharan & Sivarajan, Fl. Thrissur 46. 1996; Naithani et al., Forest Fl. Goa 52. 1997. *Chimoria pentandra* Buch – Ham. in Trans. Linn Soc. 13: 501. 1822. *Hydnocarpus wightiana* Blume, Runphia 4: 22. 1848; Hook. f., Fl. Brit. India 1: 196. 1872; Dalgado, Fl. Savantvadi 1898; Cooke, Fl. Bombay 1: 60. 1967 (repe. ed.); Gamble 1: 37. 1967 (repr. ed). *Munnicksia laurifolia* Dennst. Schluss. Hort. Ind. Mal. 27. 1818 (nomen nudum). *Hydnocarpus laurifolia* (Dennst.) Sleumer, in Englers, Bot. Jahrb. 69: 33. 1938 nom. invalid; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 164. 1976; Arora et al., Bot. South Kanara 13. 1981; Saldanha, Fl. Karnataka 1: 272. 1984; Rao, Fl. Goa 1: 22. 1985; Subramaniam et al., Fl. Palghat 14. 1987. *H. inchrans* Wall. ex Graham, Cat. Bombay Pl. 10. 1839.

Trees up to 15 m bark brown young parts pubescent. Leaves simple, alternate, petiolate; petiole c 0.5 cm, ferruginous pubescent; lamina up to 15 x 4.5 cm, ovate to oblong-lanceolate, obtuse at base, acuminate at apex, entire-serrate along margins, glabrous, green, minutely pubescent along veins when young, glabrous at

maturity. Flowers solitary or in racemes, c 1.5 cm across; racemes ferruginously pubescent. Staminate flower: Sepals five, outer two, ovate, inner three much longer, concave. Petals five, orbicular, rounded at apex, fringed with soft white hairs; scales ovate, densely hairy. Stamens five, opposite the petals, filaments as long as the petals, hairy at base. Pistillate flowers: Staminodes five. Ovary globose, hairy, brown when young; stigma flat, two lobed. Fruit globose c 7cm across, brown, tomentose; seeds obtusely angled, yellow. (Fig. 18 A-C; Plate 13 E-G).

Fl. & Fr.: November–March.

Local Name: Kusht.

Habitat: Found in moist deciduous and semievergreen forests and along the streams.

Distribution: Gujarat, Maharashtra (Satara, Sindhudurg & Thane); Goa (Canacona, Codal & Molem); Karnataka (Chickmagalur, Coorg, Hassan, Mysore, Shimoga, Uttar & Dakshin Kannada); Kerala (Cannanore, Idukii, Kasaragod, Kottayam, Palghat & Thrissur); Tamil Nadu (Coimbatore, Madurai, Nilgiri, Tirunelveli & Travancore). (Map 19).

Status: (LR).

Notes: It is distributed throughout the Western Ghats. Fruits are used in the treatment of Leprosy and other obstinate skin diseases and seeds are used in dressing wounds and ulcers. It is closely related to *Hydnocarpus alpina* Wight which is also an endemic and distributed in Karnataka, Kerala and Tamil Nadu and differs from it as stated below:

<i>Hydnocarpus pentandra</i>	<i>Hydnocarpus alpina</i>
Branches pubescent.	Branches stellately pubescent.
Leaves serrate-crenately serrate, minutely pubescent along midrib and veins; reticulation not elevated nor foveolate.	Leaves entire, glabrous; reticulation distinctly elevated and foveolate.

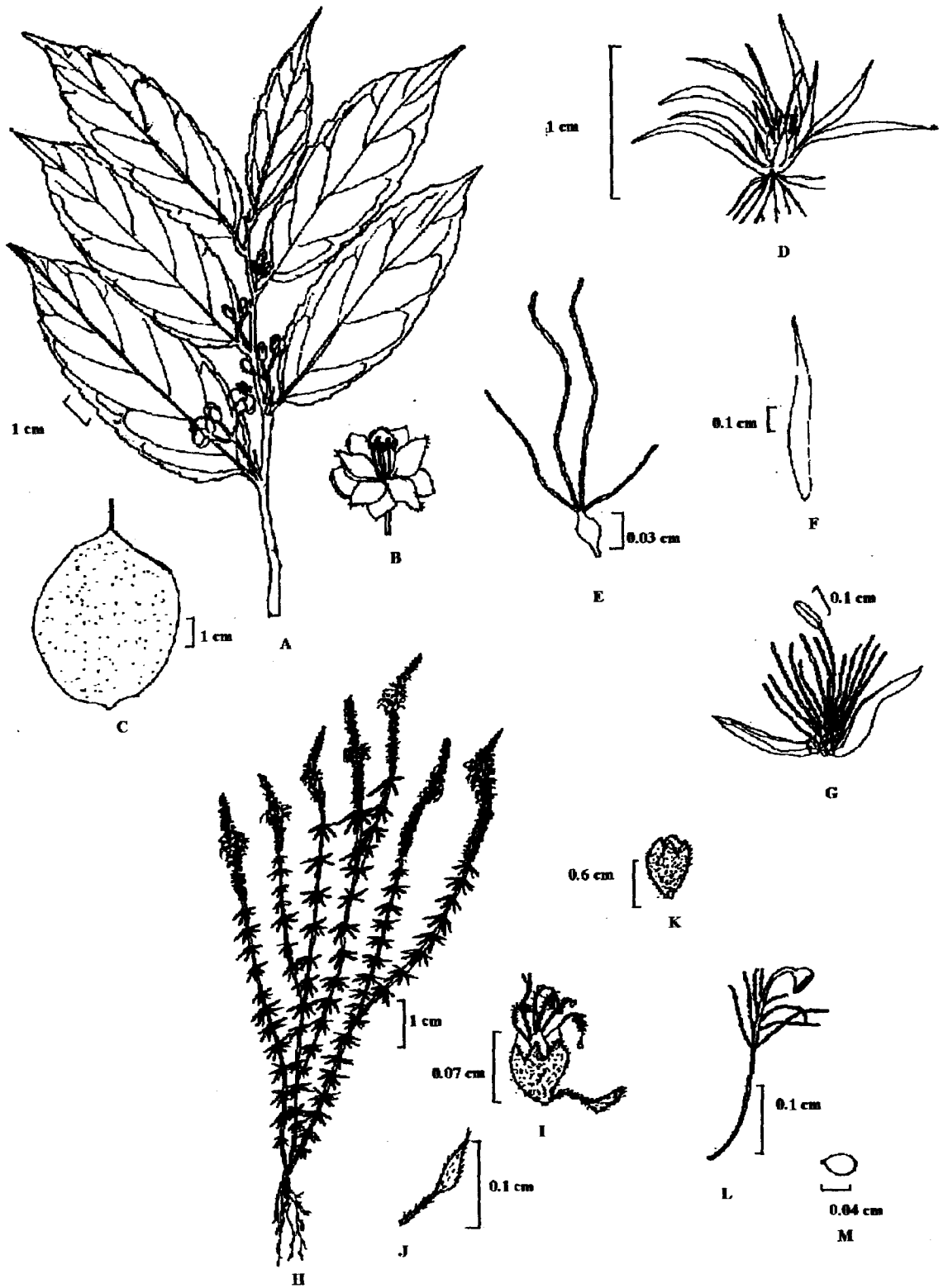


Figure 18: *Hydnocarpus pentandra* (Buch. - Ham.) Oken: A. Habit; B. Flower; C. Fruit. *Trithuria konkanensis* Yadav & Janarthanam: D. Habit; E. Pistillate flower; F. Leaf; G. Staminate flower surrounded by Pistillate flowers. *Eusteralis tomentosa* (Dalz.) Panig.: H. Habit; I. Flower; J. Bract; K. Calyx; L. Style & Stigma; M. Seed

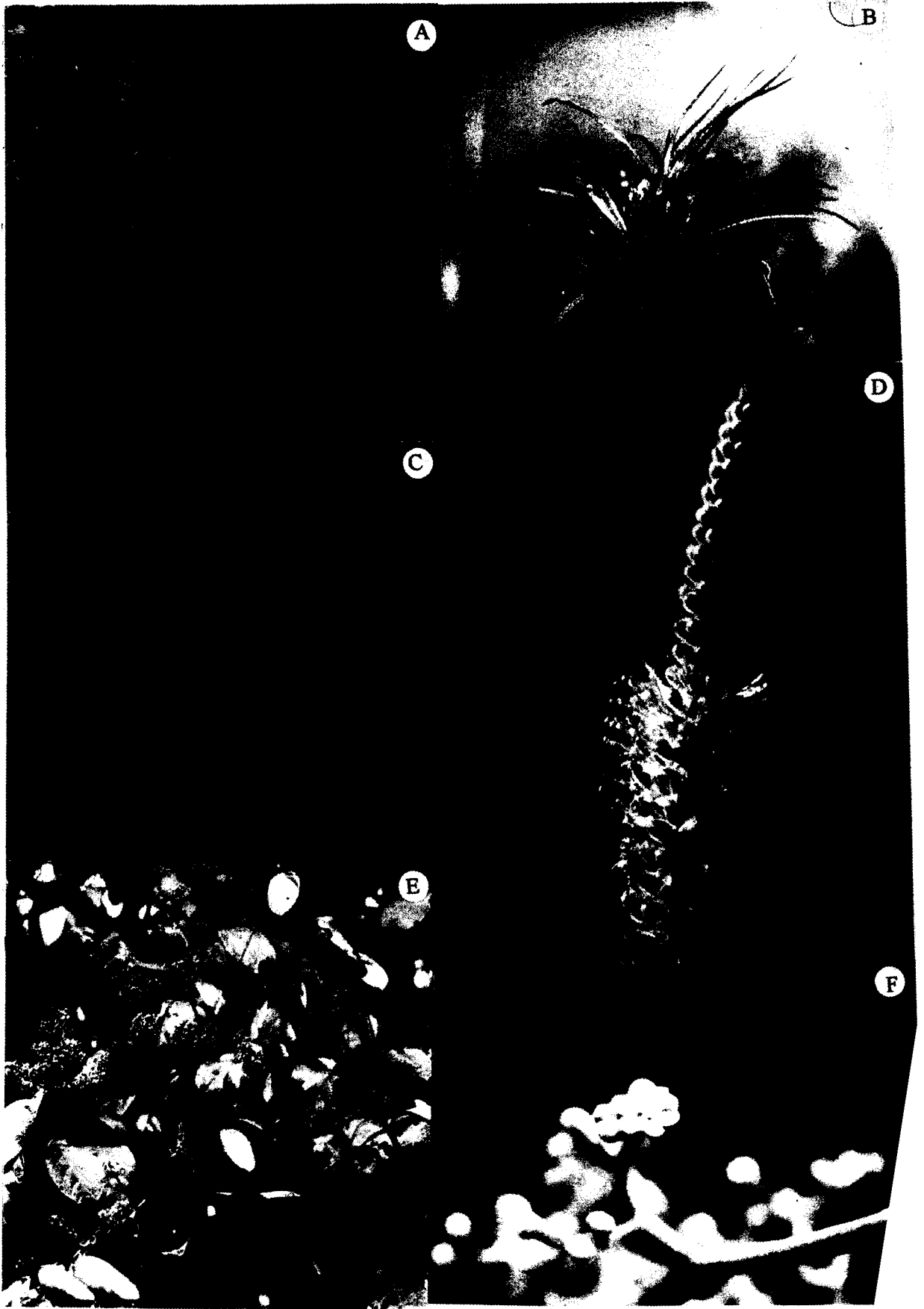
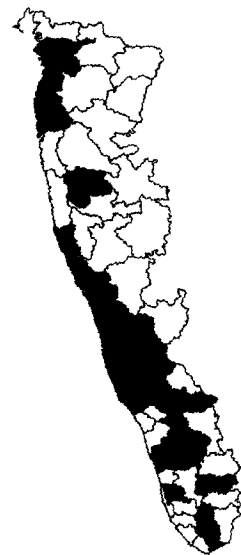
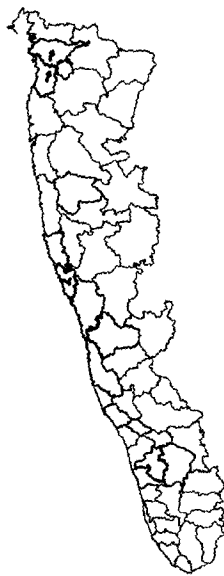
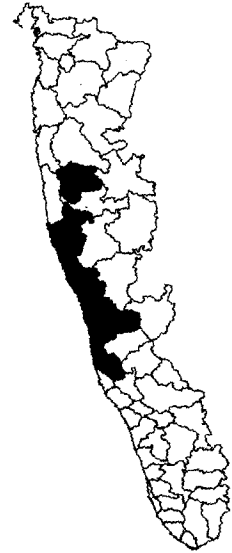
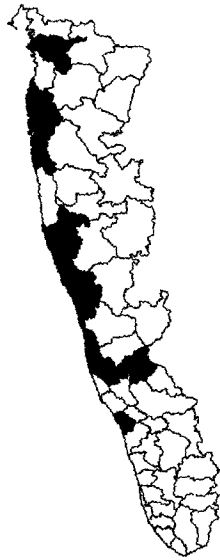


PLATE 14: A & B. *Trithuria konkanensis* Yadav & Janarthanam, C & D. *Euster tomentosa* (Dalz.) Panig., E & F. *Cryptocarya lawsonii* Gamble.

Map 19: Distribution of *Geissaspis tenella*, *Indigofera dalzellii*, *Spatholobus purpureus* and *Hydnocarpus pentandra* along Western Ghats.



Geissaspis tenella Benth.



Indigofera dalzellii Cooke



Spatholobus purpureus Benth.
ex Baker



Hydnocarpus pentandra
(Buch. - Ham.) Oken

HYDATELLACEAE

Trithuria konkanensis Yadav & Janarathanam in *Rheedea* 4: 18. 1994; Yadav & Janarathanam in *Aqua Panata* 3: 91. 1995; Cook, *Aqua. Wetland Pl. India* 215. 1996; Lakshminarasimhan in Sharma et al., *Fl. Maharashtra Monocot.* 269. 1996; Bhat in *Ind. J. Forestry* 20 (1): 103 – 105. 1997.

Annual, herbs c 1 cm long, green-red coloured; roots fibrous, unbranches, numerous. Stems reduced. Leaves tufted numerous, c 0.9 cm long, linear, one nerved, succulent, glabrous, green-red coloured aerenchymatous, truncate at base, entire along margins, acute at apex; uniseriate hairs present among leaves. Capitula numerous, scapose, crowded among leaves; stalks up to 0.2 cm long, grooved. Bracts two, c 0.24 cm long, linear-lanceolate, pale white with prominent midvein. Flowers unisexual naked. Staminate flowers solitary in the center of each head surrounded by female flower; filaments c 0.6 cm long, stout, filiform; anther one, c 0.1 cm long, red, basifixed. Pistillate flowers 15–20 per capitulum, each represented by solitary pistill. Ovary ovoid, one locular, c 0.03 cm long, triquetrous, variously stalked, pale yellow, with 2–6 stigmatic hairs; hairs uniseriate at different stages of growth up to 0.5 cm long, red in colour. Fruit up to 0.03 cm long, ovoid with three longitudinal ribs, stigmatic hairs persistent. Seeds translucent with dark tip. (Fig. 18 D-G; Plate 14 A-B).

Fl. & Fr.: August – September.

Habitat: On plateaus with other species such as *Eriocaulon sexangulare* or *Eriocaulon xeranthemum* during rainy season.

Distribution: Maharashtra (Sindhudurg); Goa (Taleigao plateau & Verna); Karnataka (Dakshin Kannada). (Map 20).

Status: (R).

Notes: It is observed on lateritic plateau during the monsoon along with other Wetland species of *Eriocaulon* and *Utricularia*. It is a recently described species from Sindhudurgh district of Maharashtra. As it is a minute herb, earlier explorers must have overlooked it. Later it was reported from other parts of Western Ghats (Bhat l.c.). It is new report to the state of Goa. The family Hydatellaceae was previously believed to be endemic to Australasia (Australia, Tasmania and New Zealand) and the occurrence of this species in India shows that it may be a relict of the ancient Gondwana flora.

LAMIACEAE

Eusteralis tomentosa (Dalz.) Panig. in *Phytologia* 32: 477. 1976; Mujumdar in *J. Bombay Nat. Hist. Soc.* 74: 385. 1978; Keshava Murthy & Yoganarasimhan, *Fl. Coorg* 353. 1990. *Dysophylla tomentosa* Dalz. in Hooker's *J. Bot. Kew Gard. Misc* 2: 337. 1850; Gandhi in Saldanha & Nicolson, *Fl. Hassan* 500. 1976; Arora et al., *Bot. South Kanara* 49. 1981; Almeida, *Fl. Savantwadi* 1: 343. 1990. *Dysophylla stellulata*, auct. non Benth. in Wall. *Pl. As. Rar.* 1: 30. 1829; Hook. f. *Fl. Brit. India* 4: 640. 1885; Cooke, *Fl. Bombay* 2: 540. 1967 (repr. ed.); Gamble, *Fl. Madras* 2: 795. 1967 (repr. ed.); Santapau, *Fl. Khandala* 218. 1967; Rao, *Fl. Goa.* 2: 345. 1986; Lakshminarasimhan & Sharma, *Fl. Nasik* 388. 1991.

Erect herbs, up to 15 cm high, much branched from the base; stem with stout internodes; internodes c 0.2 cm long, pale brown, hairy. Leaves sessile, arranged in whorls, 7–8 in each whorl; lamina up to 0.6 cm long, linear, acute at apex, hairy. Inflorescence a spike, up to 6 cm long; bracts c 0.1 cm long, hairy, white. Calyx tube c 0.06 cm, campanulate, densely hairy, teeth five, c 0.03 cm long, acute, hairy; hairs

white. Corolla tube c 0.07 cm long, funnel shaped; lobes five, c 0.03 cm long, rounded, pale lilac. Stamens five; filaments c 0.2 cm long, arising from the base of the corolla tube, bending downwards, purple with long moniliform purple hairs in the upper half of filaments; anthers cup shaped, purple, with numerous pollen; pollen white. Styles c 0.12 cm long, purple; stigma two, purple – lilac. Nutlets four, enclosed in calyx tube, c 0.04 cm across, pale brown, smooth, shining. (Fig. 18 H-M; Plate 14 C & D).

Fl. & Fr.: November–March.

Habitat: In dry paddy field and puddles.

Distribution: **Maharashtra** (Satara, Sindhudurg & Thane); **Goa** (Gaodongri & Santacruz rice fields); **Karnataka** (Belgaum, Coorg, Dakshin Kannada & Hassan.); **Kerala** (Kasaragod, Cannanore & Travancore); **Tamil Nadu** (Nilgiris). (Map 20).

Status: (LR).

Notes: It is discontinuously distributed throughout the Western Ghats.

LAURACEAE

Cryptocarya lawsonii Gamble in Kew Bull. 127. 1925 & Fl. Madras 1218. 1925 (2: 853. 1967, repr. ed.); Sharma et al., Biol. Mem 2 (1 & 2): 122. 1977; Saldanha, Fl. Karnataka 1: 64. 1984; Chandrasekaran in Henry et al., Fl. Tamil Nadu 2: 209. 1987; Manilal, Fl. Silent valley 235. 1988.

Medium sized trees, bark grey with lenticels. Leaves simple, alternate, petiolate; petiole up to 1.5 cm long; lamina up to 11 x 6 cm, oblong, ovate-lanceolate, acute at base, entire along margins, apiculate at apex, dark green adaxially, pale green abaxially, glaucous beneath, lateral nerves 8–10 pairs, obliquely curved. Inflorescence

a panicle, axillary as well as terminal, up to 8 cm long. Calyx four lobed; teeth ca 0.3 cm long. Petals 4, cm 0.6 cm long, yellow. Stamens not observed. Fruits a berry; ca 1.5 cm long, oblongoid, furrowed, brown. (Fig. 19 A; Plate 14 E-F).

Fl. & Fr.: November – December.

Habitat: In evergreen forests.

Distribution: Goa (Molem - Anmod.); Karnataka (Shimoga); Kerala (Silent valley); Tamil Nadu (Coimbatore, Nilgiri & Tirunelveli). (Map 20).

Status: (R).

Notes: It is a new report to the State of Goa and is rare as only one plant was observed in the semievergreen forests of Goa. This species was not reported by Cooke (1967 repr. ed.) for Bombay Presidency. This report for Goa is the known northern most limit of its distribution. It is discontinuously distributed in the evergreen forest of the southern Western Ghats. It is closely related to *C. bourdillonii* Graham which is also endemic to evergreen forest of southern Western Ghats and differ as stated below:

<i>C. lawsoni</i>	<i>C. bourdillonii</i>
Main nerves 6–8 pairs.	Main nerves 9–12 pairs.
Leaf acute at base, apiculate or rarely obtuse or emarginate at apex.	Leaf rounded at base, abruptly or obtusely acuminate at apex.
Berry ovoid, furrowed and often with lenticells.	Berry globose, dull and smooth.

Litsea coriacea (Heyne ex Meisner) Hook. f., Fl. Brit. India 5: 166. 1886; Gamble, Fl. Madras 2: 865. 1967 (repr. ed); Sharma et al., Biol. Mem 2 (1 & 2): 122. 1977; Arora et al., Bot. South Kanara 51. 1981; Manilal & Sivarajan, Fl. Calicut 251. 1982; Saldanha, Fl. Karnataka 1: 66. 1984; Rao, Fl. Goa 2: 370. 1986; Chandrasekaran in Henry et al., Fl. Tamil Nadu 2: 209. 1987; Manilal, Fl. Silent valley 236. 1988;

Ramachandran & Nair, Fl. Cannanore 395. 1988; Keshava Murthy & Yoganarasimhan, Fl. Coorg 383. 1990; Vajravelu, Fl. Palghat 404. 1990; Mohanan & Henry, Fl. Thiruvananthapuram 394. 1994; Sasidharan & Sivarajan, Fl. Thrissur 382. 1996; Naithani et al., Forest Fl. Goa 509. 1997. *Tetranthera coriacea* Heyne ex Meisner in DC. Prodr. 15: 186. 1864.

Small trees, young branches puberulous. Leaves simple, alternate, petiolate; petiole up to 1.5 cm long; lamina up to 18 x 5.6 cm, elliptic-ovate to elliptic-lanceolate, glabrous, darkgreen, shining adaxially, pale green, abaxially, with 6–7 pairs of lateral veins; veins not prominent, sparsely puberulous. Inflorescence an axillary umbell, subsessile. Pedicel very small, c 0.04 cm long. Involucral bracts four, concave, obtuse, truncate at base, rounded at apex, c 0.5 x 0.3 cm, three nerved, silvery, greenish grey, pubescent; hairs silvery, appressed. Flowers 3–4 in each umbell; sessile. Corolla tube c 0.25 cm long; perianth lobes four, c 0.25 cm long, linear, lanceolate, white. Stamens 12–15, inserted at the mouth of perianth tube; filaments c 0.1 cm long; anthers c 0.1 cm long, four celled. Stigma and style very small, at times rudimentary or sessile. (Fig. 19 B-D; Plate 15 A).

Fl. & Fr.: October – February.

Habitat: Semievergreen forests.

Distribution: Goa (Molem); Karnataka (Coorg, Uttar & Dakshin Kannada); Kerala (Calicut, Cannanore, Idukki, Kasaragod, Kottayam, Palghat, Thrissur, Thiruvananthapuram & Wyanad); Tamil Nadu (Coimbatore, Kanniyakumari, Madurai, Nilgiri & Tirunelveli). (Map 20).

Status: (LR).

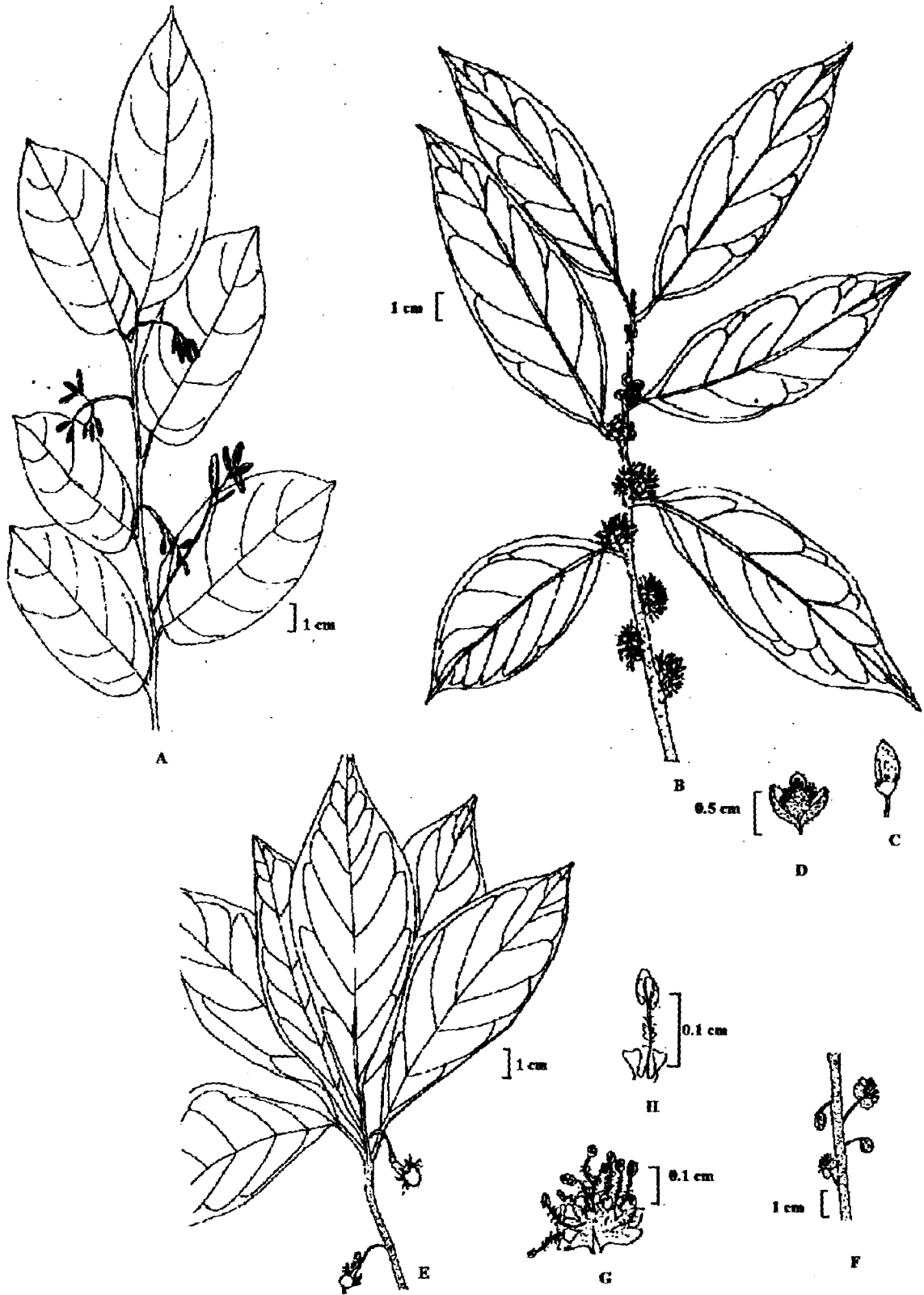
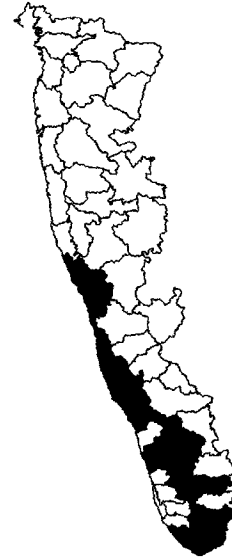
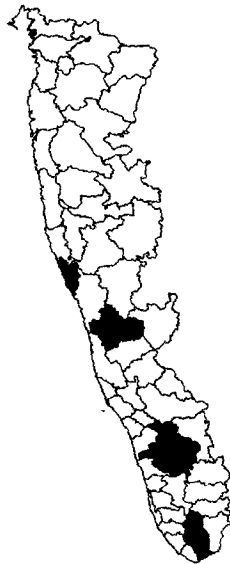
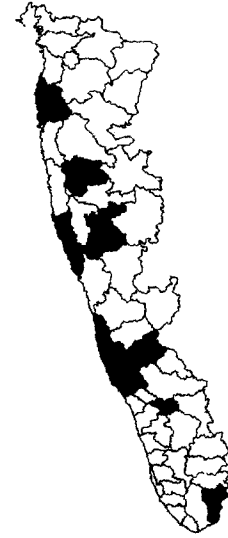
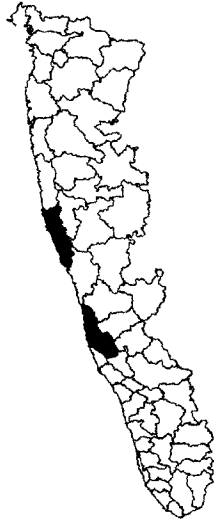


Figure 19: *Cryptocarya lawsonii* Gamble: A. Habit; B. *Litsea coriacea* (Heyne ex Meisner) Hook. f. B. Habit; C. Flower bud; D. Flower. *Litsea ghatica* Saldanha: E. Habit; F. Inflorescence; G. Flower; H. Stamen.

Map 20: Distribution of *Trithuria konkanensis*, *Eusteralis tomentosa*, *Cryptocarya lawsonii* and *Litsea coriacea* along Western Ghats.



Trithuria konkanensis
Yadav & Janarthanam



Eusteralis tomentosa
(Dalz.) Panig.



Cryptocarya lawsonii Gamble



Litsea coriacea (Heyne ex
Meisner) Hook. f.

Notes: Though it is collected from the semievergreen forests of Goa, it is generally distributed in the evergreen forest of southern Western Ghats.

Litsea ghatica Saldanha, Fl. Karnataka 1: 68. 1984; Manilal, Fl. Silent valley 36. 1988.

Shrubs, up to 3 m high; young branches tomentose, hairs rusty brown, falling at maturity. Leaves simple, petiolate, subverticillate at the tip of the shoot; petiole c 1 cm long, densely tomentose; lamina up to 15 x 5.5 cm, cuneate at base, entire along margins, acute-acuminate at apex, dark green, glabrous except on the veins adaxially; pale greyish green, densely tomentose abaxially with 10–2 pairs of distinctly looped lateral nerves with few scattered glands; glands covered by hairs, abaxially. Umbels solitary; peduncle up to 1.2 cm long, tomentose, recurved; bracts four, c 0.5 x 0.3 cm, rounded, slightly broad at apex, tomentose, caducous, leaving scars in fruits. Perianth lobes eight, c 0.2 x 0.12 cm, ovate, densely tomentose on outer side, glabrous on inner. Stamens 17–18, arranged in 2-3 rows, with few scattered abortive stamens at the base; filaments c 0.1 cm long, brown with white hairs; anthers four celled, yellow. Berry globose, seated on non accrescent ^{Perianth} tube. (Fig. 19 E-H; Plate 15 B).

Fl. & Fr.: October – December.

Habitat: Evergreen and semievergreen forest patches.

Distribution: Maharashtra (Raigad, Ratnagiri & Thane); Goa: (Netravali, Molem - Anmod & Verlem.); Karnataka (Chikmagalur, Hassan & Uttar Kannada); Kerala (Palghat); Tamil Nadu (Madurai). (Map 21).

Status: (LR).

Notes: It is new report to the state of Goa. It is a recently described species from Hassan district of Karnataka. This species is closely related to *L. deccanensis* Gamble which is distributed in Peninsular India and Sri Lanka. A lot of intermediates are observed in the herbaria and hence needs further study. These two species differ from each other as follows:

<i>Litsea ghatica</i>	<i>Litsea deccanensis</i>
Leaves subverticillate at end of branches, obovate, abruptly acute at tip, cuneate at base, lateral nerves ending forming distinct loop.	Leaves alternate, scattered, elliptic, gradually narrowing at both ends, lateral nerves endings open or obscurely confluent.

LENTIBULARIACEAE

Utricularia lazulina Taylor in Proc. Indian Acad. Sci. (Plant Sci.) 93B: 101. 1984 & in Kew Bull. Add. Ser. 14: 325. f. 89. 1989; Janarthanam & Henry, Bladderworts of India 68 . 1992.

Herbs, up to 12 cm long; rhizoids up to 1.5 cm long, tapering towards apex; branches c 0.2 cm long, papillose; stolons up to 2.5 cm long, sparsely branched. Foliar organs c 6 mm long, oblanceolate, distributed on stolons and at base of peduncle, 3 nerved, cuneate at base, rounded at apex, green. Traps c 0.12 cm across, subglobose, distinctly stalked; appendages two, subulate, recurved, glandular. Racemes c 5 cm long; peduncle angular, grooved; scales c 0.05 cm long, basifixed, ovate-lanceolate, acute-acuminate at apex; bracts c 1 mm long, ovate-lanceolate, acuminate at apex; bracteoles c 0.08 cm long, subulate. Flowers 0.7–1.1 cm long; pedicels c 0.4 cm long, narrowly winged. Calyx lobes slightly unequal; upper c 0.2 x 1.7 cm, ovate, acute-acuminate at apex; lower lobes c 0.2 x 0.14 cm, linear-lanceolate to ovate. Corolla blue-violet, rarely pink; lower lip c 0.9 x 0.4 cm, oblong, constricted at middle,

rounded at apex; lower lip c 0.5 cm across, yellow, hairy on throat, bigibbous at base, truncate or emarginate at apex; spur c 0.6 cm long, subulate, curved, acute at apex. Stamens c 1–1.5 mm long; filaments strap shaped, slightly recurved; anther thecae distinct. Pistil c 1 mm long, ovary ovoid, compressed; style distinct, broad; stigma 2 lipped, semiorbicular. Capsule c 0.3 x 0.15 cm, ovoid, wall uniformly membranous; placenta c 0.1 x 0.1 cm, ovoid, compressed. Seeds 0.02 cm long, obovoid; hilum prominent, subterminal; testa reticulate, cells elongate, verrucose within. (Fig. 20 A-G; Plate 15 C).

Fl. & Fr.: July – September.

Habitat: Open rocky plateaus, common during the monsoons.

Distribution: **Goa:** (Cotigao); **Karnataka** (Uttar & Dakshin Kannada); **Kerala** (Kasaragod & Palghat). (Map 21).

Status: (LR).

Notes: It is distributed from Goa to Palghat. It is closely related to *U. albocaerulea* Dalzell which is endemic to Maharashtra and can be distinguished from it by its smaller flowers, oblong upper lip of corolla, absence of thickening along the dehiscing margin of capsule and verrucose testa cells.

Utricularia malabarica Janathanam & Henry in J. Bombay. Nat. Hist. Soc. 86 (1): 84. 1989 & Bladderworts of India 69. 1992; Janarthanam in J. Eco. Tax. Bot. 18: 230. 1994.

Herbs, rhizoids usually absent, if present up to 1 cm long, glandular, branches up to 0.08 cm long, papillose; stolon up to 2 cm long, profusely branched. Foliar organs up to 0.4 x 0.15 cm, obovate-oblongate, three nerved, rounded at apex.

Traps up to 0.15 cm across, globose; stalk glandular; mouth basal; appendages two, subulate, simple, glandular. Racemes up to 6 cm long, erect, glabrous, angular, grooved on one side, 1–4 flowered; scales c 0.1 x 0.08 cm, basifixed, ovate–eltoid, acute-acuminate at apex; bracts c 0.1 x 0.09 cm, obovate–deltoid, acuminate at apex; bracteoles shorter than bracts, subulate; pedicel 0.3 cm long, winged, erect in anthesis, recurved in fruits. Calyx lobes c 0.2 x 0.2 cm, ovate, papillose; upper lobes acuminate at apex; lower bidentate at apex. Corolla blue with white tinge; upper lip c 0.25 x 0.15 cm, oblong, truncate to emarginate at apex; lower c 0.4 x 0.5 cm, suborbicular, hairy in throat, emarginate at apex; spur c 0.43 cm long, slender, acute at apex. Stamens c 0.1 cm long; filaments strap shaped; anther thecae distinct. Pistil c 0.1 cm long; ovary ovoid; style short; stigma two lipped, lower lip oblong hairy; upper lip short, semiorbicular. Capsule c 0.28 x 0.16 cm, ovoid–subglobose; seeds c 0.02 cm long, ovoid; hilum prominent, subterminal; testa reticulate, smooth, cells more or less elongate. (Fig. 20 H-M; Plate D-E).

Fl. & Fr.: August – November.

Habitat: In small puddels on lateritic plateaus.

Distribution: Goa (Assonora, Goa University Campus, Kalem & Loliem); Kerala (Kasaragod). (Map 21).

Status: (LR).

Notes: It is allied to *U. lazulina* Taylor, which is also endemic to Western Ghats and differs from it by its shorter inflorescence, equal papillose calyx lobes, glabrous lower margins of upper corolla lip, hairy lower lip of stigma, recurved fruiting pedicel, and smooth testa cells. In the study area it is associated with *U. praeterita* Taylor, *U. caerulea* Linn. and *U. reticulata* Smith.

Utricularia praeterita Taylor in Matthew, Fl. Tamil Nadu Carnatic 3: 1120, t. 87. 1983; Janathanam & Henry, Bladderwords of India 81. 1992.

Herbs; rhizoids up to 1 cm long, glandular; branches c 1 cm long; stolons c 0.15 mm thick, glabrous, sparsely branched. Foliar organs up to 10 x 1.5 mm, spatulate-ovoid, 3 nerved, rounded at apex. Trap subglobose, mouth basal; appendages 2, simple, subulate, glandular. Racemes up to 20 cm long, slightly grooved, winged, glabrous; scape up to 0.1 cm long, basifixed, lanceolate to subulate, one nerved, acute-obtuse at apex; bracts up to 0.15 cm long, basifixed, broadly ovate-deltoid to semiorbicular, usually one nerved, acuminate at apex; bracteoles up to 1 mm long, basifixed, linear, acuminate at apex. Flowers 0.6–0.7 cm long; pedicels 0.4 cm long, winged, erect, or spreading. Calyx lobes subequal, papillose; upper lobe c 0.2 x 0.22 cm, broadly ovate, acuminate to obtusely bidentate at apex; lower lobe 0.2 x 0.14 cm, bidentate at apex. Corolla violet; upper lip c 0.3 cm long, oblong, constricted near middle, shallowly emarginate to truncate at apex; lower lip 0.3 x 0.34 cm, obovate to subobicular, hairy on throat, gibbous at base, or 3–4 lobed at apex; spur c 0.3–0.5 cm long, descending; papillose, glandular within, acute at apex. Stamens c 0.1 cm long; filament strap shaped. Ovary ovoid, slightly compressed; style small; stigma compressed. Capsules ovoid 0.22 x 0.14 cm, slightly compressed; seeds 0.03 cm long, ellipsoid; hilum lateral, distinct; testa reticulate, cells narrow, elongate, compact, obliquely arranged. (Fig. 20 N-T; Plate 15 F).

Fl. & Fr.: August – October.

Habitat: Open lateritic plateaus.

Distribution: Maharashtra (Pune, Satara, Thane); Goa (Goa University Campus). (Map 21).

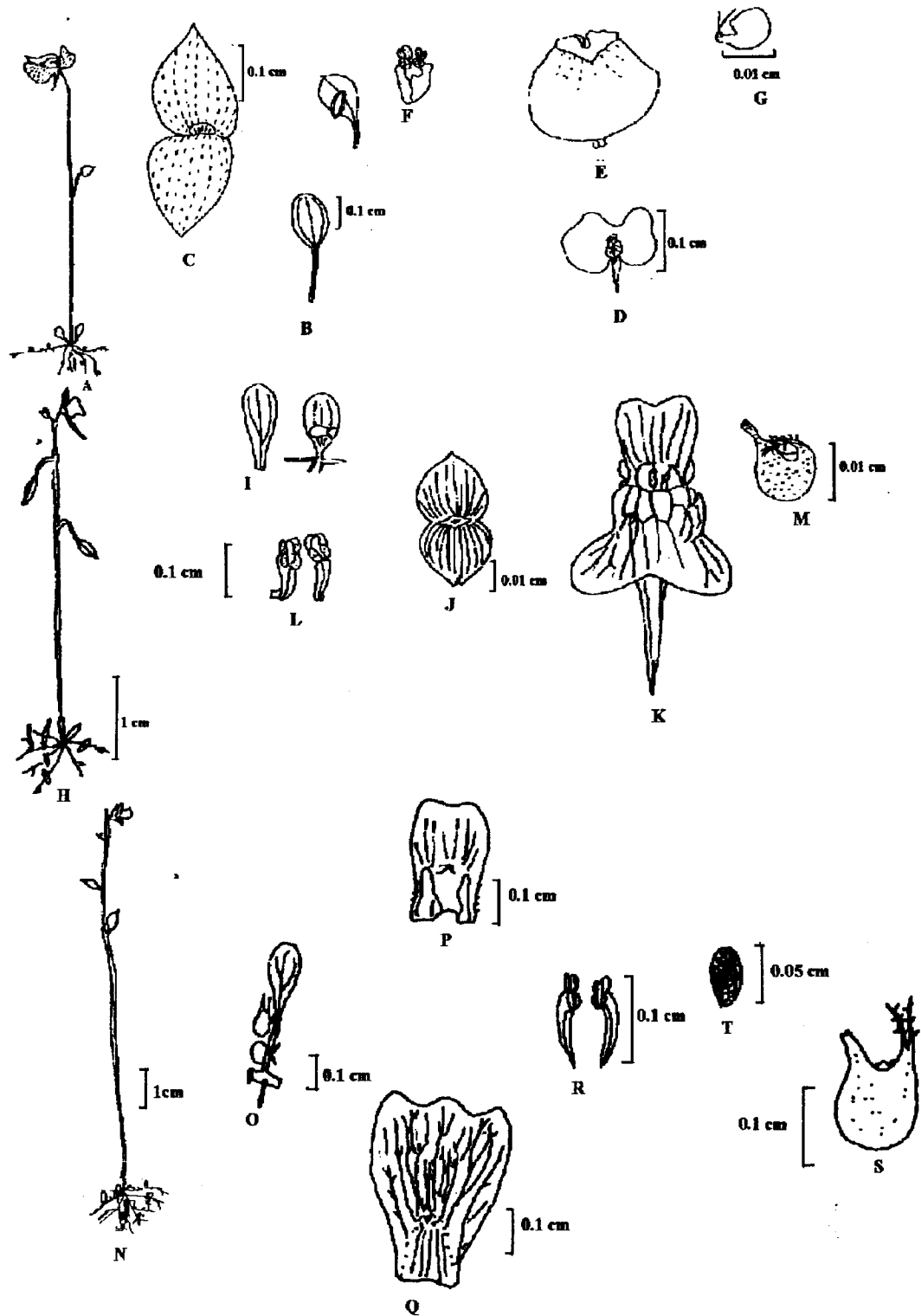
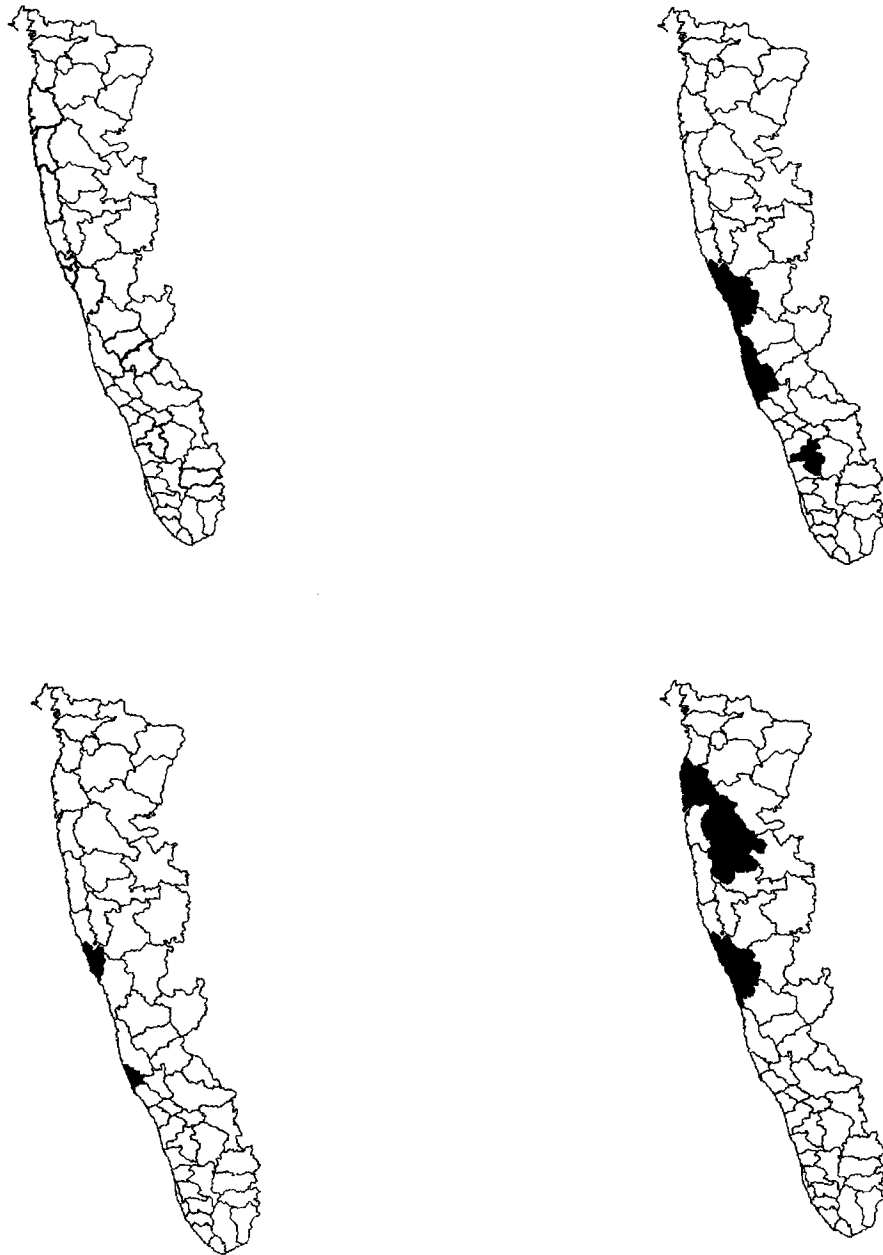


Figure 20: *Utricularia lazulina* Taylor: A. Habit; B. Foliage organ; C. Calyx; D. Corolla upper lip; E. Corolla lower lip; F. Stamens; G. Trap. *Utricularia malabarica* Janathanam & Henry: H. Habit; I. Foliage organ; J. Calyx; K. Flower; L. Stamens; M. Trap. *Utricularia praeterita* Taylor: N. Habit; O. Foliage organ; P. Corolla upper lip; Q. Corolla lower lip; R. Stamens; S. Trap; T. Seed.



PLATE 15: A. *Litsea coriaca* (Heyne ex Meisner) Hook. f., B. *Litsea ghatica* Saldanha, C. *Utricularia lazulina* Taylor, D & E. *Utricularia malabarica* Janathanam & Henry, F. *Utricularia praeterita* Taylor

Map 21: Distribution of *Litsea ghatica*, *Utricularia lazulina*, *Utricularia malabarica* and *Utricularia praeterita* along Western Ghat.



○ *Litsea ghatica* Saldanha

● *Utricularia malabarica*
Janathanam & Henry

● *Utricularia lazulina* Taylor

● *Utricularia praeterita* Taylor

Status: (LR).

Note: It is distributed in the northern Western Ghats. It is closely related to *U. uliginosa* Vahl., which is distributed in India, Sri Lanka, Japan and Australia and differs from it as stated below:

<i>Utricularia praeterita</i>	<i>Utricularia uliginosa</i>
Deeply bidentate fruiting calyx.	Obtuse or minutely bi or tri dentate lower fruiting calyx.
Seeds ellipsoid with lateral or latero – terminal hilum and much elongated testa cells.	Seeds globose, subglobose with terminal hilum and more or less isodimetric to slightly elongated cells.

LYTHRACEAE

Lagerstroemia microcarpa Wight, Ic t. 109. 1839; Gandhi in Saldanha & Nicolson, Fl. Hassan 273. 1976; Yoganarasimhan et. al., Fl. Chikmagalur 148. 1981; Srinivasan in Nair & Henry, Fl. Tamil Nadu 1: 165. 1983; Kulkarni, Fl. Sindhudurg 170. 1988; Ramachandran & Nair, Fl. Cannanore 192. 1988; Manilal, Fl. Silent valley 17. 1988; Keshava Murthy & Yoganarasimhan, Fl. Coorg 197. 1990; Vajravelu, Fl. Palghat 205. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 220. 1991; Deshpande et al., Fl. Mahabaleshwar 1: 318. 1993; Kothari & Moorthy, Fl. Raigad 156. 1993; Mohanan & Henry, Fl. Thiruvananthapuram 202. 1994; Sasidharan & Sivarajan, Fl. Thrissur 195. 1996; Saldanha, Fl. Karnataka 2: 12. 1996; Naithani et al., Forest Fl. Goa 300. 1997.

Lagerstroemia lanceolata Wall. ex Clarke in Hook. f., Fl. Brit. India 2: 576. 1879; Dalgado, Fl. Savantvadi 78. 1898; Vartak, Enum. Pl. Gomantak 53. 1966; Cooke, Fl. Bombay 1: 545. 1967 (repr. ed.); Gamble, Fl. Madras 1: 362. 1967 (repr. ed.); Santapau, Fl. Khandala 100. 1967; Sharma et al., Biol. Mem 2 (1 & 2): 60. 1977; Shah, Fl. Gujarat 308. 1978; Rao, Fl. Goa. 1: 175. 1985; Almeida, Fl. Savantwadi 1: 178. 1990. *L. parviflora* Dalz. & Gibs. in Bombay Fl. 98. 1861, non Roxb. 1795. *L.*

thomsonii Koehne in Engler, Pflanzenr 17: 251. 1903; Kothari & Moorthy, Fl. Raigad, 155. 1993; Gamble, Fl. Madras 1: 362. 1967 (repr. ed).

Trees, up to 10 meters high; bark smooth, whitish, peeling off in large flakes. Leaves simple, opposite, petiolate; petiole c 0.5 cm long, glabrous; lamina up to 10 x 5.5 cm, elliptical-lanceolate, acute at base, entire along margins, acute at apex, dark green adaxially, pale green abaxially, with prominent 8-10 pairs of veins; veins hairy. Inflorescence axillary panicle; panicle up to 9 cm long. Peduncle c 9 cm long, pale green, tomentose; pedicel c 0.2 cm long, pale cream, tomentose. Calyx tube c 0.3 cm long pale cream-white, densely tomentose; lobes five, c 0.2 x 0.1 cm, acute at apex, densely tomentose. Petals five, alternating with calyx teeth, c 0.2 x 0.1 cm, clavate, white, curled. Stamens numerous; filaments c 0.2 cm long, filiform, white, incurved in bud, much exerted in open flowers; anthers 2 celled, yellow, some what orbicular. Ovary globose, c 0.1 x 0.1 cm, glabrous; style c 0.4 cm long, folded, glabrous white; stigma bright red. Capsule c 1 cm long, ellipsoid, four valved. (Fig. 21 A-B; Plate 16 A).

Fl. & Fr.: November - April.

Local name: Nano.

Habitat: In moist deciduous and semi evergreen forests.

Distribution: Gujarat (Surat); Maharashtra (Kolhapur, Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Anmod, Canacona, Chorla, Molem & Verlem); Karnataka (Belgaum, Chikmagalur, Coorg, Mysore, Hassan, Uttar & Dakshin Kannada); Kerala (Cannaonore, Calicut, Idukki, Kottayam, Palghat, Quilon, Thrissur & Thiruvananthapuram); Tamil Nadu (Coimbatore, Kanniyakumari, Nilgiris & Tirunelveli). (Map 22).

Status: (LR).

Notes: It is distributed throughout the Western Ghats. It is a common element in the semi evergreen and moist deciduous forests of Goa. It is closely related to *L. parviflora* Roxb. which is also associated with it and is distributed from India, Nepal, Bangladesh and Myanmar and differs from it as stated below:

<i>Lagerstroemia microcarpa</i>	<i>Lagerstroemia parviflora</i>
Calyx tube without a ring.	Calyx tube with a ring inside the lobes appressed to the capsule in fruits.
Leaves glabrous or downy and bluish white beneath, acute at base.	Leaves grey and glabrous or shortly pubescent beneath, rounded at base.

Rotala macrandra Koehne in Engler, Bot. Jahrb. Syst. 1: 176. 1881; Gamble, Fl. Madras 1: 359. 1967 (repr. ed.); Sharma et al., in Biol. Mem. 2 (1 & 2): 60. 1977; Manilal & Sivarajan, Fl. Calicut 113. 1982; Srinivasan in Nair & Henry, Fl. Tamil Nadu 1: 166. 1983; Kulkarni, Fl. Sindhudurg 173. 1988; Ramachandran & Nair, Fl. Cannanore 194. 1988; Joseph & Sivarajan, Proc. Indian Acad. Sci (Plant Sci.) 99(3): 185. 1989; Vajravelu, Fl. Palghat 207. 1990; Cook, Aqua. Wetland Pl. India 258. 1996; Saldanha, Fl. Karnataka 2: 16. 1996; Sasidharan & Sivarajan, Fl. Thrissur 196. 1996; Joshi et al., J. Econ. Tax. Bot. 21: 498. 1997. *Ameletia rotundifolia* Wight, Ic. t. 258. 1840, non Roxb. 1820. *R. rotundifolia* sensu Blatt. and Hallb., J. Bombay Nat. Hist. Soc. 25: 718. 1918. *Ammannia rotundifolia* Wight & Arn. Prod. 1: 306. 1834 p.p, non Buch. Ham. ex D. 1825; Clarke in Hook. f., Fl. Brit. India 2: 566. 1879; Cooke, Fl. Bombay 1: 540. 1967 (repr. ed.); Gandhi in Saldanha & Nicolson, Fl. Hassan 274. 1976.

Erect perennial herbs, up to 20 cm high, partly submerged in water, rooting at nodes; stems obtusely angled, smooth, pubescent. Leaves simple, opposite, decussate; lamina up to 0.7 x 0.7 cm, ovate-orbicular, entire along margins, obtuse at apex,

glabrous with prominent veins adaxially, membranous. Inflorescence a terminal, simple or bracteate spike; bracts c 0.3 x 0.4 cm, ovate, acute at apex; bracteoles 2, c 0.1 cm long, linear. Calyx tube c 0.15 cm long, campanulate; teeth 4, c 0.7 cm long, triangular, membranous, acute at apex, pink. Petals 4, c 1 cm long, ovate, obtuse at apex, pink. Stamens 4; filaments c 0.3 cm long, filiform, inserted at the base of calyx tube; anthers two celled. Ovary globose, four celled; style c 0.25 cm long; stigma capitate. Capsule four valved. (Fig. 21 C-H; Plate 16 B-D).

Fl. & Fr.: October – January.

Habitat: Marshy areas near ponds and puddles.

Distribution: Maharashtra (Satara & Sindhudurg); Goa (Carambolim & Rivona); Karnataka (Chickmagalur & Hassan); Kerala (Calicut, Cannanore, Kasaragod, Palghat & Thrissur). (Map 22).

Status: (LR).

Notes: It is a new report to the state of Goa. It is continuously distributed along the Western Ghats. In dry condition its leaves turn pink. It is closely related to *R. rotundifolia* Blatt. & Hall., which is distributed from India to Japan. It was considered conspecific to *R. rotundifolia* by Blatter & Hallberg (1919) as only stamen size differentiate it from *R. macrandra*, but later it was revealed that besides stamen character (Joseph & Sivarajan l.c.), other characters also show differences as shown below:

<i>Rotala macrandra</i>	<i>Rotala rotundifolia</i>
It is a low land species.	It is usually restricted to higher altitude.
Bracteoles are much shorter than the corolla tube.	Bracteoles almost equaling the corolla tube.
Stamens are much longer than the calyx.	Stamens are as long as or shorter than the calyx.

Rotala malampuzhensis Nair (J. Bombay Nat. Hist Soc. 72: 57. 1975. nom. invalid.)
ex Cook, Boissiera 29: 98. 1979; Manilal & Sivarajan, Fl. Calicut. 114. 1982; Panigr.
& Nicols in Taxon 32: 120. 1983; Joseph & Sivarajan in Proc. Indian Acad. Sci.
(Plant Sci.) Vol. 99. 3: 186. 1989; Vajravelu, Fl. Palghat 207. 1990; Bhat in J.
Bombay Nat. Hist. Soc. 90: 138. 1993; Cook, Aqua. Wetland Pl. India 258. 1996;
Sasidharan & Sivarajan, Fl. Thrissur 196. 1996; Saldanha, Fl. Karnataka 2: 17. 1996;
Joshi et al., in J. Econ. Tax. Bot. 21 (2) 498. 1997.

Annuals up to 30 cm high. Stems much branched, rooting below. Leaves simple, decussate, sessile; lamina up to 1.5 x 0.4 cm, scale like, orbicular in submerged leaves; upper leaves linear-lanceolate. Bracts leafy; bracteoles ca 0.1 cm long, capillary. Flowers monomorphic, sessile, solitary. Calyx tube c 0.08 cm long, campanulate, three lobed, ovate-acute, bright red, appendages three, minute, sometimes absent. Petals three, small, bright red. Stamens three, inserted above the base of the calyx tube; anthers up to the middle of calyx tube. Nectar scales three, prominent, linear, alternating with stamens. Ovary globose; style very short or absent; stigma capitate. Capsule globose, bright red, exceeding the calyx tube, opening by three valves. Seeds 10-15, semi ovoid, smooth, bright red. (Fig. 21 I-M; Plate 16 C).

Fl. & Fr.: July – October.

Habitat: In puddles on open lateritic plateaus.

Distribution range: Maharashtra (Kolhapur); Goa: (Goa University Campus & Loliem); Karnataka (Uttar Kannada); Kerala: (Calicut, Palghat & Thrissur). (Map 22).

Status: (LR).

Notes: It is a new report to the state of Goa. It is closely related to *R. mexicana* Chamissoet Schlechtendal which is distributed in India, Africa, Arabia and Pacific island and differs from it as stated below:

<i>Rotala malampuzhensis</i>	<i>Rotala mexicana</i>
Calyx lobes ovate -acute, red.	Calyx lobe triangular, pink
Petals present.	Petals absent
Stamens three, above the base of calyx tube.	Stamens two, inserted at the base of calyx tube.

MALVACEAE

Decaschistia trilobata Wight, Ic. t. 88. 1840; Hook. f., Fl. Brit. India 1: 332. 1874; Vartak, Enum. Pl. Gomantak 28. 1966; Cooke, Fl. Bombay 1: 109. 1967 (repr. ed.); Gamble, Fl. Madras 1: 68. 1967 (repr. ed.); Saldanha, Fl. Karnataka. 1: 248. 1984; Rao, Fl. Goa 1: 34. 1985; Kulkarni, Fl. Sindhudurg 40. 1988; Nayar et al. in Nayar & Sastry, Red Data Book Indian Pl. 2: 150. 1988; Almeida, Fl. Savantwadi 1: 59. 1990; Paul in Sharma et al. Fl. India 3: 300. 1993; Almeida, Fl. Maharashtra 1: 105. 1996; Sivarajan & Pradeep, Malvaceae of South. Peninsular India 23. 1996; Naithani et al., Forest Fl. Goa 72. 1997.

Erect herbs, up to 1.5 m high; stem densely woolly, tomentose; hairs stellate. Leaves simple, petiolate; petiole up to 0.9 cm long, tomentose; lamina usually deeply 3 lobed, upper leaves entire; lobes oblong, acute at base, dentate along margins, acute at apex, dark green adaxially, pale green abaxially with prominent veins, tomentose on both surfaces. Flowers solitary, arising from the leaf axil, up to 7 cm across; pedicel up to 2 cm long, tomentose with stellate hairs; bracts 10, up to 0.8 cm long, linear, acute at apex, tomentose. Calyx tube up to 0.7 cm long; lobes 5, acute at apex with prominent midrib, densely tomentose along the midrib. Petals 5, up to 5 x 2 cm, obovate, yellow with purple center, glabrous inside, prominent veins with stellate

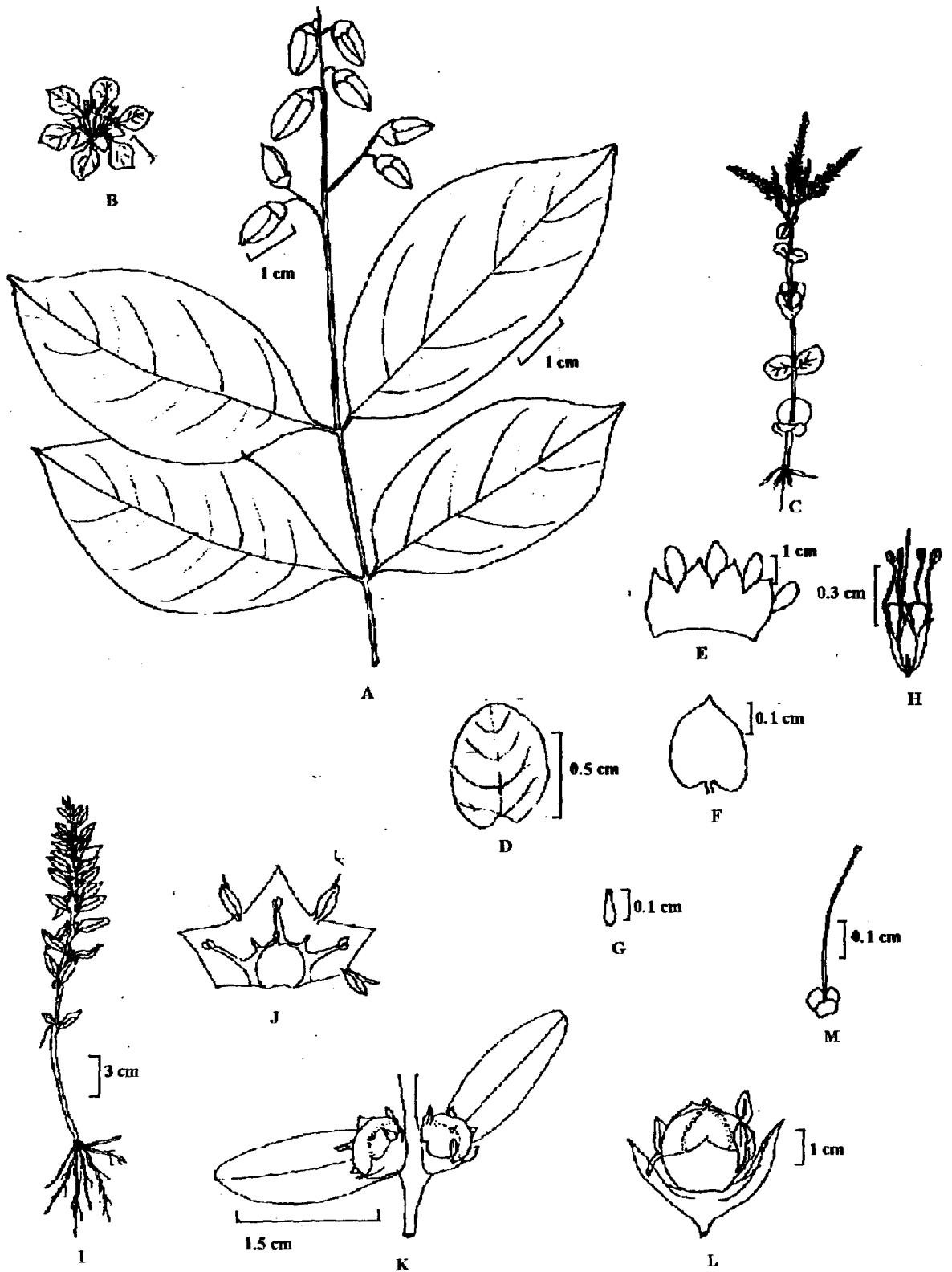


Figure 21: *Lagerstroemia microcarpa* Wight: A. Habit; B. Flower. *Rotala macrandra* Koehne: C. Habit; D. Leaf; E. Corolla split open; F. Bract; G. Ovary; H. Stamens. *Rotala malampuzhensis* Nair: I. Habit; J. L.S. of Flower; K. & L. Fruit; M. Pistil.



PLATE 16: A. *Lagerstroemia microcarpa* Wight, B & D. *Rotala macrandra* Koehne, C. *Rotala malampuzhensis* Nair, E. *Sonerila rheedii* Wight & Am., F. *Memecylon talbotianum* Brandis (inset close up of flower)

Map 22: Distribution of *Lagestroemia microcarpa*, *Rotala macrandra*, *Rotala malampuzhensis* and *Decaschistia trilobata* along Western Ghats.



hairs outside. Staminal column cylindrical, up to 2.5 cm long, with numerous stamens; filaments up to 0.2 cm long, filiform; anthers 2 celled. Styles 10 with glandular hairs; stigma 10, capitate, yellow. Capsule hispid, green. (Fig. 22 A-C; Plate 17 A-B).

Fl. & Fr.: October - November.

Habitat: At slightly higher elevation in open areas of moist deciduous and semievergreen forests.

Distribution: **Maharashtra** (Kolhapur, Raigad, Satara & Sindhudurg); **Goa** (Anmod, Charan -Chorla & Verlem); **Karnataka** (Belgaum, Mysore, Shimoga, Uttar & Dakshin Kannada). (Map 22).

Status: (R).

Notes: It is distributed in northern and central Western Ghats. Nayar et al. (l.c.) reported it to be rare in the Red Data Book as only few collections are available. Rao (l.c.) mentioned it to be common in the forests of Goa but it was observed to be rare in the present study.

MELASTOMATACEAE

Memecylon talbotianum Brandis in Talbot, Bombay List ed. 2. Append. 1902 & Indian Trees 336. 1906; Cooke, Fl. Bombay 1: 536. 1967 (repr. ed.); Gamble, Fl. Madras 1: 355. 1967 (repr. ed); Santapau, Fl. Khandala 96. 1967; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 288. 1976; Yoganarasimhan et al., Fl. Chikmagalur 76. 1981; Vivekananthan in Nair & Henry, Fl. Tamil Nadu 1: 161 1983; Rao, Fl. Goa 1: 173. 1985; Kulkarni, Fl. Sindhudurg 168. 1988; Ramachandran & Nair, Fl. Cannanore 186. 1988; Almeida, Fl. Savantwadi 1: 175. 1990; Keshava Murthy &

Yoganarasimhan, Fl. Coorg 192. 1990; Kothari & Moorthy, Fl. Raigad 151. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 239. 1995; Saldanha, Fl. Karnataka 2: 40. 1996; Naithani et al., Forest Fl. Goa 295. 1997.

Trees, up to 8 m high; branches terete, slightly quadrangular. Leaves opposite, petiolate; petiole c 0.5 cm long; lamina up to 6.5 x 3 cm, elliptic-ovate, acute at base, slightly revolute along margins, obtusely acuminate at apex, thickly coriaceous. Flowers in axillary clusters, sessile, on bracteate, nearly sessile tubercles; buds pyriform. Calyx c 0.2 cm long; tube campanulate, limb four lobed; teeth triangular, green. Petals small, orbicular, glabrous, blue. Stamens 3; filaments filiform; anthers short, connectives ending in to an obtuse spur. Styles filiform; stigma punctiform. Berry c 0.5 cm across, globose, yellow, black on maturity. (Fig. 22 D-E; Plate 16 F).

Fl. & Fr.: March – May.

Local name: Anguni.

Habitat: Along the streams in semievergreen forests.

Distribution: Gujarat; Maharashtra: (Kolhapur, Raigad, Satara, Sindhudurg & Thane); Goa (Sanguem & Tamdi Surla); Karnataka: (Chikmagalur, Coorg, Hassan, Shimoga, Uttar & Dakshin Kannada); Kerala (Cannanore & Kottayam); Tamil Nadu (Madurai & Nilgiri). (Map 23).

Status: (LR).

Notes: It is distributed throughout Western Ghats. It is closely related to *M. umbellatum* Burm. which is distributed in India and Sri Lanka and differs from it as stated below:

<i>M. talbotianum</i>	<i>M. umbellatum</i>
Flowers sessile, in compact head.	Flowers pedicelled, in umbels.
Fruits yellow when ripe.	Fruits black when ripe.

Sonerila rheedii Wight & Arn. Prodr. 321. 1834; Vartak, Enum. Pl. Gomantak 53. 1966; Cooke, Fl. Bombay 1: 533. 1967 (repr. ed.); Gamble, Fl. Madras 1: 353. 1967 (repr. ed.); Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 280. 1976; Sharma et al., Biol. Mem 2 (1 & 2): 59. 1977; Manilal & Sivarajan, Fl. Calicut 109. 1982; Vivekananthan in Nair & Henry, Fl. Tamil Nadu 1: 164. 1983; Ramachandran & Nair, Fl. Cannanore 189. 1988; Keshava Murthy & Yoganarasimhan, Fl. Coorg 195. 1990; Mohanan & Henry, Fl. Thiruvananthapuram 200. 1994; Sasidharan & Sivarajan, Fl. Thrissur 193. 1996; Saldanha, Fl. Karnataka 2: 44. 1996. *S. Wallichii* sensu Clarke in Hook. f., Fl. Brit. India 2: 538. 1879 p.p., non Benn. 1844.

Tuberous herbs, up to 13 cm high; tubers ovoid, disc like, flat, numerous with fibrous roots arising from it; stem irregular, six angled, pale green-cream coloured, reddish-purple at the base, ciliate along margins. Leaves simple, petiolate; petiole up to 1.6 cm long, hairy, lower leaves opposite, decussate, upper leaves clustered or umbellate, four arising from a node; lamina up to 2.5 x 1.7 cm, ovate, rounded at base, serrate along margins, acute at apex, dark green adaxially with scattered, silvery white hairs abaxially; hairs more prominent along the margins and veins; tertiary veins arising from the base. Flowers usually four, subumbellate; pedicel c 0.6 cm long, stout, angled with glandular hairs. Calyx tube c 0.4 cm long, campanulate, pale green, angled; teeth 3, c 0.01 cm long, acute, triangular, hairy. Petals 3, alternating with the sepals; sepal c 0.7 x 0.3 cm, oblong-ovate, acute, slightly triangular at apex, violet with prominent midrib. Stamens 3; filaments c 0.4 cm long, violet; anthers yellow, sagittate. Ovules many; style c 0.7 cm long, filiform, violet; bifid. (Fig. 2 F-J; Plate 16 E).

Fl. & Fr.: September – October.

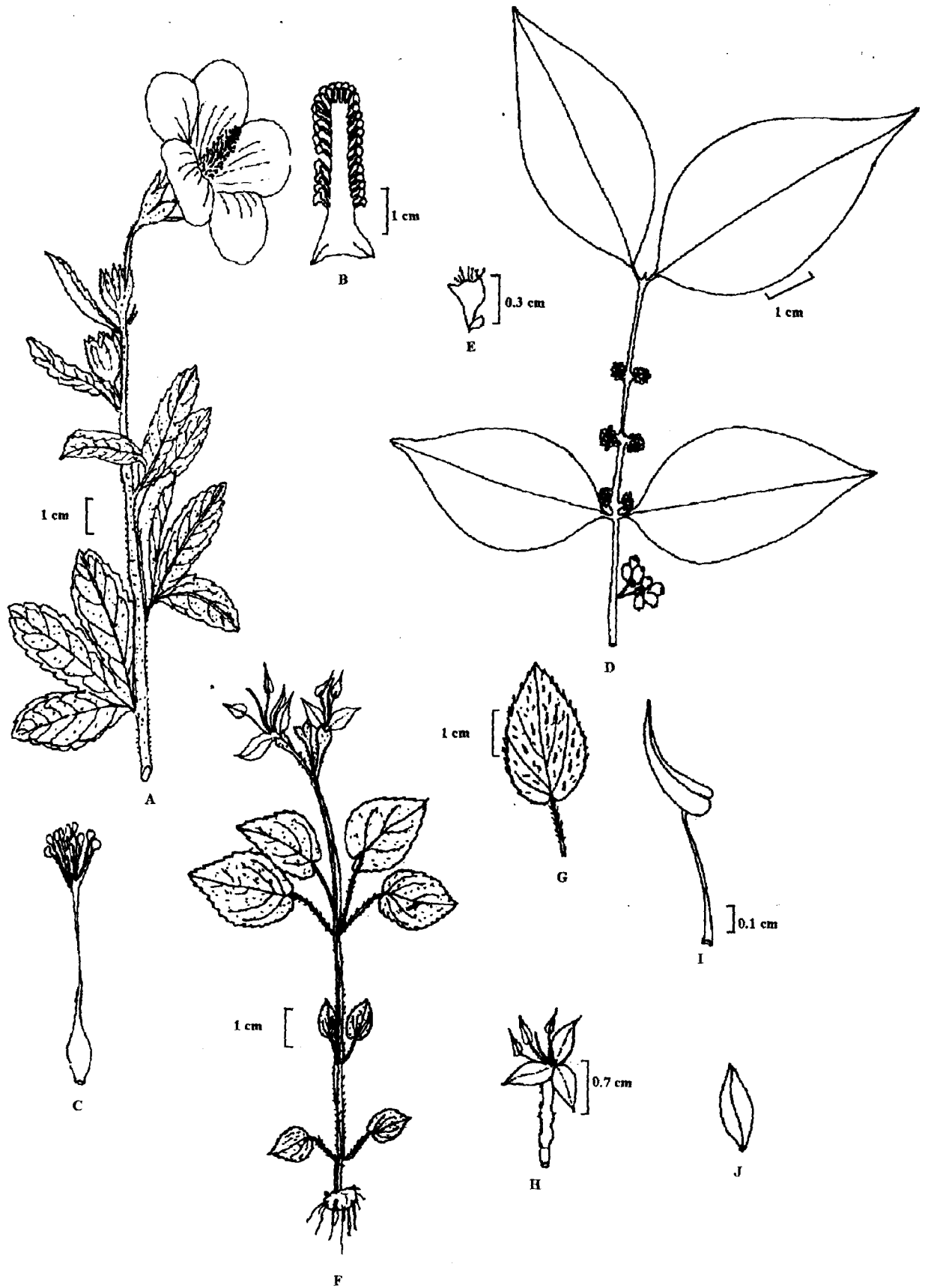


Figure 22: *Decaschistia trilobata* Wight: A. Habit; B. Staminal column; C. Pistil. *Memecylon talbotianum* Brandis: D. Habit; E. Flower. *Sonerila rheedii* Wight & Arn.: F. Habit; G. Leaf; H. Flower; I. Anther; J. Bract.

Habitat: On lateritic rocks in shady places at higher elevations.

Distribution: Gujarat (Saurashtra); Maharashtra (Kolhapur & Satara); Goa (Chandranath hills); Karnataka (Coorg, Hassan, Mysore, Uttar Kannada); Kerala (Calicut, Cannanore, Idukki, Kasaragod, Thrissur, Thiruvananthapuram & Wyanad); Tamil Nadu (Nilgiris). (Map 23).

Status: (R).

Notes: It is a new report to the state of Goa. It is distributed throughout Western Ghats. It has been reported from Andhra Pradesh (Pullaiah 1997) based on Fyson's collection from Godavari district, however as no recent collections were observed from Andhra Pradesh it is being included in the present work.

MORACEAE

Artocarpus hirsutus Lam. Encycl. 3: 210. 1789; Hook. f., Fl. Brit. India 5: 541. 1888; Dalgado, Fl. Savantvadi 179. 1898; Vartak, Enum. Pl. Gomantak 97. 1966; Cooke, Fl. Bombay 3: 157. 1967 (repr. ed.); Gamble, Fl. Madras 3: 957. 1967 (repr. ed.); Ramamoorthy & Gandhi in Saldanha & Nicolson, Fl. Hassan 78. 1976; Yoganarasimhan et al., Fl. Chikmagalur 310. 1981; Manilal & Sivarajan, Fl. Calicut 278. 1982; Saldanha, Fl. Karnataka 1: 112. 1984; Rao, Fl. Goa 2: 406. 1986; Chitra in Henry et al., Fl. Tamil Nadu 2: 251. 1987; Ramachandran & Nair, Fl. Cannanore 430. 1988; Almeida, Fl. Savantvadi 1: 403. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 418. 1990; Vajravelu, Fl. Palghat 443. 1990; Mohanan & Henry, Fl. Thiruvananthapuram 430. 1994; Sasidharan & Sivarajan, Fl. Thrissur 426. 1996; Naithani et al., Forest Fl. Goa 594. 1997.

Trees, up to 12 m high. Leaves alternate, stipulate, petiolate; stipule up to 2.5 cm long, stout; petiole up to 1.25 cm long; lamina up to 15 x 9 cm, broadly ovate-elliptic, coriaceous, entire, narrow at base, smooth, glabrous at maturity, except on the midrib and nerves beneath, with 10 pairs of prominent nerves. Inflorescence an axillary, pedunculate receptacle. Male receptacles cylindrical, at first erect, pendulous later, up to 10 cm long. Female receptacles up to 7 cm long. Staminate flowers: Sepals 2, united below; stamens 1; anther exerted, ovate, receptacles chaffy. Pistillate flowers: Perianth tube confluent below the receptacles, mouth minute; ovules pendulous; style central; stigma entire. Fruit up to 25 cm long, echinate; spines c 0.5 cm long, cylindrical, straight, hispid, perforated at apex from the filiform style. (Fig. 23 A; Plate 17 C-E).

Fl. & Fr.: January – February.

Local name: Amjeli; Phal phanas.

Habitat: Slopes of plateaus as well as in the moist deciduous forests.

Distribution: Maharashtra (Sindhudurg); Goa (Chandranath & Goa University Campus); Karnataka (Chikmagalur, Coorg, Hassan, Uttar & Dakshin Kannada); Kerala (Calicut, Cannanore, Idukki, Kasaragod, Kottayam Palghat & Thiruvananthapuram). (Map 23).

Status: (LR).

Notes: It is distributed throughout Western Ghats. Wood is used in construction work, furniture making and ship building. It is used locally in medicine; fruit is edible. It differs from other species of *Artocarpus* in having pendulous, cylindrical male heads; fruits oblong, ovoid with under surface of the leaf and young shoot yellowish brown.

MYRISTICACEAE

Gymnacantha farquhariana (Hook. & Thom.) Warburg, Monogr. Myrist. 365. 1897; Saldanha, Fl. Karnataka 1: 51. 1984; Ramachandran & Nair, Fl. Cannanore 390. 1988; Mohanan & Henry, Fl. Thiruvananthapuram 385. 1994; Sasidharan & Sivarajan, Fl. Thrissur 377. 1996; Naithani et al., Forest Fl. Goa 501. 1997. *Myristica farquhariana* Hook. & Thom., Fl. Ind. 162. 1855, non 1886; Hook f., Fl. Brit. India 5: 108. 1855. *Myristica canarica* Bedd. ex King in Ann. Roy. Bot. Gard. Cal. 3: 307. t. 138. 1891. *Gymnacantha canarica* (King) Warburg, Monogr. Myrist. 368. 1897; Manilal & Sivarajan, Fl. Calicut 82. 1982.

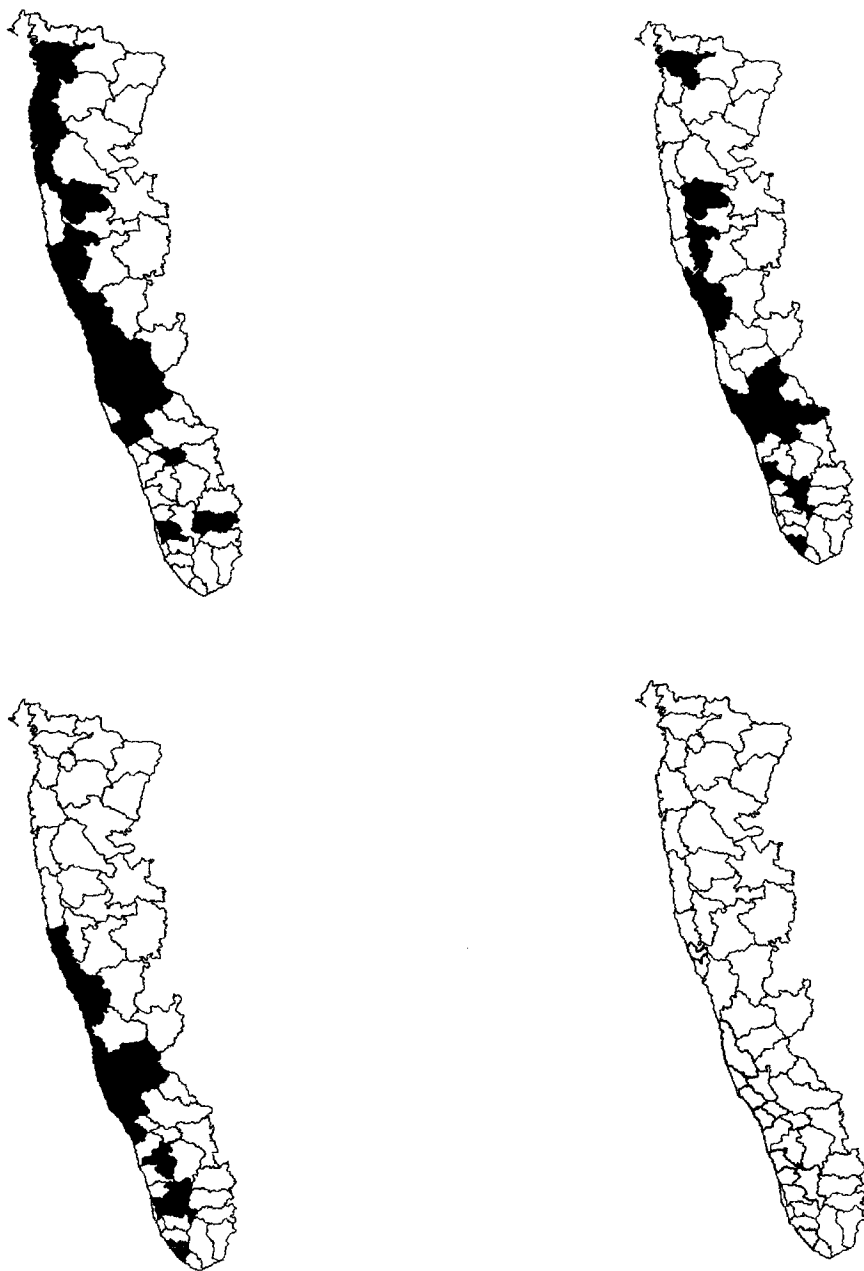
Evergreen trees; roots forming knee shaped bend; bark grey, smooth, glabrous with lenticels. Leaves simple, alternate, petiolate; petiole c 1 cm long, outer part covered with brown tomentum when young, glabrous at maturity; lamina up to 19 x 5.5 cm, oblong-elliptic, lanceolate, acute at base, entire along margins, acuminate at apex, dark green shining, glabrous adaxially, dull whitish bloom present abaxially, with 10–12 pairs of not very prominent veins. Staminate flowers: Inflorescence axillary, subumbellate, bracteate cymes, up to 5 cm long; bracts small, densely tomentose, brown –orange. Flowers usually in cluster of two–three at each node; bracteoles small, suborbicular, closely appressed to the base of flower; pedicel c 0.4 cm long, orange– reddish brown, tomentose. Perianth c 0.3 cm long, puberulous and orange coloured out side, glabrous and pale creamish yellow inside, teeth four, c 0.15 cm long, acute. Anthers 8, fused to form a staminal column at base, free at apex, pale creamish brown. Female flowers not observed. Fruits c 1.5 cm across, pale brown. (Fig. 23 B-C; Plate 17 D-F).

Fl. & Fr.: April - November.



PLATE 17: A & B. *Decaschistia trilobata* Wight, C & E. *Artocarpus hirsutus* Lam. (C. Flowers, E Fruits), D & F. *Gymnacantha farquhariana* (Hook. & Thom.) Warburg (Myristica swamp)

Map 23: Distribution of *Memecylon talbotianum*, *Sonerila rheedii*, *Artocarpus hirsutus* and *Gymnacantha farquhariana* along Western Ghats.



● *Memecylon talbotianum*
Brandis

● *Artocarpus hirsutus* Lam.

● *Sonerila rheedii* Wight &
Arn.

○ *Gymnacantha farquhariana*
(Hook. & Thom.) Warburg

Habitat: In swamp along the stream with characteristic knee shaped roots above the soil surface.

Distribution: Goa (Nirankarichi rai near Valpoi); Karnataka (Dakshin Kannada); Kerala (Calicut, Cannanore, Idukki, Thrissur & Thiruvananthapuram). (Map 23).

Status: VU

Notes: It is distributed in the evergreen forests of southern Western Ghats. Observed only at one locality in Goa and it forms the northern most limit of its distribution along the Western ghats. The seed fat is locally used in making Candles.

Knema attenuata (Wall. ex Hook. f., & Thoms.) Warb., Monog. Myris. 590. 1897; Vartak, Enum. Pl. Gomantak 90. 1966; Gamble Fl. Madras 1: 851. 1967 (repr. ed.); Santapau, Fl. Khandala 230. 1967; Gandhi in Saldanha & Nicolson, Fl. Hassan 42. 1976; Sharma et al. Biol. Mem 2 (1 & 2): 122. 1977; Arora et al., Bot. South Kanara 51. 1981; Yoganarasimhan et al., Fl. Chikmagalur 277. 1981; Saldanha, Fl. Karnataka 1: 53. 1984; Nair & Nayar, Fl. Courtallum 26. 1986; Rao, Fl. Goa 2: 367. 1986; Kumari in Henry et. al., Fl. Tamil Nadu 2: 205. 1987; Kulkarni, Fl. Sindhudurg 374. 1988; Ramachandran & Nair, Fl. Cannanore 390. 1988; Almeida, Fl. Savantwadi 1: 361. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 379. 1990; Vajravelu, Fl. Palghat 400. 1990; Kothari & Moorthy, Fl. Raigad 345. 1993; Mohanan & Henry, Fl. Thiruvananthapuram 386. 1994; Sasidharan & Sivarajan, Fl. Thrissur 377. 1996; Naithani et al., Forest Fl. Goa 506. 1997. *Myristica attenuata* Wall. ex Hook. f. & Thoms., Fl. Ind. 1: 157. 1855; Cooke, Fl. Bombay 3: 25. 1967 (repr. ed.). *M. corticosa* Bedd. Fl. Sylv. t. 278. 1872.

Dioecious evergreen trees, young branches covered with tawny, feirfuraceous tomentum glabrous at maturity; tomentum deciduous, golden brown; bark black, coming out in patches, brown surface beneath. Leaves simple, alternate, petiolate; petiole up to 1.5 cm long; lamina up to 18 x 7 cm, elliptic-oblongate, cuneate at base, entire along margins, acuminate at apex, darkgreen, shining adaxially, white, glaucous abaxially. Male flowers in axillary umbels; peduncle stout with deciduous tomentum, c 0.8 cm long; pedicel c 1.3 cm long, slender, with tomentum goldenbrown. Perianth lobes three-four, c 0.5 x 0.3 cm, obovate-orbicular, triangular-acute at apex, glabrous, succulent, wrinkled inside, golden tomentose outside. Stamens 18-20, arranged on a disc shaped staminal column; purplish red; filaments very small; anthers yellow arranged at the margins. Fruits up to 5 cm long, ovoid, brown, with rusty tomentum outside, with a short pointed beak at base; seed c 2.5 x 1.5 cm, ovoid, surrounded by aril; aril orange brown, densely forked at base. (Fig. 23 D- F; Plate 18 A-B).

Fl. & Fr.: November - December.

Local name: Ran jayphal.

Habitat: In lowland semievergreen and evergreen forests.

Distribution: Maharashtra (Kolhapur, Raigad, Satara & Sindhudurg); Goa (Gaodongri - Natravali; Molem-Anmod, Nadquem, Nandora, Satari, Vageri hills,); Karnataka (Chikmagalur, Coorg, Hassan, Shimoga, Uttar & Dakshin Kannada & Yellapur); Kerala (Cannanore, Idukki, Kasaragod, Kottayam, Palghat, Thrissur & Thiruvananthapuram); Tamil Nadu (Coimbatore, Nilgiri & Tirunelveli). (Map 24).

Status: (LR).

Notes: It is distributed throughout Western Ghats. It is a characteristic element in the evergreen forests of Goa. Its wood being soft, is used in match box making, splint and for light and heavy packing cases.

MYRTACEAE

Eugenia macrocephala Duthie in Hook. f., Fl. Brit. India 2: 501. 1879; Cooke, Fl. Bombay 1: 524. 1967 (repr. ed.); Rao, Fl. Goa 1: 167. 1985; Saldanha, Fl. Karnataka 2: 24. 1996.

Trees up to 9 m; branches pale brown, smooth; young branches grey, pubescent. Leaves simple, opposite, petiolate; petiole c 0.4 cm long; lamina up to 7.5 x 3.5 cm, oblong-lanceolate, cuneate at base, entire along margins, acute-acuminate at apex or obtusely acuminate at apex, dark green, smooth adaxially, pale green abaxially with prominent 3-4 pairs of veins. Flowers 3-4 fascicled at leaf axils; flowers surrounded by bracts; bracts two, c 0.4 cm long, linear, pilose, slightly shorter than the corolla lobes; calyx tube very short, densely hairy; lobes four, c 0.6 cm long, lanceolate, ciliate along margins. Petals four c 0.45 cm long, broadly ovate, white, ciliate along margins, rounded at apex. Stamens numerous, inserted at the base; filaments c 0.3 cm long, white; anther two celled, brown. Style c 0.45 cm long, twisted or crumpled. Fruits not observed. (Fig. 23 G-H; Plate 18 C-D).

Fl. & Fr.: February - March.

Habitat: In evergreen and semievergreen forests.

Distribution: Goa (Anmod, Nadquem, Panchi near Nanorem, Tamdi surla Valpoi); Karnataka (Mysore, Shimoga & Uttar Kannada). (Map 24).

Status: (R).

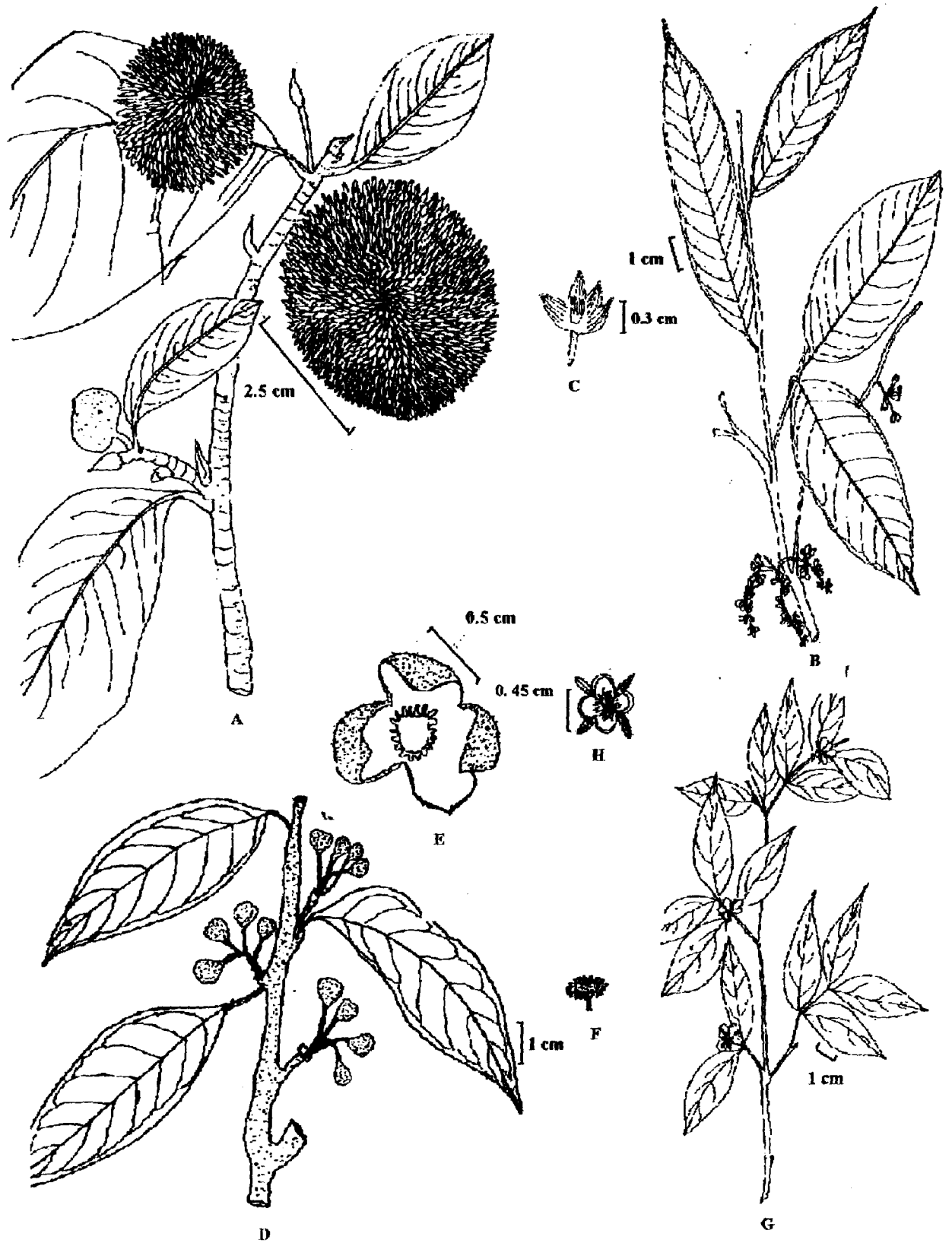


Figure 23: *Artocarpus hirsutus* Lam.: A. Habit. *Gymnacantha farquhariana* (Hook. & Thom.) Warburg: B. Habit; C. Flower. *Knema attenuata* (Wall. ex Hook. f., & Thoms.) Warb.: D. Habit; E. Flower; F. Staminal column. *Eugenia macrocephala* Duthie: G. Habit; H. Flower.

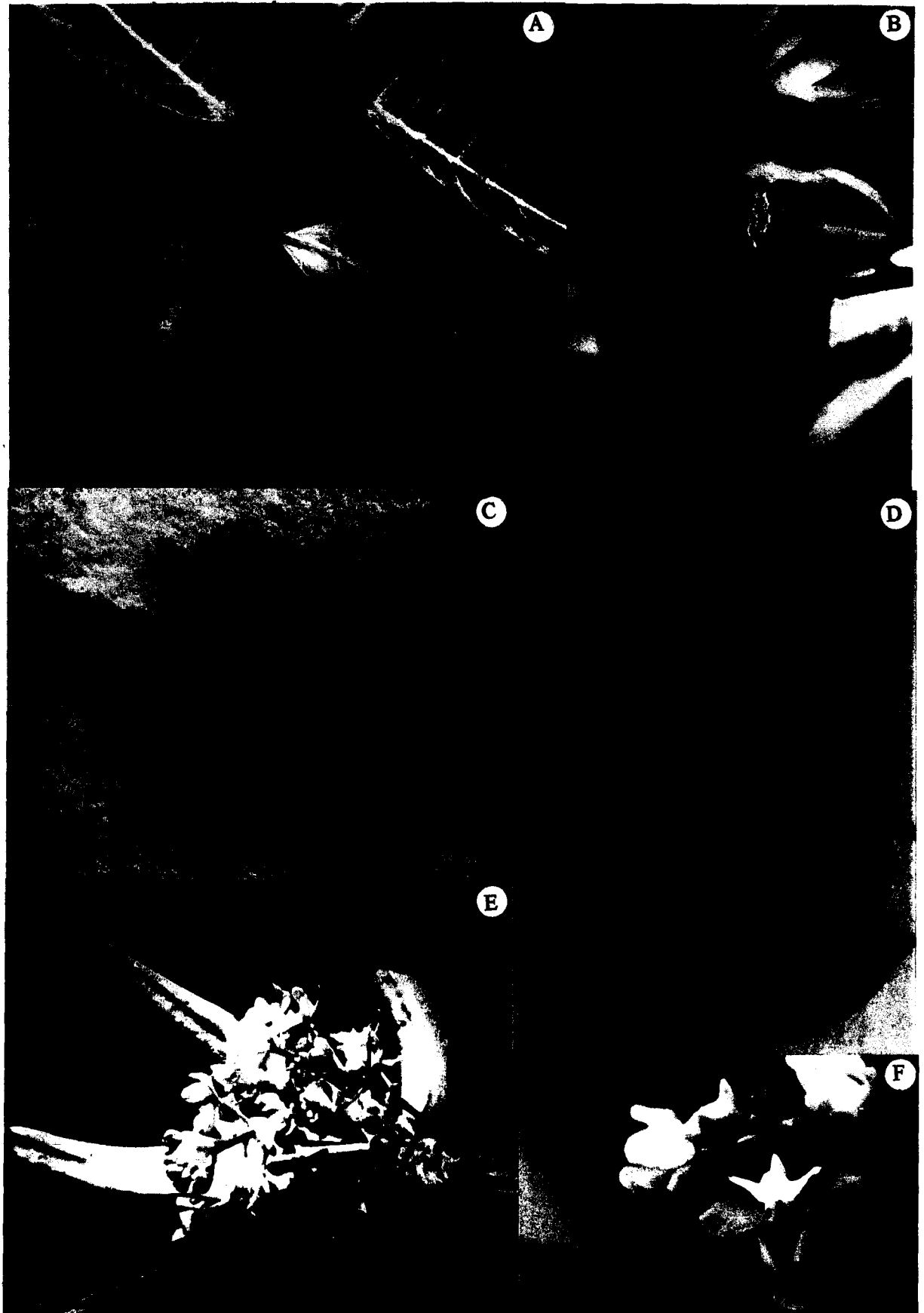


PLATE 18: A & B. *Knema attenuata* (Wall. ex Hook. f., & Thoms.) Warb (B. Fruit), C & D *Eugenia macrocephala* Duthie, E & F. *Aerides dalzelliana* (Sant.) Garay

Notes: Its distribution is known only from Goa and Karnataka. Flowers are big as compared to other species of *Eugenia* in the study area.

ORCHIDACEAE

Aerides dalzelliana (Sant.) Garay in Bot. Mus. Leafl. Harv. Univ. 23 (4): 158. 1972; Deshpande et al., Fl. Mahabaleshwar 2: 562. 1995; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 12. 1996. *Sarcochilus dalzelliana* Santapau in Kew Bull. 1948: 498. 1949 et in Rec. *Micropera viridifolia* Dalz. in Hook. J. Bot. 3: 282. 1851; Cooke, Fl. Bombay 3: 201. 1967 (repr. ed.). *Saccolabium viridiflorum* (Dalz.) Lindl. in J. Linn. Soc. 3: 36. 1858. *Gastrochilus dalzellianus* (Sant.) Sant & Kapadia in J. Bombay Nat. Hist. Soc. 59: 842. 1962; Vartak, Enum. Pl. Gomantak 101. 1966; Santapau, Fl. Khandala 266. 1967; Santapau & Kapadia, Critical notes on Orchida of Bombay, J. Bombay Nat. Hist. Soc. 59: 842. *Sarcochilus viridiflorus* (Dalz.) T. Cooke, Fl. Press. Bomb. 2: 697. 1907, non Hook. f., 1890. *Smithsonia viridiflora* (Dalz.) Sald. in J. Bombay Nat. Hist. Soc 71: 75. 1974.

Epiphytic herbs with succulent, green roots, attached to the wood. Leaves 2–3, up to 7.5 x 1.5 cm, elliptic–lanceolate, cuneate–tapering at base entire along margins, unequally bilobed at apex succulent; lobes entire or slightly toothed; tooth 2–3, darkgreen; mid vein depressed adaxially, swollen abaxially. Inflorescence raceme, corymbose umbellate; raceme 4.5–5 cm long, arising from the base. Peduncle stout, green with purple spots, bracteate; bracts c 0.15 x 0.1 mm, lower one ensheathing the peduncle, upper not so, acute at apex, pale yellowish brown. Flowers c 1.3 cm across, greenish white. Pedicels c 1 cm long, stout, green. Sepals three, unequal, broadly ovate - spatulate, tapering at base, entire or rounded at apex; dorsal sepal c 6 x 3 mm,

green; lateral sepal c 6 x 2.5 mm, less broad as compared to the terminal sepal. Petals c 5 x 2.5 mm, pale green, obovate, tapering at base, rounded or some times recurved at apex. Column c 4 mm long, purple-red spots in the center. Lip divided in to three lobes; midlobe acute; lateral lobes slightly rounded, white, fleshy, stout. Spur short, c 0.4 x 0.8 cm long, pale cream; anthers pale yellow with truncate apiculum; pollinia two, deeply grooved, c 0.4 mm in diameter, caudicle narrow, glands narrow linear. (Fig. 24 A-D; Plate 18 E-F).

Fl. & Fr.: May - June.

Habitat: Epiphyte on trees in semievergreen and evergreen forests.

Distribution: Maharashtra (Satara & Thane); Goa (Molem – Anmod & Tamdi Surla);

Karnataka (Belgaum); Kerala (Idukki). (Map 24).

Status: (LR).

Notes: Epiphytic on trees like *Diospyros saldanhae* and *Terminalia* spp. and it is restricted to northern Western Ghats. Santapau (1949), while treating the species under the genus *Sarcochilus* found that the combination *Sarcochilus viridiflorus* (Dalz.) T. Cooke, used in the earlier flora is a later homonym of *S. viridiflorus* (Thw.) Hook. f. (1890), hence proposed a new name *Sarcochilus dalzelliana* Sant. However, now it is accepted that the species best fits under the genus *Aerides* and treated so by several authors as *A. dalzelliana*. The epithet “*viridiflora*” though published earlier cannot be used under *Aerides* because the name *A. viridiflora* Thw. 1864 is already existing for a different species. Taxonomically *A. dalzelliana* is closely related to *A. maculatus* Lindl. which is distributed throughout India and differs from it as stated below:

<i>Aerides dalzelliana</i>	<i>Aerides maculatus</i>
Inflorescence shorter than leaves.	Inflorescence longer than leaves.
Flowers greenish white.	Flowers yellow, without reddish spots.

Dendrobium ovatum (Willd.) Kranzl. in Engler Prantel. 45: 71. 1910; Vartak, Enum. Pl. Gomantak 100. 1966; Gamble, Fl. Madras 2: 990. 1967 (repr. ed); Santapau & Kapadia, Orch. Bombay 91: 1966; Santapau, Fl. Khandala 264. 1967; Saldanha in Saldanha & Nicolson, Fl. Hassan 822. 1976; Shah, Fl. Gujarat 2: 655. 1978; Abraham & Vatsala, Intr. Orch 353. f. 83. 1981; Yoganarasimhan et al., Fl. Chickmagalur 327. 1981; Rao, Fl. Goa 2: 418. 1986; Kulkarni, Fl. Sindhudurg 429. 1988; Karthikeyan et al., Fl. Ind. Enum. Mono. 129. 1989; Almeida, Fl. Savantwadi 2: 8. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 443. 1990; Vajravelu, Fl. Palghat 474. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 447. 1991; Kothari & Moorthy, Fl. Raigad 385. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 567. 1995; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 23. 1996; Sasidharan & Sivarajan, Fl. Thrissur 439. 1996. *Cymbidium ovatum* Willd. Sp. Pl. 4: 101. 1805. *Dendrobium chlorops* Lindl. in Edward's Bot. Reg. 44. 1844; Hook. f., Fl. Brit. India 5: 719. 1890; Cooke, Fl. Bombay 3: 184. 1967 (repr. ed.); Sharma et al., Biol. Mem 2 (1 & 2): 140. 1977.

Epiphytic on trees; roots numerous, arising from the lower nodes. Stems dry, brown, grooved, internodes c 2.5 cm long. Inflorescence a raceme, arising from the node, up to 9 cm long; bracts c 0.02 cm long, linear, acute. Sepals three-five nerved; lateral sepal c 0.8 x 0.4 cm, oblanceolate, broad at base, subacute, cream coloured; dorsal sepal oblanceolate, obtuse. Corolla white-cream coloured; lateral lobes c 0.8 x 0.6 cm, obovate, 5-nerved; lower lip three lobed; two lateral lobes small, c 0.3 x 0.2 cm, rounded, acute, pale greenish yellow; mid-lobe broad at base, c 0.6 x 0.4 cm, pale

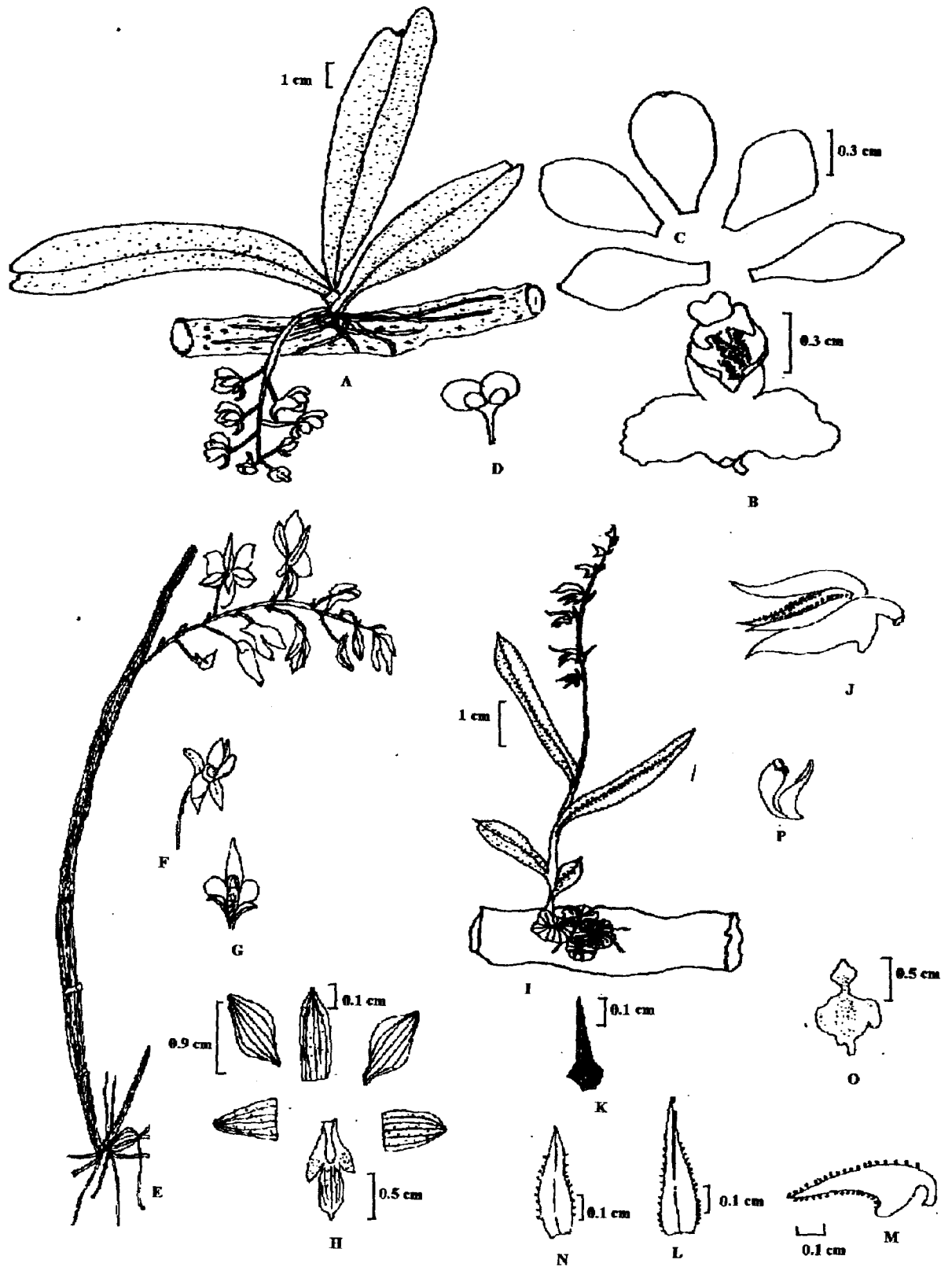
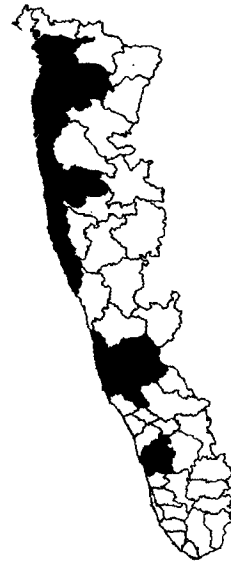
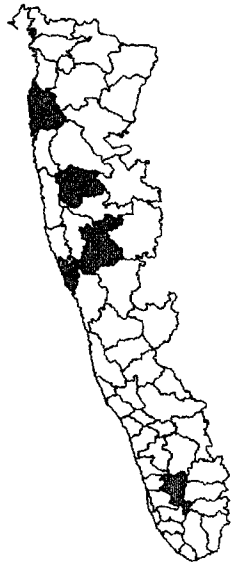
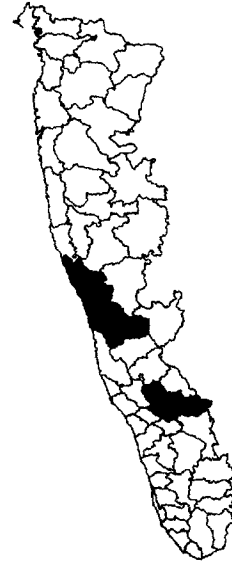
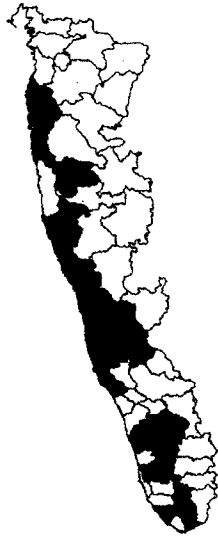


Figure 24: *Aerides dalzelliana* (Sant.) Garay: A. Habit; B. Flower. C. Dissected flower; D. Pollinia. *Dendrobium ovatum* (Willd.) Kranzl.: E. Habit; F & G. Flower; H. Dissected flower. *Eria dalzellii* (Hook. ex Dalz.) Lindl.: I. Habit; J. Flower; K. Bract; L. Sepal; M & N. Petal; O. Lip; P. Staminal column.

Map 24: Distribution of *Knema attenuata*, *Eugenia macrocephala*, *Aerides dalzelliana* and *Dendrobium ovatum* along Western Ghats.



● *Knema attenuata* (Wall. ex Hook. f., & Thoms.) Warb.

● *Eugenia macrocephala* Duthie

● *Aerides dalzelliana* (Sant.) Garay

● *Dendrobium ovatum* (Willd.) Kranzl.

green with yellowish-green hairs; lip pale creamish yellow, obtuse. Column greenish; anthers white. (Fig. 24 E-H; Plate 19 A-B).

Fl. & Fr.: December.

Habitat: Epiphyte on trees in moist deciduous forests and open areas.

Distribution: Gujarat; Maharashtra (Nasik, Pune, Raigad, Ratnagiri, Satara, Sindhudurg & Thane); Goa (Carmal ghat, Dhavali & Vageri hills); Karnataka (Coorg, Chikmagalur, Dakshin Kannada & Hassan); Kerala (Palghat, Idukki, Kasaragod, Kottayam & Thrissur). (Map 24).

Status: (LR).

Notes: It is new report to the state of Goa. Rao (l.c.) mentioned it in his flora but did not collect it from Goa. It is usually found in moist deciduous forest on *Xantholis tomentosa*, *Randia* and *Artocarpus* spp. The juice of the plant is given internally for stomach ache; it exites the bile and acts as a laxative. It is closely related to *D. barbatulum* Lindl. which is distributed in Peninsular India, but differs as shown below:

<i>Dendrobium ovatum</i>	<i>Dendrobium barbatulum</i>
Flower cream coloured, c 1.5 cm across	Flowers white with pink tinge, 2.5–4 cm across.
Lip c 0.6 cm long .	Lip c 3 cm long.
Disc with pale green hairs all along.	Disc with pale yellow hairs at base and apex only.
Midlobe of lip quadrangular – rounded.	Midlobe of lip broadly ovate or ovate oblong or rarely sub flattened.
Fl. & Fr.: December.	Fl. & Fr.: May - June.

Eria dalzellii (Hook. ex Dalz.) Lindl. in J. Proc. Linn. Soc. Bot. 3: 47. 1858; Hook. f., Fl. Brit. India 5: 789. 1890; Cooke, Fl. Bombay 3: 193. 1967 (repr. ed.); Gamble, Fl. Madras 3: 996. 1967 (repr. ed.); Santapau & Kapadia, Orch. Bombay 151: 1966; Santapau, Fl. Khandala 265. 1967; Saldanha in Saldanha & Nicolson, Fl. Hassan 827.

1976; Sharma et al., Biol. Mem 2 (1 & 2): 140. 1977; Kulkarni, Fl. Sindhudurg 430. 1988; Ramachandran & Nair, Fl. Cannanore 454. 1988; Joseph & Ansari in Henry et al., Fl. Tamil Nadu 3: 11. 1989; Almeida, Fl. Savantwadi 2: 9. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 444. 1990; Vajravelu, Fl. Palghat 477. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 448. 1991; Manilal, Fl. Silent valley 279. 1988; Kothari & Moorthy, Fl. Raigad 389. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 568. 1995; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 25. 1996. *Dendrobium dalzellii* Hook. ex Dalz. in Hook. J. Bot. Kew Gard. Misc. 4: 292. 1852. *Eria dalzellii* (Hook. ex Dalz.) Lindl. var. *fimbriata* Hook. f. Fl. Brit. India 5: 789. 1890.

Epiphytic herbs; pseudobulb c 0.5 cm in diameter, discoid, flattened with white reticulations. Leaves simple, sessile, up to 4.5 x 0.7 cm, oblanceolate, with sheathing leafbase, minutely papillate along the margins, obtuse, pale green with 6–7 pairs of veins; veins white, mid vein depressed adaxially, prominent abaxially. Inflorescence a terminal raceme, up to 8 cm long, glabrous. Flowers pedicelate, bracteate; bracts c 0.4 cm long, lanceolate, broad at base, acuminate at apex, pale green with white spots, recurved at apex, midrib prominent. Sepals three, dorsal sepal c 0.6 x 0.1 cm, pale yellow, three nerved with glandular hairs along the margins, acute at apex; two lateral sepals fused at base, triangular, three nerved with glandular hairs along the margins. Petals two, lateral c 0.4 x 0.05 cm, acute, three nerved, pale yellow, acute; lip c 0.1 x 0.05 cm, concave, projecting upwards, broad, ovate at base with undulate incurved margins, minutely papillate on outer side, glabrous inside with two yellowish orange–brown ridges united in the middle of the lip, apical lobes rounded. Column oblong, broad at base, foot c 0.2 cm, pale

yellowish orange, at right angle to the column. Pollinia 80, yellow, waxy. Ovary greenish yellow, curved; stigma yellow. (Fig. 24 I-P; Plate 19 D).

Fl. & Fr.: August.

Habitat: Moist deciduous and semievergreen forests.

Distribution: **Maharashtra** (Kolhapur, Nasik, Pune, Raigad, Ratnagiri, Satara Sindhudurg & Thane); **Goa**: (Cotigao & Dhavali); **Karnataka** (Coorg & Hassan); **Kerala** (Cannanore, Silent valley & Palghat); **Tamil Nadu** (Nilgiri). (Map 25).

Status: (LR).

Notes: It is discontinuously distributed along the Western Ghats. It is closely related to *E. microchilos* Lindl. which is distributed in Peninsular India and differs from it as stated below:

<i>Eria dalzellii</i>	<i>Eria microchilos</i>
Robust herbs.	Slender herbs.
Peduncles stout.	Peduncles filiform.
Racemes secunded or subsecunded.	Racemes not secunded or subsecunded.
Floral bracts three times longer than the ovary.	Floral bracts little longer than the ovary.
Sepals and petals short.	Sepals and petals long.
Margins with capitate glands.	Margins without glands.
Lip thin, pendular, without callosities at base, apical portion subcrenulate.	Lip fleshy, scarcely lobed, ovate-lanceolate, with two clear callosities at base, apical portion distinctly crenulate.

Oberonia brachyphylla Blatter & McCann in J. Bombay. Nat. Hist. Soc. 35: 257, t. 2. 1931; Santapau & Kapadia, Orch. Bombay 57: 1966; Saldanha in Saldanha & Nicolson, Fl. Hassan 838. 1976; Manilal, Fl. Silent valley 296. 1988; Vajravelu in Nayar & Sastry, Red Data Book Indian Pl. 2: 180. 1988; Vajravelu, Fl. Palghat 486. 1990; Ansari & Balakrishnan, Orch. Monog. 4: 38. 1990.

Small, epiphytic, pendulous herbs, up to 8 cm long including the inflorescence.

Leaves up to 2.5 x 0.7 cm, fleshy, ovate-lanceolate, falcate at apex. Inflorescence up to

3 cm long, arising from the uppermost leaf, bracteate, densely flowered, decurved; bracts c 1 mm long, lanceolate, acute at apex, margins irregular, gland dotted. Flowers c 1.6 mm across, bright orange; pedicel c 1.2 mm long, slightly longer than the bract. Sepals three, c 0.7 x 0.4 mm, terminal somewhat obtuse, slightly smaller than the lateral ones, the two dorsal obliquely ovate, subacuminate, gland dotted. Petals c 0.8 mm long, oblong-obovate, dentate, irregular along margins, rounded-truncate at apex, narrow at base bright orange, gland dotted; lip c 1.5 mm long, three lobed; lateral lobes slightly broader than the middle lobe, gland dotted, irregular along margins; midlobe two lobed with a broad sinus between the two lobes, three nerved, gland dotted. Capsule c 5 x 2 mm, oblong, palegreen. (Fig. 25 A-F; Plate 19 C).

Fl. & Fr.: March – April.

Habitat: An epiphyte on moss covered trees, in evergreen forests and sholas.

Distribution: **Maharashtra** (Locality unknown); **Goa** (Molem-Belgaum road); **Karnataka** (Chikmagalur, Hassan & Uttar Kannada.); **Kerala** (Idukki, Palghat & Trivandrum); **Tamil Nadu** (Nilgiri). (Map 25).

Status: (VU)

Chromosome number: 30. (2n)

Notes: An epiphyte on moss covered trees in evergreen forest and sholas. It is a new record to the state of Goa. Vajravelu (l.c.) reported it as rare in Red Data Book. Ansari and Balakrishnan (l.c.) in their revisionary work on *Oberonia* species mentioned Maharashtra and Kerala as its distribution centers, while there is no mention of this species in the latest Flora of Maharashtra by Lakshminarasimhan (1996). Small size and lack of frequent and intensive collections could be the reasons for very few

collections of this species. As a result of which its distribution appeared to be restricted and fragmented.

Porpax jerdoniana (Wight) Rolfe in Orchid Rev. 16: 18. 1908; Gamble, Fl. Madras 3: 995. 1967 (repr. ed.); Santapau & Kapadia, Orch. Bombay 158. 1966; Saldanha in Saldanha & Nicolson, Fl. Hassan 845. 1976; Manilal, Fl. Silent valley 302. 1988; Joseph & Ansari in Henry et al., Fl. Tamil Nadu 3: 23. 1989; Almeida, Fl. Savantwadi 2: 22. 1990; Vajravelu, Fl. Palghat 491. 1990; Kothari & Moorthy, Fl. Raigad 388. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 581. 1993; Mohanan & Henry, Fl. Thiruvananthapuram 469. 1994; Lakshminarasimhan, in Sharma et al., Fl. Maharashtra Monocot. 59. 1996; Sasidharan & Sivarajan, Fl. Thrissur 453. 1996. *Lichenora jerdoniana* Wight, Ic. t. 1738. 1851. *Eria lichenora* Lindl. in J. Linn. Soc., Proc. 3: 46. 1859; Hook. f., Fl. Brit. India 5: 787. 1890. *Eria jerdoniana* (Wight) Reichb. f. in Walp. Ann. 6: 267. 1861. *Pinalia jerdoniana* (Wight) O. Kuntze. Rev. Gen. Pl. 2: 679. 1891. *Porpax lichenora* (Lindl.) Cooke, Fl. Bombay 2: 689. 1907.

Epiphytic herbs. Pseudobulbs with fibrous roots; bulbs discoid, c 1 x 1.5 cm, with reticulately nerved sheaths. Leaves two, appearing along with the flowers, c 2 x 1.3 cm, oblong-ovate, mucronate, ciliolate along the margins, obtuse at apex, pale greenish brown with prominent mid vein abaxially, lateral veins pale green. Flowers two, usually arising in the leaf base. Bracts c 0.5 x 0.4 cm, orbicular, membranous, translucent with prominent mid rib. Sepals two, dorsal sepal c 0.7 x 0.5 cm, obovate, slightly three nerved, convex, brick red, glabrous inside, fleshy, densely tomentose outside. Upper lip fuse with the lower lip. Lower lip formed by the fusion of the lateral lobes, concave, c 0.5 x 0.3 cm, slightly incurved, connate along the foot, glabrous inside, tomentose outside. Petals two, c 0.5 x 0.1 cm, linear, brick red,

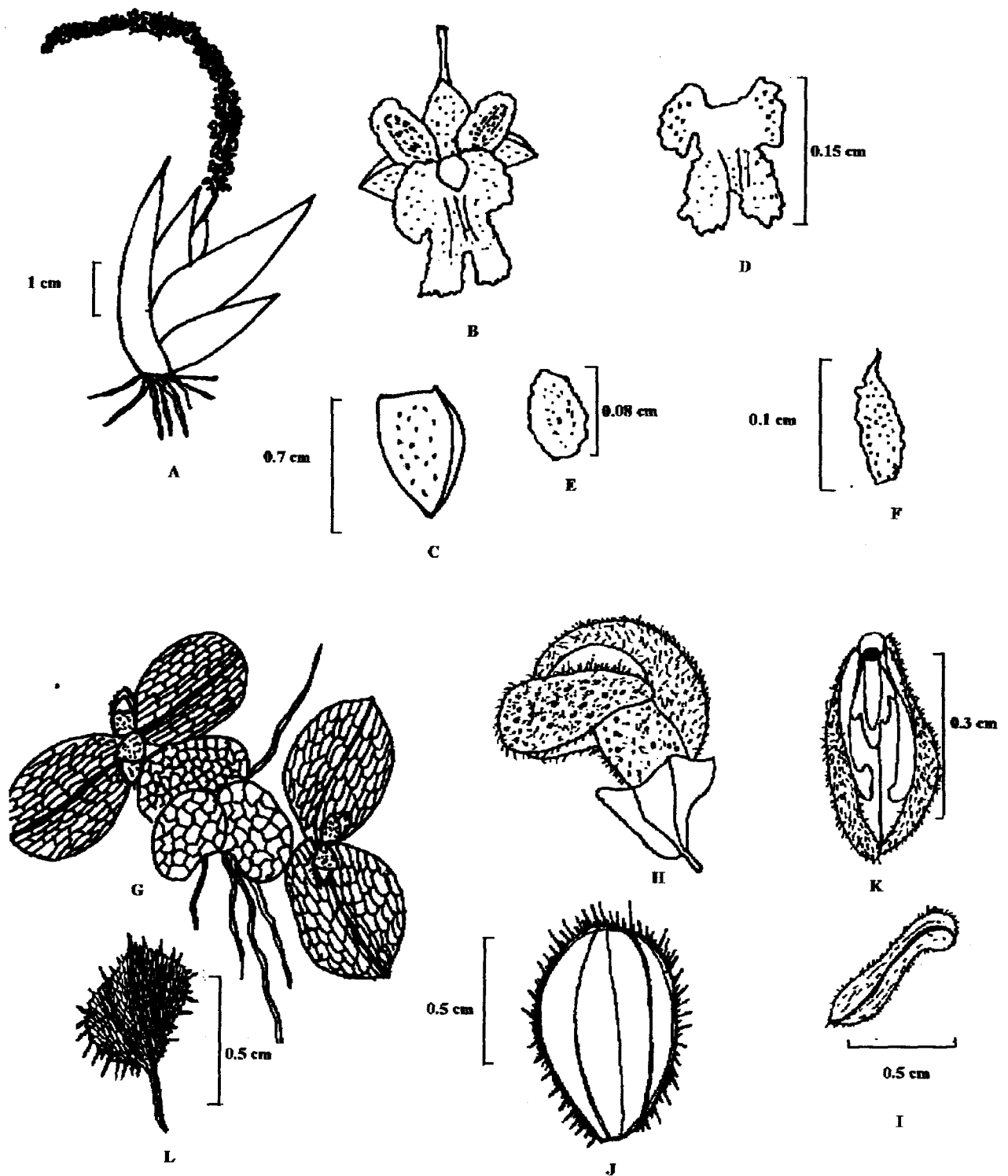


Figure 25: *Oberonia brachyphylla* Blatter & McCan.: A. Habit; B. Flower; C. Sepal; D. Lip; E. Petal; F. Bract. *Porpax jerdoniana* (Wight) Rolfe: G. Habit; H. Flower; I. Sepal; J. Upper lip; K. Lower lip; L. Bract.



PLATE 19: A & B. *Dendrobium ovatum* (Willd.) Kranzl., C. *Oberonia brachyphylla* Blatter & McCann., D. *Eria dalzellii* (Hook. ex Dalz.) Lindl., E. *Arthraxon lanceolatus* (Roxb.) Hochst var. *meeboldii* (Stapf.) Welzen, F. *Porpax jerdoniana* (Wight) Rolfe

slightly yellow at base, glabrous with prominent mid rib, obtuse at apex; lip arising from the base of lower sepal; lip c 0.3 cm long, triangular, acuminate. Column minute, c 0.15 cm long, stout, rusty brown. Pollinia apiculate, all equal. (Fig. 25 G-L; Plate 19 F).

Fl. & Fr.: July – September.

Habitat: An epiphyte on trees in semievergreen and evergreen forests.

Distribution: Maharashtra (Raigad, Ratnagiri, Satara & Sindhudurg); Goa (Cotigao, Molem–Anmod & Netravali); Karnataka (Belgaum, Chikmagalur, Hassan, Uttar & Dakshin Kannada); Kerala (Silent valley, Thrissur, Thiruvananthapuram); Tamil Nadu (Kanniyakumari). (Map 25).

Status: (LR).

Notes: It is an epiphyte on trees such as *Terminalia* spp. It is a new report to the state of Goa and is distributed throughout the Western Ghats. It is closely related to *P. reticulata* Lindl. which is distributed in Peninsular India and differs from it as stated below:

<i>Porpax jerdoniana</i>	<i>Porpax reticulata</i>
Leaves and flowers appearing together.	Leaves developing after flowers
Leaves oblong–orbicular, ciliolate, tessellate.	Leaves obovate–elliptic or sphenulate, minutely papillate, more on the margins.
Flowers two lipped, dirty orange brown, densely setulose, almost tomentose outside, glabrous and smooth within.	Flowers tubular, deep red – brown, glabrous outside, papillate or pilose within.
Fl. & Fr.: June–July.	Fl. & Fr.: June–October.

POACEAE

Arthraxon lanceolatus (Roxb.) Hochst var. **meeboldii** (Stapf.) Welzen in Blumea 27: 285. 1981; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 710. 1976; Karthikeyan et al., Fl. Ind. Enum. Mono. 185. 1989; Lakshminarasimhan & Sharma

Fl. Nasik 533. 1991; Deshpande et al., Fl. Mahabaleshwar 2: 660. 1995; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 401. 1996; Rajkumar et al. J. Bom. Nat. Hist. 96: 181. 1999. *Arthraxon meeboldii* Stapf in Kew Bull. 1908: 449. 1908; Cooke, Fl. Bombay 3: 488. 1967 (repr. ed.); Blatter & McCann. Bombay Grass. 761. 1935; Bor, Grass. India 101. 1960. *Arthraxon purandharensis* Bharucha in J. Bombay Nat. Hist. Soc. 52: 481. 1954.

Annual herbs; stem prostrate, glabrous, nodes with stiff hairs. Leaf sheath up to 1.8 cm long, dense ciliate along the margins; lamina up to 3 x 0.8 cm, ovate-lanceolate, cordate at base, entire along margins; margins with stiff bulbous based hairs, acuminate at apex. Inflorescence a paniculate raceme arising from the leaf axil. Pediceled spikelet: Lower glume c 0.4 x 0.1 cm, 7-8 nerved, pale green with stiff ciliate hairs along the margins. Upper glume membranous, c 3.5 x 0.04 cm, three nerved; upper glume empty. Lower glume with lemma and palea. Lemma c 2.5 cm long, membranous, lanceolate. Palea c 1.5 cm long, membranous, hyaline. Sessile spikelet: Lower glume c 0.5 x 0.03 cm, stiff, concave, ribbed with hooked hairs; hairs stiff, long, white at tip, acuminate at apex. Upper glume c 0.45 x 0.03 cm, membranous, hyaline, two lobed at apex, acute at apex, margins keeled; keels ciliate, white, three nerved, margins hyaline. Lemma and palea c 0.25 cm long, membranous, hyaline, awned; awns c 1 cm long, geniculate. (Fig. 26 A -A8; Plate 19 E).

Fl. & Fr.: November – December.

Habitat: Open grassy slopes in ghat area.

Distribution: Maharashtra (Kolhapur, Nasik, Pune, Raigad, Ratnagiri, Satara & Sindhudurg); Goa (Surla). (Map 25).

Status: (LR).

Map 25: Distribution of *Eria dalzellii*, *Oberonia brachyphylla*, *Porpax jerdoniana* and *Arthraxon lanceolatus* var. *meeboldii* along Western Ghats.



● *Eria dalzellii* (Hook. ex Dalz.)
Lindl.

● *Porpax jerdoniana* (Wight)
Rolfe

● *Oberonia brachyphylla* Blatter &
McCan.

● *Arthraxon lanceolatus* (Roxb.)
Hochst var. *meeboldii* (Stapf.)

Notes: The present collections forms new report to the state of Goa. It is closely related to *A. lanceolatus* Hochst. var. *raizadae* Welzen which is also endemic to Western Ghats and differs from it as stated below:

<i>Arthraxon lanceolatus</i> var. <i>meeboldii</i>	<i>Arthraxon lanceolatus</i> var. <i>raizadae</i>
Lower glume of sessile spikelet with hooked hairs on dorsal surface.	Lower glumes of sessile spikelets densely pilose on dorsal surface.

Arundinella metzii Hochst. ex Miq. in Verh. Konink. Nederl. Inst. 3 (4): 31. 1851; Hook. f., Fl. Brit. India 7: 72. 1896; Bor, Grass. India 423. 1960; Cooke, Fl. Bombay 3: 523. 1967 (repr. ed.); Gamble, Fl. Madras 3: 1247. 1967 (repr. ed.); Santapau, Fl. Khandala 305. 1967; Shah, Fl. Gujarat 785. 1978; Manilal & Sivarajan, Fl. Calicut 346. 1982; Rao, Fl. Goa. 2: 488. 1986; Kulkarni, Fl. Sindhudurg 507. 1988; Karthikeyan et al., Fl. Ind. Enum. Mono. 186. 1989; Almeida, Fl. Savantwadi 112. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 525. 1990; Sreekumar & Nair, Fl. Kerala Grass. 339. 1991; Lakshminarasimhan & Sharma, Fl. Nasik 534. 1991; Kothari & Moorthy, Fl. Raigad 505. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 662. 1995; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 405. 1996. *Arundinella pygmaea* Hook. f., Fl. Brit. India 7: 72. 1896; Gamble, Fl. Madras 3: 1247. 1967 (repr. ed.). *Arundinella lawii* Hook. f. in Trim. Handb Fl. Ceyl. 5: 180. 1900; Gamble, Fl. Madras 3: 1247. 1967 (repr. ed).

Culm up to 70 cm high, geniculate, glabrous; nodes sparsely hairy. Leaf sheath up to 7 cm long; ligule c 0.5 cm, membranous, truncate, hairy; lamina up to 3.5 x 0.7 cm, linear-lanceolate, rounded -cordate at base, entire along margins, glabrous. Inflorescence a panicle, up to 25 cm long. Spikelets c 3 x 0.5 mm. Lower glume c 2.5 x 1 mm, ovate, acute - acuminate, 3- nerved, chartaceous. Upper glume c 2 x 1.5 mm, ovate-lanceolate, acuminate, chartaceous, 5-nerved. Upper floret bisexual. Lower

floret male. Lower lemma c 2 x 1 mm, 3-nerved, chartaceous. Pale c 0.5 x 1 mm, delicate, hyaline, membranous. Upper lemma c 1.5 x 0.2 mm, hyaline, membranous, notched, awned; awn c 4 mm long, geniculate. Palea c 1 x 0.5 mm, membranous, hyaline. Stamens 3; anthers c 1 mm long, two celled, yellow. (Fig. 26 B - B5; Plate 20 C).

Fl. & Fr.: October – December.

Habitat: Moist deciduous forests.

Distribution: Gujarat; Maharashtra (Kolhapur, Nasik, Pune, Raigad, Ratnagiri, Satara, Sindhudurg & Thane); Goa (Butpal, Chimbhel, Molem, Porvorim, Quepem & Valpoi); Karnataka (Belgaum, Coorg, Dakshin Kannada & Shimoga); Kerala (Calicut & Kasaragod). (Map 26).

Status: (LR).

Chromosome number: 20. (2n)

Notes: It is distributed in the northern and central Western Ghats. It is closely related to *A. leptochloa* Hook. f. which is endemic to Peninsular India and differs from it as stated below:

<i>Arundinella metzii</i>	<i>Arundinella leptochloa</i>
Annual.	Perennial.
Base of the upper lemma bearded.	Base of upper lemma glabrous.
Spikelets distinctly awned.	Spikelets not awned.
Leaves and culms slender.	Leaves and culms not slender.

Dimeria woodrowii Stapf in Hook. Ic. Pl. t. 2312.1894; Hook. f., Fl. Brit. India 7: 104. 1896; Blatt. & McCann, Bombay Grass. India 8. 1935; Vartak, Enum. Pl. Gomantak 113. 1966; Cooke, Fl. Bombay 3: 462. 1967 (repr. ed.); Bor, Grass. India 144. 1960; Kulkarni, Fl. Sindhudurg 523. 1988; Deshpande in Nayar & Sastry, Red Data Book Indian Pl. 1: 298. 1987; Karthikeyan et al., Fl. Ind. Enum. Mono. 210.

1989; Almeida, Fl. Savantwadi 2: 125. 1990; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 470. 1996.

Annuals. Culm erect, up to 12 cm high, branched at base, glabrous; nodes bearded, white. Leaves up to 6 x 0.2 cm, linear, 3-nerved, glabrous, ciliate along margins, prominent at the base; midrib prominent; sheaths up to 3 x 0.3 cm, glabrous; ligule c 0.1 cm long, hyaline. Racemes 2, up to 2 cm long, at first erect then coiling; rachis trigonous, one side flattened. Pedicel distinct, c 0.1 cm long, stiff. Spikelets 15- 20 on each raceme, up to 0.5 cm long, linear, acute, bearded at base, coiling inwards at maturity. Lower glume up to 3.5 x 0.5 mm, linear, glabrous, slightly dentate along margins, curved, rarely hairy. Upper glume up to 3.7 x 0.7 mm, linear with prominent nerves on back, black - purple, curved when dry, margins hyaline, ciliate. Lower lemma c 2 x 0.1 mm, hyaline, papery. Upper lemma c 2 x 0.4 mm, hyaline, papery, slightly two fid, awned; awn up to 1 cm long, purple, slightly coiled at base, dentate along margins, geniculate at apex. Stamens 2; anthers c 2 mm long, yellow. Styles short; stigma short, exerted. Grains up to 0.4 cm long, linear - lanceolate, flattened or compressed. (Fig. 26 C-C4; Plate 20 D).

Fl. & Fr.: August - November.

Habitat: Open lateritic plateaus.

Distribution: Maharashtra (Ratnagiri & Sindhudurg); Goa (Taleigao; Usgao near MRF, Verna). (Map 26).

Status: (LR).

Notes: It is restricted to the northern Western Ghats and is observed along the rocky slopes. Its racemes are incurved at maturity. Deshpande (l.c.) reported it as rare in the Red Data Book, but it is very common in the study area.

Glyphochloa acuminata (Hack.) Clayton var. **woodrowii** (Bor) Clayton 35: 815. 1981; Karthikeyan et al., Fl. Ind. Enum. Mono. 224. 1989; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 499. 1996. *Manisuris acuminata* (Hack.) Kuntze var. *woodrowii* Bor, Grass. of Burma, India 191. 1960; Vartak, Enum. Pl. Gomantak 113. 1966; Jain, Bull. Bot. Surv. India 12 (1-4): 10. 1970 (1972); Kulkarni, Fl. Sindhudurg 532. 1988. *Rottboellia acuminata* Hack. in DC. Mon, Phan. 6: 291. 1889.

Annual, up to 30 cm high, slender, erect, green, nodes purplish, sparsely hairy. Leaves up to 6 x 0.5 cm, linear-lanceolate, glabrous, green succulent, ligules membranous, truncate; sheath green, membranous. Culms slightly swollen at base of the racemes. Racemes up to 8 cm long with sessile and pedicelate spikelets. Sessile spikelet: Spikelets up to 4 mm long. Lower glumes up to 3 x 0.7 mm with 3 vertical ridges, less winged at apex as compared to the upper glume. Upper glume c 3.2 x 1 mm with 3 vertical ridges, unevenly winged at apex; slightly more on one side. Outer lemma, c 2 x 0.8 mm, membranous, hyaline with vertical ridges. Inner lemma c 1.7 x 0.7 mm, hyaline. Palea c 1.2 x 0.5 mm, linear-lanceolate, hyaline. Anthers 3, c 1.7 x 0.5 mm, yellow- purple; filaments 0.2 mm long. Pedicelated spikelet slightly clavate at base with 4 transverse ridges, 3 faint vertical ridges with 2 wings; one wing c 1.5 mm long, other c 0.5 mm long. Inner glumes c 2 x 0.7 mm, papery, hyaline, pale green. Lower lemma c 0.7 x 0.5 mm. Upper lemma c 1.2 x 0.5 mm, hyaline, membranous. Palea c 1 x 0.2 mm, hyaline. (Fig. 26 D-D13; Plate 20 A & B).

Fl. & Fr.: August - October.

Habitat: Open lateritic plateau.

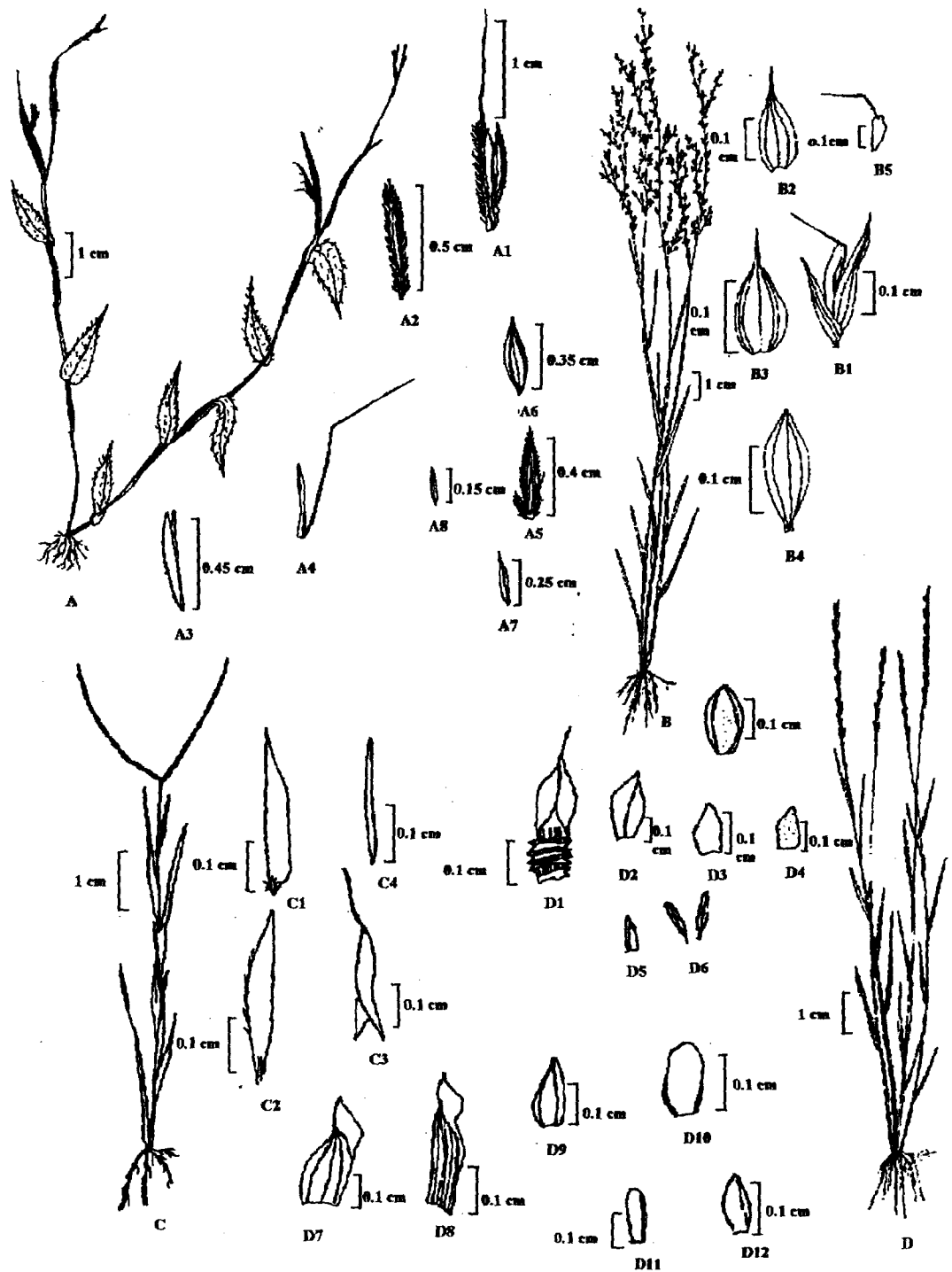


Figure 26: *Arthraxon lanceolatus* (Roxb.) Hochst var. *meeboldii* (Stapf.) Welzen: A. Habit; A1. Spiklet; Sessile spikelet: A2. Lower glume; A3. Upper glume; A4. Lemma; Pedicelled spikelet: A5. Lower glume; A6. Upper glume; A7. Lower lemma; A8. Lower palea. *Arundinella metzii* Hochst. ex Miq.: B. Habit; B1. Spiklet; B2. Lower glume; B3. Upper glume; B4. Lower lemma; B5. Upper lemma. *Dimeria woodrowii* Stapf: C. Habit; C1. Lower glume; C2. Upper glume; C3. Upper lemma; C4. Lower lemma. *Glyphochloa acuminata* (Hack.) Clayton var. *woodrowii* (Bor) Clayton: D. Habit; Sessile spikelet: D1. Lower glume; D2. Upper glume; D3. Lower lemma; D4. Upper lemma; D5. Lower palea; D6. Upper palea. D7. Stamens; Pedicelled spikelet: D8. Lower glume; D9. Upper glume; D10. Lower lemma; D11. Upper lemma; D12. Lower palea; D 13. Upper palea.

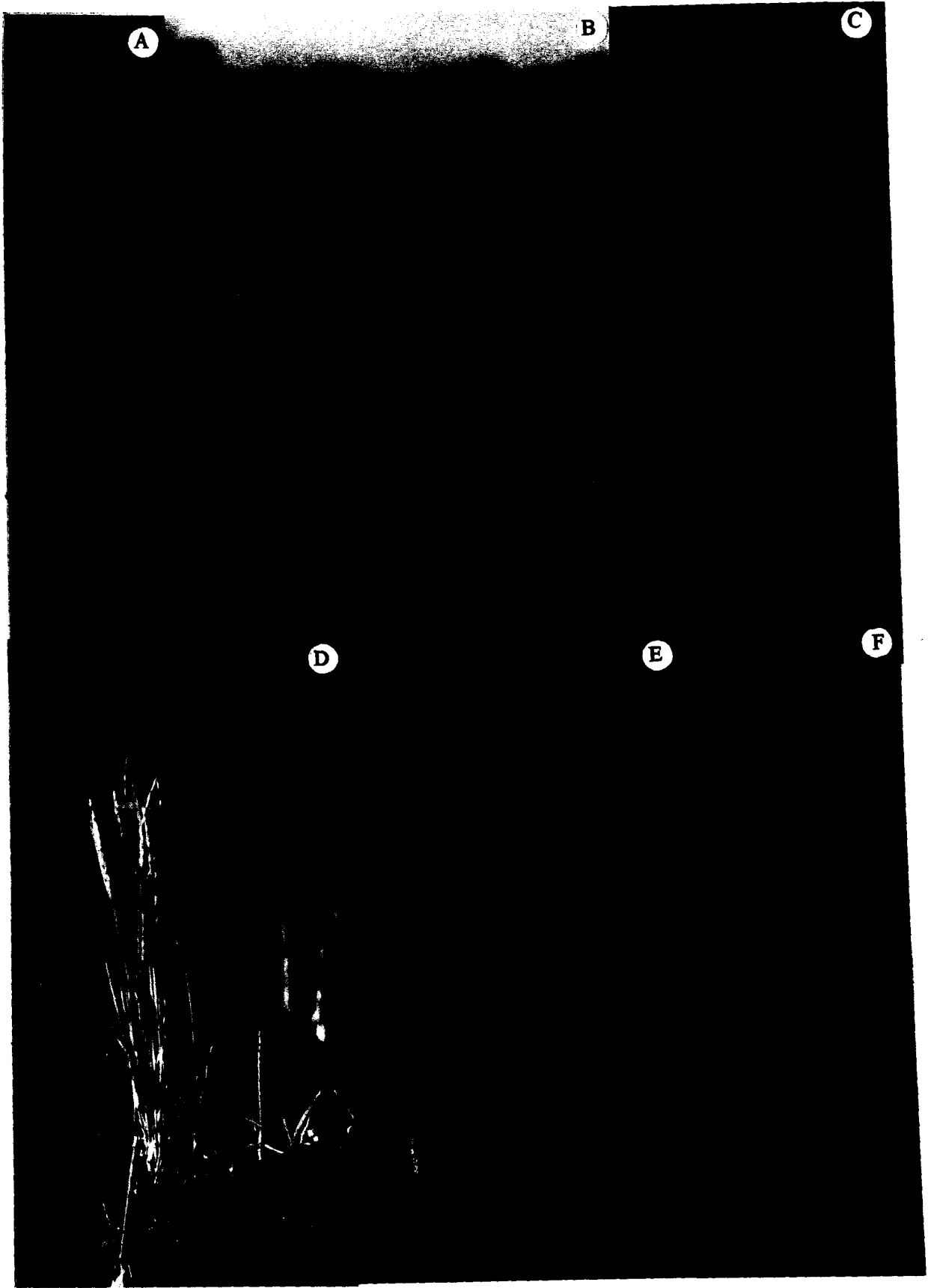


PLATE 20: A & B. *Glyphochloa acuminata* (Hack.) Clayton var. *woodrowii* (Bor) Clayton, C. *Arundinella metzii* Hochst. ex Miq., D. *Dimeria woodrowii* Stapf, E & F. *Glyphochloa goaensis* (Rao & Hemadri) Clayton.

Distribution: Maharashtra (Sindhudurg & Ratnagiri); Goa (Taleigao, Marmugoa, Nuvem). (Map 26).

Status: (LR).

Chromosome number: 20. (2n)

Notes: The genus *Glyphochloa* is endemic to Peninsular India. This species is restricted to northern Western Ghats. It is closely related to *G. acuminata* Clayton var. *acuminata* which is distributed in Western Ghats and central India and differs from it as stated below:

<i>Glyphochloa acuminata</i> var. <i>woodrowii</i>	<i>Glyphochloa acuminata</i> var. <i>acuminata</i>
Sessile spikelet including the awn up to 0.5 cm long	Sessile spikelet including the awn up to 1 cm long.
Lower glume awn less or shortly awned.	Lower glume with long awn.

Glyphochloa goensis (Rao & Hemadri) Clayton in Kew Bull 35: 815. 1981; Karthikeyan et al., Fl. Ind. Enum. Mono. 225. 1989; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 500. 1996. *Manisuris goensis* Rao & Hemadri in Bull. Bot. Surv. India 10: 106 – 109. 1968; Jain in Bull. Bot. Surv. India 12 (1 – 4): 14. 1970 (1972); Rao Fl. Goa 2: 507. 1986; Kulkarni, Fl. Sindhudurg 533. 1988.

Annual, tufted, erect up to 30 cm long; nodes hairy when young, glabrous at maturity. Lamina up to 11 cm long, linear, incurved, sparsely hairy adaxially, glabrous abaxially; ligule c 0.1 cm long; leaf sheath c 2.5 cm long. Inflorescence terminal raceme, up to 7 cm long; peduncles sparsely hairy, with long spreading hairs, glabrous at maturity; joint of the raceme tumid in the upper half. Sessile spikelets: Lower glume c 0.5 cm long, ovate-lanceolate, with two transverse ridges facing down wards; ridges undulate along margins; glumes unequally winged on either side along the margins converging in to awn; awn up to 0.7 cm long, scabrid.

Upper glume up to 0.35 x 0.1 cm long, ovate, one nerved, acute at apex. Lower lemma up to 0.32 x 0.1 cm, ovate, oblong, hyaline, membranous, lanceolate. Lower palea up to 0.22 x 0.1 cm, hyaline, membranous. Stamens three; anthers c 0.12 cm long, yellow. Upper lemma c 0.3 x 0.1 cm, lanceolate, hyaline, membranous. Upper palea c 0.12 cm long, hyaline, membranous. Stamens three; anthers c 0.12 cm long, yellow. Style two; stigma plumose. Pedicelled spikelet: Pedicell up to 0.2 cm long. Lower glume c 0.45 x 0.1 cm, winged on one side, awned; awn up to 0.5 cm long. Lower glume up to 0.4 x 0.15 cm, keeled on the margin, broadly winged on one side at the apex. Lower lemma up to 0.25 x 0.1 cm, hyaline, membranous. Lower pales up to 0.15 x 0.1 cm, hyaline, membranous. Stamens three, anthers c 0.15 cm, yellow. Upper lemma up to 0.23 x 0.1 cm, hyaline, membranous. Upper palea up to 0.12 x 0.1 cm, hyaline, membranous. Stamens three; anthers c 0.12 cm long, yellow. (Fig. 27 A - A4; Plate 20 E-F).

Fl. & Fr.: August – October.

Habitat: Hard lateritic plateaus.

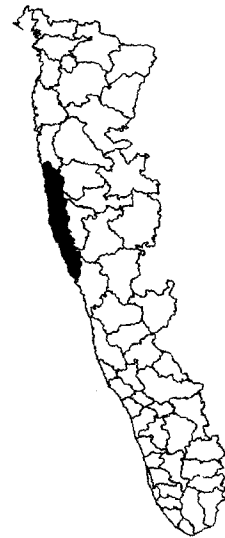
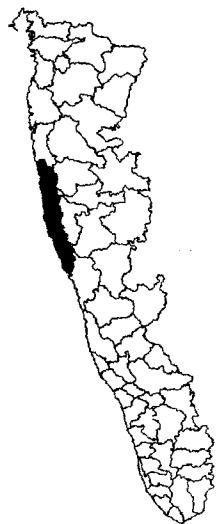
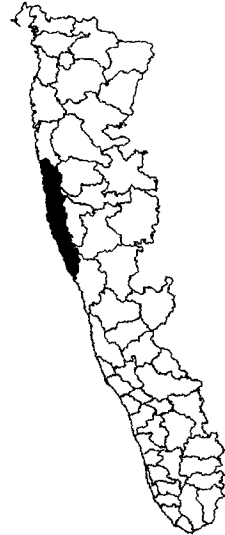
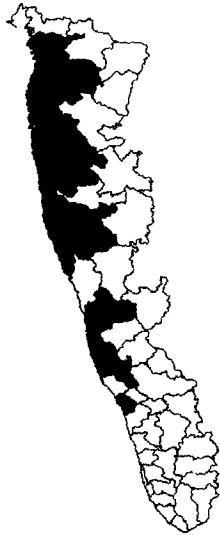
Distribution: Maharashtra (Ratnagiri & Sindhudurg); Goa (Taleigao, Tiska-Usgao). (Map 26).

Status: (LR).

Notes: It is restricted to the northern Western Ghats. It is closely related to *G. talbotii* (Hook. f.) Clayton which is also endemic to Western Ghats and differs from it as stated below:

<i>Glyphochloa goaensis</i>	<i>Glyphochloa talbotii</i>
Pedicelled spikelet fused, but not tumid.	Pedicelled spikelet fused to form a tumid structure.
Ridges on the lower glume of sessile spikelet facing down wards.	Ridges on the lower glume of sessile spikelets facing up wards.

Map 26: Distribution of *Arundinella metzii*, *Dimeria woodrowii*, *Glyphochloa acuminata* var. *woodrowii* and *Glyphochloa goaensis* along Western Ghats.



- *Arundinella metzii* Hochst.
ex Miq.
- *Glyphochloa acuminata* (Hack.)
Clayton var. *woodrowii* (Bor)
Clayton

- *Dimeria woodrowii* Stapf
- *Glyphochloa goaensis* (Rao
& Hemadri) Clayton

Glyphochloa talbotii (Hook. f.) Clayton in Kew Bull. 35: 816. 1981; Deshpande in Red Data Book Indian Pl. 1: 302. 1987; Karthikeyan et al., Fl. Ind. Enum. Mono. 225. 1989; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 502. 1996. *Rottboellia talbotii* Hook. f. Fl. Brit. India 7: 155. 1896. *Manisuris talbotii* (Hook. f.) Bor, Grass. India 192. 1960; Rao Fl. Goa 2: 507. 1986. *Peltiphorum talbotii* (Hook. f.) A. Camus in Bull. Mus. Hist. Nat. Paris 27: 371. 1921.

Annual, culms up to 25 cm long, glabrous at nodes, reddish green, sparsely hairy near the spikes. Leaves up to 5 x 0.5 cm, linear, lanceolate, some what succulent; ligule membranous, white. Raceme up to 6 cm long, stout; individual spikelets up to 0.2 cm long, linear-lanceolate, swollen at base. Sessile spikelet: Lower glume c 1.2 cm long including the awn, broadly winged along the margins, with two transverse ridges facing upwards. Upper glume c 0.3 x 0.1 cm, acute at apex, three nerved, membranous. Upper lemma c 0.25 x 0.08 cm, hyaline, membranous. Lower lemma c 0.3 x 0.1 cm, ovate-oblong, hyaline, membranous. Lower palea c 0.2 x 0.1 cm, hyaline, membranous. Upper palea c 0.15 x 0.05 cm, hyaline, membranous. Stamens c 0.1 cm long, yellow. Pediceled spikelet: Pedicel c 0.2 cm long, stout. Lower glume c 0.9 x 0.15 cm, including awns, winged on one side. Lower lemma c 0.3 x 0.15, hyaline, membranous. Upper lemma c 0.3 x 0.1 cm, hyaline, membranous. Lower palea c 0.3 x 0.7 cm, hyaline, membranous. Upper palea c 0.2 x 0.1 cm; anthers c 0.15 cm long. (Fig. 27 B-B5; Plate 21 A-C).

Fl. & Fr.: September–November.

Habitat: Open lateritic plateaus.

Distribution: Maharashtra (Sindhudurg); Goa (Taleigao, Dabal – Panchavadi). (Map 27).

Status: (R).

Note: It is restricted to northern Western Ghats. It is locally common. It is closely related to *G. goaensis* (Rao & Hemadri) Clayton which is also endemic to northern Western Ghats and differs from it as stated under *G. goaensis*. This species might have originated in Goa and Sindhudurg region as it is restricted only to these districts along Western Ghats and is very common on the lateritic plateaus of these districts.

Ischaemum dalzellii Stapf ex Bor in Kew Bull. 1951: 448. 1952 & Grass. India 178. 1960; Kulkarni, Fl. Sindhudurg 539. 1988; Karthikeyan et al., Fl. Ind. Enum. Mono. 231. 1989; Almeida, Fl. Savantwadi 2:136. 1990; Sreekumar & Nair, Fl. Kerala Grass. 132. 1991; Kothari & Moorthy, Fl. Raigad 462. 1993; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 516. 1996; Rajkumar et al. J. Bom. Nat. Hist. 96: 182. 1999.

Annuals; culms up to 70 cm long, erect, stout, nodes glabrous. Lower leaves petioled; petiole up to 3 cm long, grooved, sparsely hairy; ligule ovate, acute, membranous; lamina up to 7 x 1.2 cm, sagittate at base, entire along margins, acute – acuminate at apex, 5 - 6 nerved, darkgreen adaxially, pale abaxially with bulbous hairs along the veins on both surfaces. Inflorescence a leaf axillary raceme. Racemes two; peduncles stout, smooth, glabrous; pedicel stout clavate, densely hairy, villous, white, shining. Spikelets c 0.5 cm long. Pediceled spikelet c 0.6 cm long, oblong– lanceolate, awned or awnless; pedicels c 0.15 cm long, densely ciliate. Lower glume c 0.5 x 0.15 cm, coriaceous, stiff, wrinkled, with densely ciliate hairs at base, 7–8 nerved, slightly serrate along margins. Upper glume c 0.4 x 0.08 cm, keeled, margins ciliate, sparsely ciliate at base. Lemma c 0.3 cm long, three nerved, hyaline. Palea c 0.25 cm long, three nerved. Sessile Spikelet c 0.6 cm long, linear–oblong, awned.

Lower glume c 0.6 x 0.2 cm, linear-oblong, crustaceous below, with 3 – 4 side nodules, chartaceous above, 7–9 nerved, densely villous on upper side. Upper glume c 0.5 x 0.1 cm, oblong, lanceolate, chartaceous, 3–5 nerved, keeled, sparsely hairy. Lower floret male or bisexual with rudimentary pistill. Upper floret bisexual. Lower lemma c 0.5 x 0.15 cm hyaline, three nerved; palea c 0.5 x 0.1 cm, hyaline, membranous, two keeled, two nerved. Stamens three; anthers c 0.02 cm long. Upper lemma c 0.4 x 0.1 cm, deeply notched, acute, hyaline with long aristate awn; palea c 0.3 cm long, oblong, delicate, hyaline, two nerved; lodicule two, obovate, two horned at apex. Stamens three, c 0.4 cm long, yellowish green–pale brown. Ovary c 0.05 cm long, linear-oblong; style c 0.1 cm long; stigma 0.2 - .03 cm long. (Fig. 27 C -C10; Plate 21 B-D).

Fl. & Fr.: October – November.

Habitat: On lateritic rocks on plateaus and moist deciduous forests.

Distribution: **Maharashtra:** (Kolhapur, Pune, Raigad, Ratnagiri, Satara, Sindhudurg & Thane); **Goa:** (Goa University campus & Molem – Anmod); **Karnataka:** (Belgaum, Shimoga, Uttar & Dakshin Kannada). (Map 27).

Status: (LR).

Notes: It is distributed in the northern and central Western Ghats and the present collection forms a new report to the state of Goa. It is closely related to *I. semisagittatum* Roxb., which is distributed in Peninsular India and differs from it as stated below:

<i>Ischaemum dalzellii</i>	<i>Ischaemum semisagittatum</i>
Joints of racemes linear-clavate.	Joints of racemes distinctly turbinate.
Lower glume crustaceous or coriaceous with three–four side nodules; some times deeply or irregularly wrinkled.	Lower glume chartaceous, with or without side nodules; sometimes nodules are interconnected.
Leaves up to 15 cm long.	Leaves up to 10 cm long.

Ischaemum jayachandranii Ansari et al. in Curr. Sci. 53 (3): 151. 1984; Sur in J. Econ. Tax. Bot. 9 (2). 313. 1987; Karthikeyan et al., Fl. Ind. Enum. Mono. 232. 1989; Sreekumar & Nair, Fl. Kerala Grass. 140. 1991; Cook, Aqua. Wetland Pl. India 300. 1996.

Perennial; culms up to 50 cm high, slender, erect. Leaf sheath up to 8 cm long, longer than the internodes, glabrous; ligules c 0.2 cm long, ovate, acute, membranous; lamina up to 10 x 0.4 cm, lanceolate, cordate at base, minutely serrulate along margins. Inflorescence two racemes, up to 6 cm long, slender, glabrous. Sessile spikelet c 0.5 x 0.2 cm, oblong-lanceolate, unawned. Lower glume c 0.5 x 0.2 cm, lanceolate, coriaceous below, subcoriaceous above, faintly 10–12 nerved, scabrid at apex. Upper glume c 0.46 x 0.17 cm, boat shaped, sharply keeled, minutely winged at apex, coriaceous, faintly 3–5 nerved. Lower floret male. Lemma c 0.5 x 0.14 cm, lanceolate, delicate, hyaline, faintly 3–5 nerved, glabrous. Palea c 0.45 x 0.12 cm, lanceolate, delicate, hyaline, two keeled, two nerved, glabrous. Stamens three; anthers c 0.1 cm long. Upper floret bisexual. Lemma c 0.4 x 0.13 cm, entire, ovate-lanceolate, faintly 5 nerved, median nerve prominent, prolonged into rudimentary awn, delicate, hyaline, with warts like outgrowth in the upper half. Stamens three; anthers c 0.1 cm long. Ovary c 0.05 cm long; styles c 0.15 cm long, slender; stigma 0.07 cm long, feathery. Pediceled spikelet c 0.5 cm long, oblong -acute, awnless; pedicels c 0.1 cm long, glabrous. Lower glume c 0.5 x 0.15 cm, ovate-acute, narrowly winged on one margin; wings scaberulous, coriaceous, smooth, glabrous, faintly 10–12 nerved. Upper glume c 0.45 x 0.12 cm, lanceolate, keeled, rounded, coriaceous, smooth, glabrous. Florets similar to sessile spikelet. (Fig. 27 D- D10; Plate 21 E)

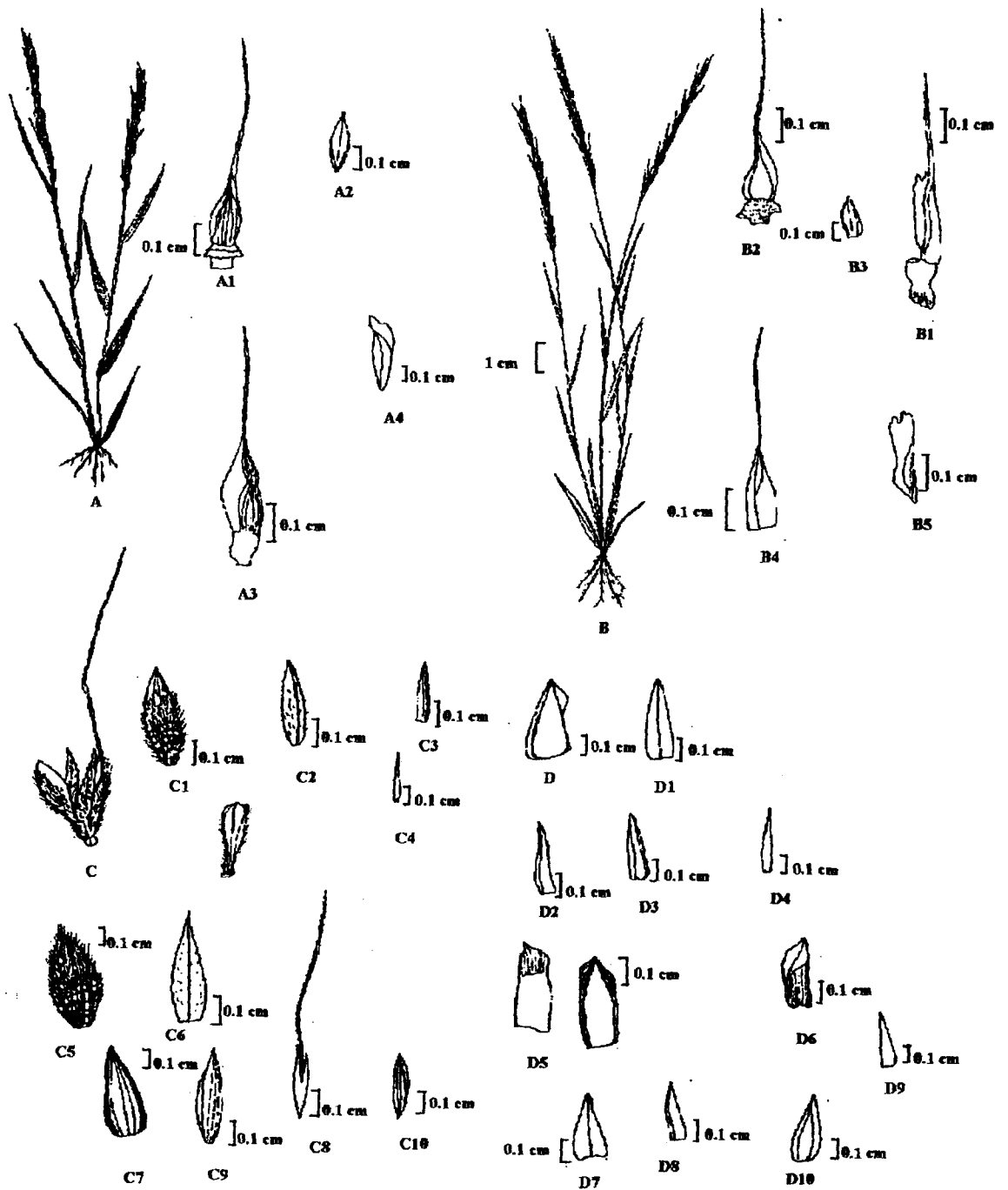


Figure 27: *Glyphochloa goensis* (Rao & Hemadri) Clayton: A. Habit; Sessile spikelet. A1. Lower glume; A2. Upper glume; Pedicelled spikelet. A3. Lower glume; A4. Upper glume. *Glyphochloa talbotii* (Hook. f.) Clayton: B. Habit; B1. Joints; Sessile spikelet: B2. Lower glume; B3. Upper glume; Pedicelled spikelet. B4. Lower glume; B5. Upper glume. *Ischaemum dalzellii* Stapf ex Bor: C. Spike; Pedicelled spikelet: C1. Lower glume; C2. Upper glume; C3. Lemma; C4. Palea; Sessile spikelet: C5. Lower glume; C6. Upper glume; C7. Lower lemma; C8. Upper lemma; C9. Lower palea; C10. Upper palea. *Ischaemum jayachandranii* R. Ansari et al.: Sessile spikelet: D. Lower glume; D1. Upper glume; D2. Lower lemma; D3. Upper lemma; D4. Palea; Pedicelled spikelet: D5. Lower glumes; D6. Upper glume; D7. Lower lemma; D8. Upper lemma; D9. Lower palea; D10. Upper palea

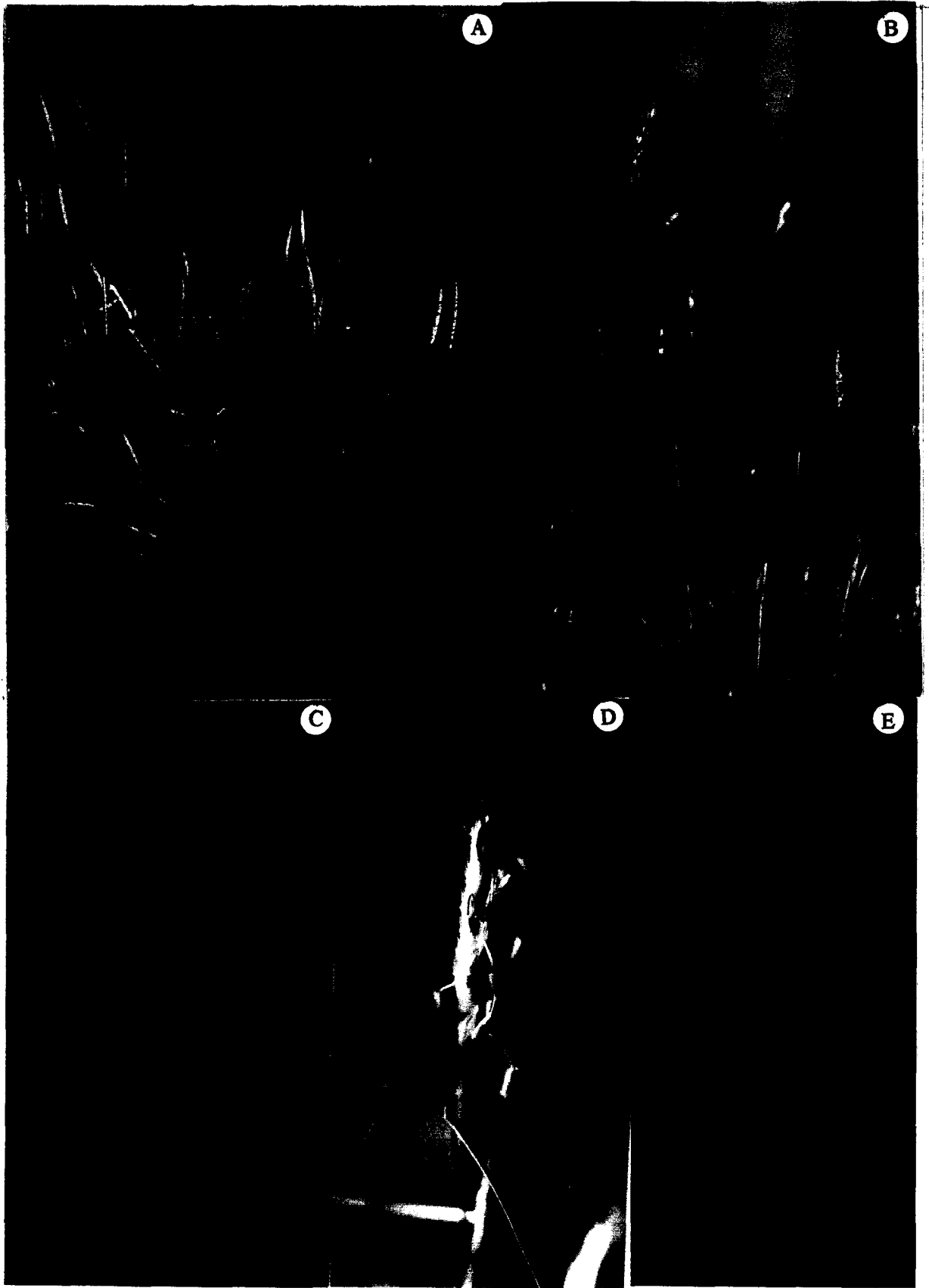


PLATE 21: A & C. *Glyphochloa talbotii* (Hook. f.) Clayton, B & D. *Ischaemum dalzellii* Stapf ex Bor, E. *Ischaemum jayachandranii* R. Ansari et al.

Fl. & Fr.: January.

Habitat: Fallow fields.

Distribution: Goa (Darbandhora); Kerala (Cannanore). (Map 27).

Status: (R).

Notes: It is a new report to the state of Goa, and only known locality outside the type locality. Since it is a recently published species, its distribution is unknown. It is possible that it may be present in other districts along the Western Ghats. It is closely related to *I. commutatum* Hack. which is distributed in Peninsular India and differs from it as shown below:

<i>I. jayachandranii</i>	<i>I. commutatum</i>
Culms slender.	Culms stout .
Leaves entirely glabrous.	Leaves usually densely or sparsely villous
Joints distinctly turbinate, coriaceous, entirely glabrous.	Joints of racemes linear, slightly turbinate, crustaceous, keels long ciliate.
Callus glabrous.	Callus bearded.
Sessile spikelet without awn	Sessile spikelet with awn.
Lower glume of sessile spikelet oblong, coriaceous, flat, smooth without side nodules.	Lower glumes of sessile spikelet oblong-obtuse, crustaceous below, coriaceous above and usually with a few side nodules.
Upper glume of sessile spikelet keeled on dorsal side.	Upper glume of sessile spikelet rounded on dorsal surface.
Upper lemma of sessile spikelets without awns.	Upper lemma of sessile spikelet with very well developed awns.
Pedicel of pedicelled spikelet less than 1/3 of the length of the sessile spikelet; keels glabrous .	Pedicel of the pedicelled spikelet more than 1/3 the length of the sessile spikelet; keels long ciliate.
Lower glume narrowly winged on one margin.	Lower glume of pedicelled spikelet broadly winged on one margin

Ischaemum travancorense Stapf ex C. E. C. Fischer in Kew Bull. 1933: 353. 1933;

Sur in J. Econ. Tax. Bot. 9: (2). 314. 1987; Kulkarni, Fl. Sindhudurg 543. 1988;

Karthikeyan et al., Fl. Ind. Enum. Mono. 233. 1989; Almeida, Fl. Savantwadi 2:

139.1990; Sreekumar & Nair, Fl. Kerala Grass. 165. 1991; Cook, Aqua. Wetland Pl. India 301. 1996; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 530. 1996. *Ischaemum aristatum* ssp. *rotleri* Hook. f. Fl. Brit. India 7: 127. 1896.

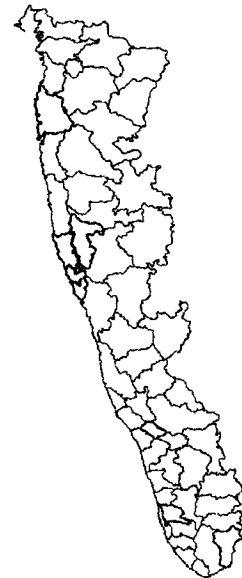
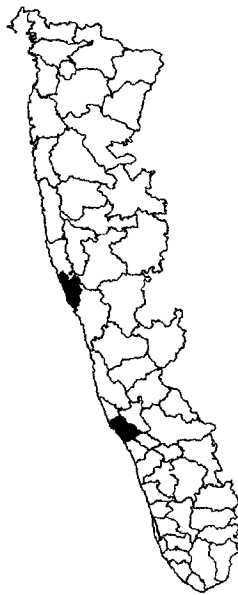
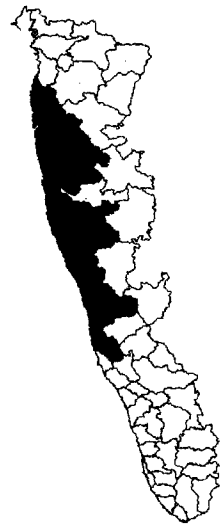
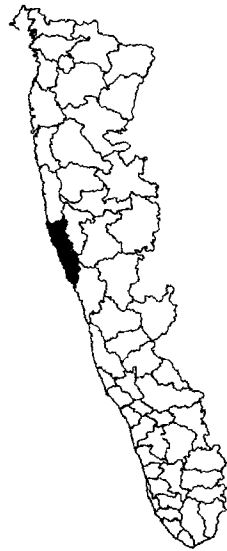
Annuals; culms up to 150 cm long, geniculate, rooting at lower nodes, upper nodes slightly swollen. Leaf sheath up to 8 cm long, glabrous, green; ligule membranous, truncate, c 0.3 cm long; lamina up to 30 x 0.7 cm, linear-lanceolate, rounded at base, entire along margins; margins with bristly hairs, acute-acuminate at apex. Racemes two, appressed, appearing solitary, purple, up to 9.5 cm long. Sessile spikelets: Lower glume c 0.4 x 0.12 cm, ovate-oblong, crustaceous with few side nodules connected by shallow ridges, chartaceous above, faintly 12-13 nerved, slightly winged at apex on one side, glabrous. Upper glume c 0.4 x 0.1 cm, ovate-lanceolate, dorsally keeled, faintly ribbed at apex, appressed hairs above, margins infolded, hyaline, ciliate at apex. Lower lemma c 0.4 x 0.1 cm, hyaline, three nerved, oblong-lanceolate, ciliolate towards apex. Lower palea c 0.4 x 0.1 cm, hyaline. Upper lemma c 0.4 x 0.1 cm, hyaline, deeply notched, awned; awn c 1 cm long, aristate. Upper palea c 0.4 x 0.1 cm, delicate, hyaline, three nerved. Lodicules two, oblanceolate. Stamens three; anthers c 0.2 cm long. Pediceled spikelets: Lanceolate, awnless; pedicels clavate, glabrous. Lower glume c 0.5 x 0.2 cm, ovate-oblong, broadly winged on one margin. Upper glume slightly keeled on one side, ciliate on upper surface. Lemma and palea same as sessile spikelet. (Fig. 28 A-A13; Plate 22 B).

Fl. & Fr.: October – January.

Habitat: On open lateritic plateau where water gets accumulated during rainy season.

Distribution: **Maharashtra:** (Kolhapur, Sindhudurg & Thane); **Goa** (Cuncolim & Taleigao); **Kerala** (Wyanad, Kottayam & Travancore). (Map 27).

Map 27: Distribution of *Glyphochloa talbotii*, *Ischaemum dalzellii*, *Ischaemum jayachandranii* and *Ischaemum travancoreense* along Western Ghats.



● *Glyphochloa talbotii* (Hook. f.)
Clayton

● *Ischaemum jayachandranii* R.
Ansari et al.

● *Ischaemum dalzellii* Stapf ex
Bor

○ *Ischaemum travancoreense*
Stapf ex C. E. C. Fischer

Status: (LR).

Notes: It is a new record to the state of Goa. It is discontinuously distributed along the Western Ghats. It is closely related to *I. vembanadense* Patil & D'Cruz, which is endemic to Kerala, but differs from it as shown below:

<i>Ischaemum travancorense</i>	<i>Ischaemum vembanadense</i>
Racemes up to 9.5 cm long.	Racemes up to 8 cm long.
Lower glumes of pedicelled spikelet broadly winged on one margin.	Lower glume of pedicel spikelet narrowly winged on one margin.
Leaves up to 30 cm long.	Leaves up to 15 cm long.
Sessile spikelets awnless.	Sessile spikelets awned.

Ophiuros bombaiensis Bor in Kew Bull. 1951: 167. 1951 & Grass. Ind. 198. 1960; Karthikeyan et al., Fl. Ind. Enum. Mono. 240. 1989; Nair in Henry et al., Fl. Tamil Nadu 3: 128. 1989; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 540. 1996.

Annuals, up to 35 cm long, roots fibrous. Leafsheath up to 5 cm long, glabrous, green, terete; ligules membranous, white, c 0.01 cm long; lamina up to 20 x 0.8 cm, glabrous green, terete, linear-lanceolate, acuminate at apex; nodes glabrous, reddish purple. Spikelets c 10–15 cm long, slender, acuminate, glabrous, greenish purple. Spikes oblong, lanceolate, awnless. Lower glume c 0.3 x 0.1 cm, oblong-lanceolate, coriaceous, 5–7 nerved, obtuse, slightly winged at apex. Upper glume c 0.27 x 0.08 cm, oblong-lanceolate, membranous, three nerved, acute-acuminate. Lower lemma c 0.25 x 0.04 cm, lanceolate, hyaline, nerveless; lodicules two; stamens three, c 0.15 x 0.03 cm. Upper lemma c 0.25 x 0.09, broadly elliptic, obtuse, hyaline; palea c 0.12 x 0.08 cm, broad, lanceolate, membranous. Stamens three, c 0.2 cm, purple, lodicules two. (Fig. 28 B -B9; Plate 22 A).

Fl. & Fr.: September – October.

Habitat: Open area near paddy fields.

Distribution: Maharashtra (Sindhudurg); Goa (Sanguem); Karnataka (Shimoga, Mysore); Tamil Nadu (Locality unknown). (Map 28).

Status: (V).

Notes: It is a new report to the state of Goa. Its distribution is relatively unknown. Though quoted in Flora of Tamil Nadu (Nair, l.c.), it's exact locality in that state is not known. The distribution for Sindhudurg district of Maharashtra was unknown before and during the present study it was observed near a paddy field on gneiss rocks in Vengurla.

Panicum paianum Nair & Patunkar in Reinwardtia 9: 407. 1980; Patunkar, Grass. Marathw. 157. 1980; Karthikeyan et al., Fl. Ind. Enum. Mono. 243. 1989; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 550. 1996.

Annuals up to 60 cm long, erect, sometimes creeping, rooting at lower nodes; nodes pubescent with bulbous based hairs. Leaf sheath pubescent; ligule a ring of hairs; lamina up to 7 x 0.7 cm, linear, lanceolate, rounded at base, entire along margins, acute at apex. Panicles up to 15 cm long, branches and pedicel capillary, scabrous, glabrescent. Spike c 0.25 x 0.1 cm, deciduous, acute with bulbous base hairs, shortly pedicelate; pedicel c 0.02 cm. Lower glume c 0.01 x 0.08 cm, overlapping at base, acute at apex, five nerved. Lower lemma c 0.2 x 0.1 cm, ovate, lanceolate, 5-6 nerved. Lower palea c 0.15 x 0.05 cm, lanceolate, hyaline, two nerved, empty. Upper glume c 0.3 x 0.1 cm, ovate-lanceolate, 7-8 nerved. Upper lemma c 0.18 x 0.1 cm, obovate, coriaceous, three nerved, yellow. Lower palea c 0.17 x 0.1

cm, subcoriaceous, two nerved. Stamens three. Ovary c 0.05 cm long, oblong; styles c 0.04 cm long; stigma c 0.01 cm long. (Fig. 28 C-C7; Plate 22 C).

Fl. & Fr.: October – April.

Habitat: Open area on plateaus.

Distribution: Maharashtra (Aurangabad); Goa (Taleigao). (Map 28).

Status: (LR).

Notes: It is a new report to the State of Goa and presence of this species in Goa shows it extended distribution along the Western Ghats. It is closely related to *P. trypheron* Schult. which is distributed in Gangetic plains in eastern India and south wards and differs from it as stated below:

<i>Panicum paianum</i> var. <i>paianum</i>	<i>Panicum trypheron</i>
Pedice c 0.02 cm long.	Pedicel c 0.1 cm long.
Lower glumes ovate, acute.	Lower glumes cuspidate, acuminate.
Spikelets with bulbous based hairs.	Spikelets glabrous.

Paspalum canarae (Steud.) Veldk. in Blumea 21: 72. 1973 var. **fimbriatum** (Bor.) Veldk. in Blumea 21: 72. 1973; Kulkarni, Fl. Sindhudurg 550. 1988; Ramachandran & Nair, Fl. Cannanore. 1988; Karthikeyan et al., Fl. Ind. Enum. Mono. 244. 1989; Sreekumar & Nair, Fl. Kerala Grass. 283. 1991; Deshpande et al., Fl. Mahabaleshwar 2: 567. 1995; Lakshminarasimhan in Sharma et al., Fl. Maharashtra Monocot. 557. 1996; Rajkumar et al. J. Bom. Nat. Hist. 96: 182. 1999. *Panicum canarae* Steud. Syn. Pl. 1: 58. 1853. *Paspalum compactum* var. *fimbriatum* Bor, Grass. India 336. 1960.

Annuals. Culms up to 25 cm long, creeping; nodes villous. Leaf sheath sparsely villous with tubercle based hairs; ligules obscure; lamina up to 3 x 0.4 cm, oblong– elliptic–elliptic lanceolate, decurrent at base, glabrous or sparsely tubercled, base hairy.. Racemes 4–12, up to 1.2 cm long; rachis winged, c 0.03 cm long,

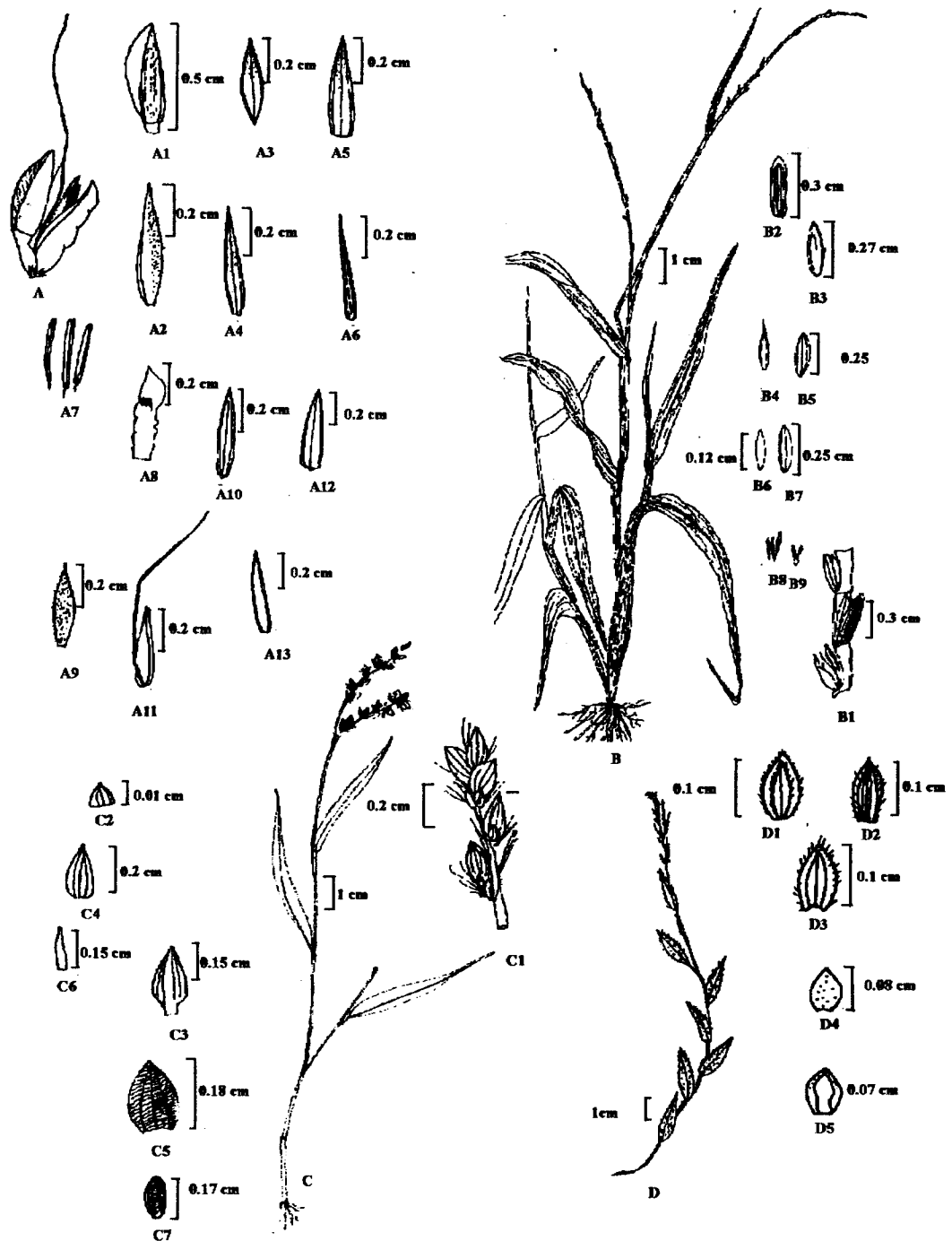


Figure 28: *Ischaemum travancorense* Stapf ex C. E. C. Fischer: A. Spikelet; Pedicelled spikelet: A1. Lower glume; A2. Upper glume; A3. Lower lemma; A4. Upper lemma; A5. Lower palea; A6. Upper palea; A7. Stamens; Sessile spikelet: A8. Lower glume; A9. Upper glume; A10. Lower lemma; A11. Upper lemma; A12. Lower palea; A13. Upper palea. *Ophiuros bombaiensis* Bor: B. Habit; B1. Spikelet; B2. Lower glume; B3. Upper glume; B4. Lower lemma; B5. Upper lemma; B6. Lower palea; B7. Upper palea; B8. Stamens; B9. Anthers. *Panicum paianum* Nair & Patunkar: C. Habit; C1. Spike; C2. Lower glume; C3. Upper glume; C4. Lower lemma; C5. Upper lemma; C6. Lower palea; C7. Upper palea. *Paspalum canarae* (Steud.) Veldk. var. *fimbriatum* (Bor.) Veldk.: D. Habit; D1. Spikelet; D2. Upper glume; D3. Lower lemma; D4. Upper lemma; D5. Upper palea.

tubercled. hairy. Spikelets c 0.2 x 0.1 cm, tubercled base hairs. Lower glume absent . Upper glume c 0.1 x 0.07 cm, chartaceous, obovate, acute, 3-5 nerved, with tubercled base hairs. Lower floret empty. Upper floret bisexual. Lower lemma ovate, acute, chartaceous, 5-nerved. Upper lemma c 0.1 x 0.07 cm , chartaceous, 3 nerved. Palea c 0.1 x 0.1 cm, ovate, crustaceous, two keeled. Stamens three; anthers c 0.02 cm long. Pistill c 0.7 cm. (Fig. 28 D-D5; Plate 22 D).

Fl. & Fr.: November – December.

Habitat: Under growth in the forest.

Distribution: Maharashtra (Sindhudurg, Satara); Goa (Surla); Kerala: (Cannanore & Wyanad). (Map 28).

Status: (R).

Notes: It is distributed in the northern and central Western Ghats. It is closely related to *Paspalum canarae* (Steud.) Veldk. var. *canarae*, which is distributed almost throughout India and differs from it by its sparsely placed tubercled base hairs on upper glume and lower lemma.

PODOSTEMACEAE

Griffithella hookeriana (Tulasne) Warming, Kongel Danske Vidensk. Selsk. Skr. Ser. 6, 11: 13. 1901; Willis, Ann. Roy. Bot. Gard. (Peradeniya) 1: 233. 1902; Subramanyam, Aquatic. Angio 47, f. 32. 1962; Vartak, Enum. Pl. Gomantak 89. 1966; Cooke, Fl. Bombay 3: 30. 1967 (repr. ed.); Gamble, Fl. Madras 3: 838. 1967 (repr. ed.); Vartak & Bhadbhade, J. Univ. Pune 44: 180 –197. 1973; Yoganarasimhan et al., Fl. Chikmagalur 272. 1981; Rao, Fl. Goa 2: 363. 1986; Kulkarni, Fl. Sindhudurg 370. 1988; Almeida, Fl. Savantwadi 1: 357. 1990; Cook, Aqua. Wetland

Pl. India 318. 1996; Saldanha, Fl. Karnataka 2: 2. 1996. *Mniopsis hookeriana* Tulasne, Ann. Sci. Nat. Ser. 3 (11): 105. 1849. *Podostemon hookerianus* (Tulasne) Weddell in DC. Prodr. 17: 74. 1973; Hook. f., Fl. Brit. Ind. 5: 65. 1886. *Cladopus hookerianus* (Tulasane) Cusset, Fl. Cambodge, Laos & Vietn 14: 71. 1973.

Small herbs attached to the rocks in fast flowing rivers. Roots ribbon like, algiform, fucoid, or cup like, attached to the rocks only by the central part. Leaves distichous 2–5, c 0.3 cm long, tips deciduous. Flowers solitary arising from spathe; spathe funnel shaped, toothed, irregularly splitted at apex. Pedicel c 0.4 cm long, developing up to 0.6 cm in fruit, brown, broadening at tip. Tepals 2, one on each side of the ovary, c 0.17 cm long, brown, linear. Stamens monadelphous, filaments two, c 0.2–0.22 cm long, brown; staminodes two at the side of the filaments, yellow. Stigma two, linear, simple. Capsule globose–spherical; c 0.1 x 0.1 cm, smooth, brown, breaking by two unequal valves, seeds c 0.02 cm, flattened, reddish brown. (Fig. 29 C- F; Plate 22 E).

Fl. & Fr.: October – November.

Habitat: Attached firmly to rocks in flowing rivers.

Distribution: Maharashtra (Kolhapur, Sindhudurg); Goa: (Canacona); Karnataka (Chikmagalur, Uttar & Dakshin Kannada); Kerala (Kasaragod & Thrissur). (Map 28).

Status: (LR).

Notes: The plant leaves an impression on the boulders in the river bed even after drying. It is distributed in the northern and central Western Ghats.

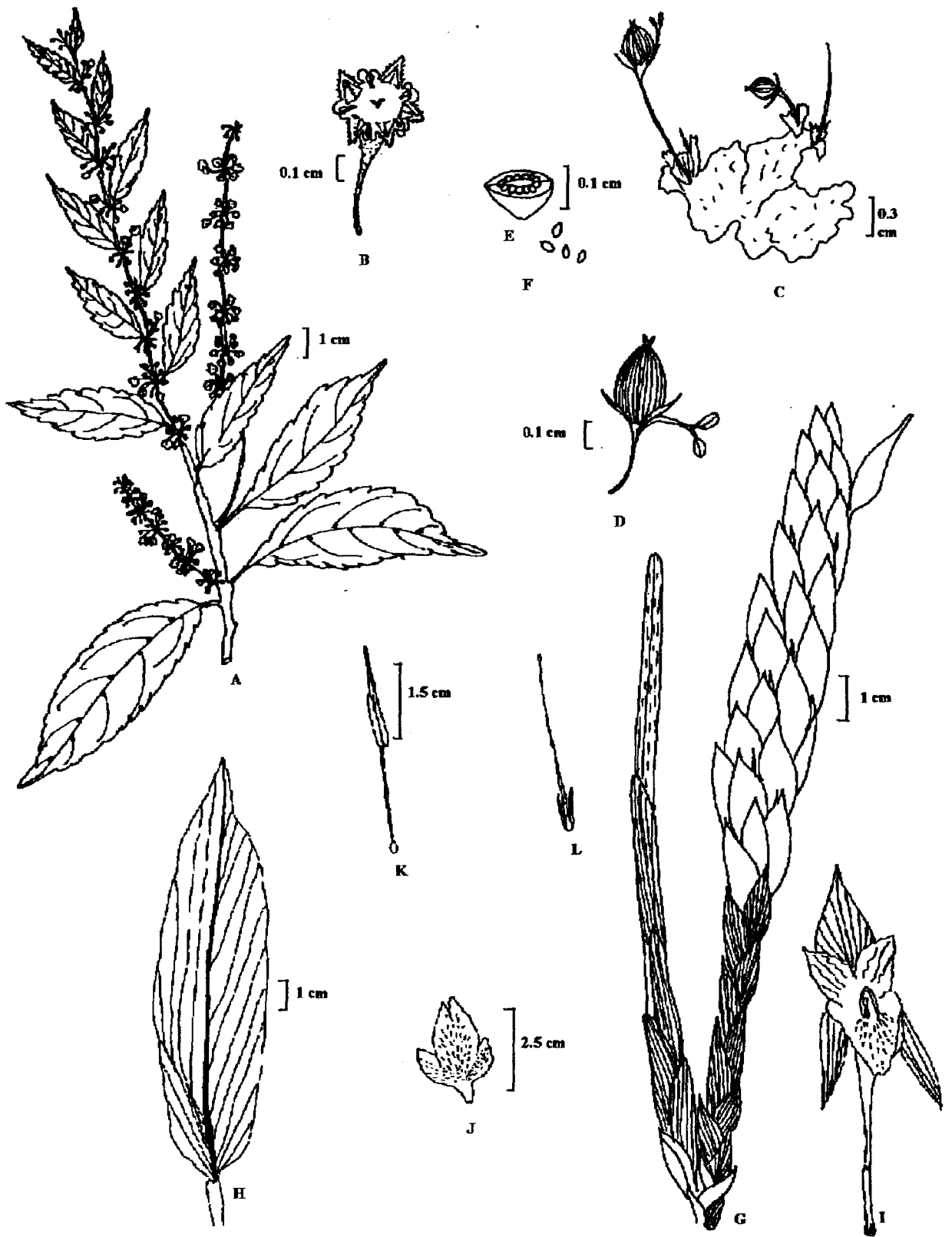


Figure 29: *Ventilago bombaiensis* Dalz: A. Habit; B. Flower. *Griffithella hookeriana* (Tulasne) Warming: C. Habit; D. Flower; E. T.S. of Capsule; F. Seeds. *Zingiber neesatum* (Graham) Ramamoorthy: G. Inflorescence; H. Leaf; I. Flower; J. Labellum; K. Stamen; L. Pistil.

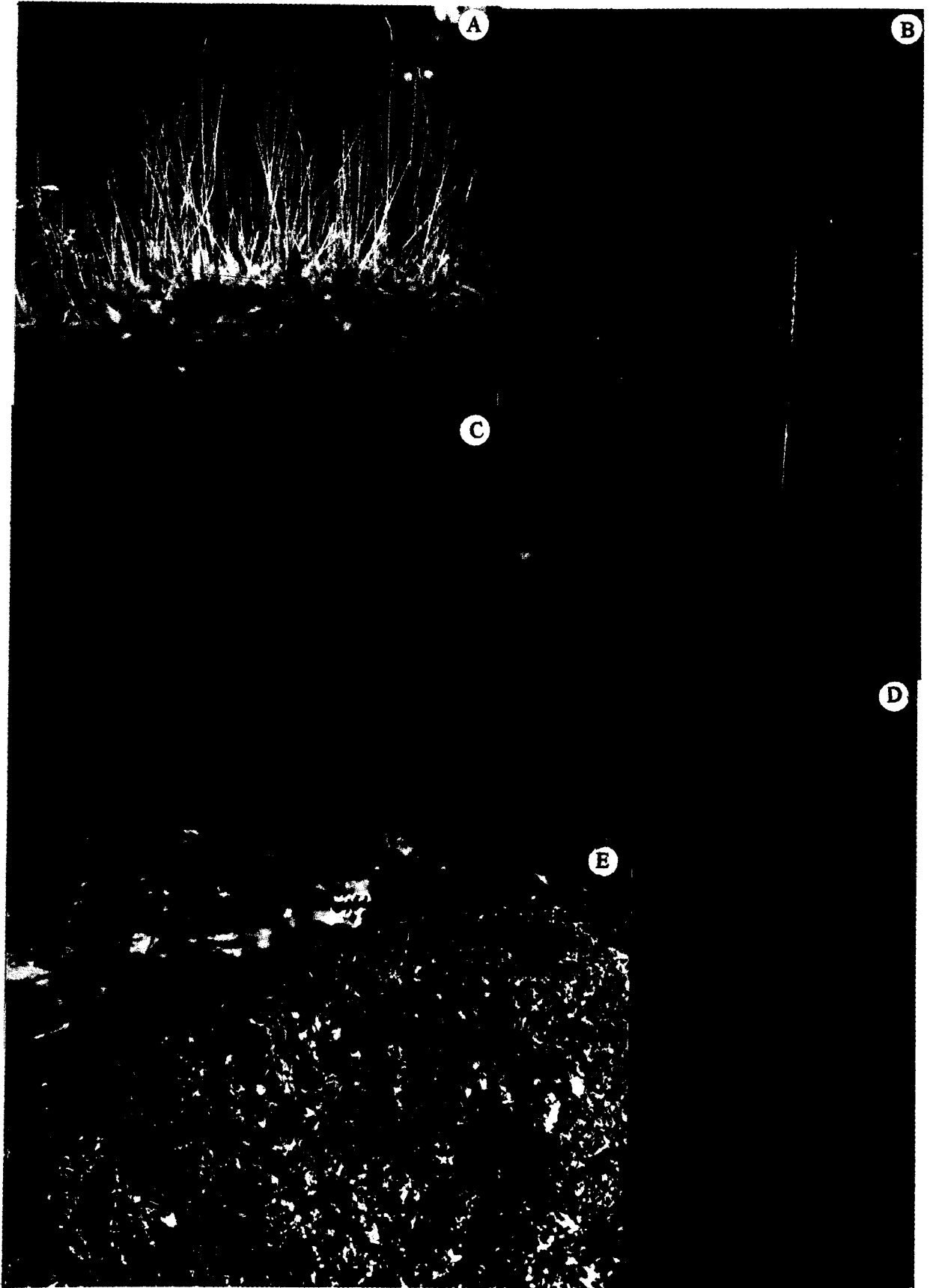
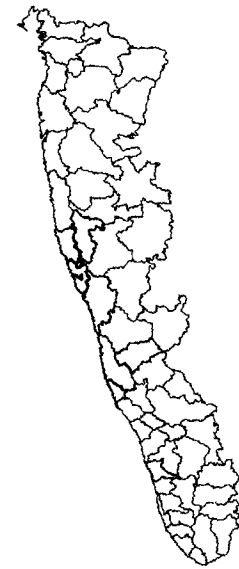
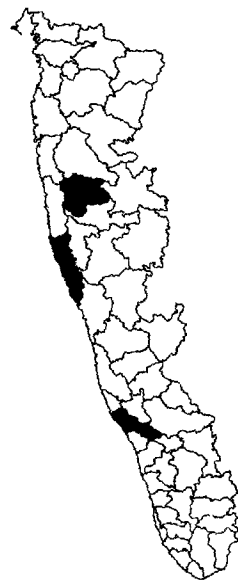
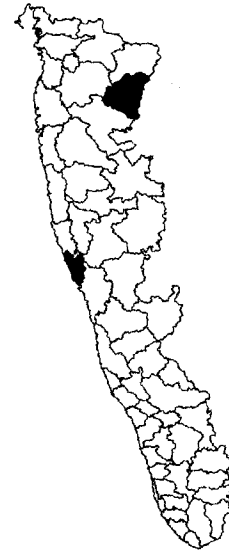
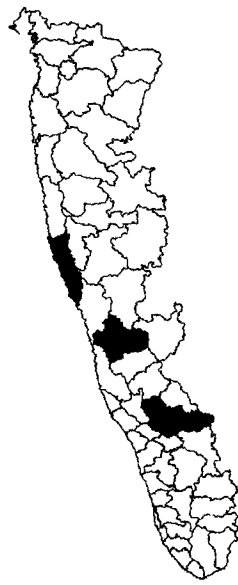


PLATE 22: A. *Ophiuros bombaiensis* Bor, B. *Ischaemum travancorense* Stapf ex C. E. C. Fischer, C. *Panicum paianum* Nair & Patunkar, D. *Paspalum canarae* (Steud.) Veldk. var. *fimbriatum* (Bor.) Veldk, E. *Griffithella hookeriana* (Tulasne) Warming.

Map 28: Distribution of *Ophiuros bombaiensis*, *Panicum paianum*, *Paspalum canarae* var. *fimbriatum* and *Griffithella hookeriana* along Western Ghats.



- *Ophiuros bombaiensis* Bor
- *Paspalum canarae* (Steud.) Veldk var. *fimbriatum* (Bor.) Veldk.

- *Panicum paianum* Nair & Patunkar
- *Griffithella hookeriana* (Tulasne) Warming

RHAMNACEAE

Ventilago bombaiensis Dalz. in Hooker's. J. Bot. Kew Gard. Misc 3: 36. 1851; Laws. in Hook. f., Fl. Brit. India 1: 631. 1875; Cooke, Fl. Bombay 1: 254. 1967 (repr. ed.); Gamble, Fl. Madras 2: 157. 1967 (repr. ed.); Santapau, Fl. Khandala 42. 1967; Ramachandran & Nair, Fl. Cannanore 99. 1988; Almeida, Fl. Savantwadi 1: 98. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 111. 1990; Vajravelu, Fl. Palghat 120. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 125. 1991; Kothari & Moorthy, Fl. Raigad 63. 1993; Deshpande et al., Fl. Mahabaleshwar 134. 1993; Sasidharan & Sivarajan, Fl. Thrissur 110. 1996; Almeida, Fl. Maharashtra 1: 252. 1996; Saldanha, Fl. Karnataka 2: 168. 1996. *Smythea bombaiensis* (Dalz.) Banerj. & Mukh., Indian For. 96: 214. 1970; Kulkarni, Fl. Sindhudurg 82. 1988.

Climbing shrubs; young branches fulvous tomentose or pubescent when young, glabrous at maturity. Leaves simple, alternate, petiolate, stipulate; stipules very small; petiole c 0.8 cm long, fulvous pubescent, pale brown; lamina up to 10 x 3.5 cm, lanceolate, unequal at base, crenate along margins, acuminate at apex, dark green with 4–5 pairs of veins abaxially, pale green with prominent veins adaxially, tertiary veins almost parallel; villous glands in the axil of vein. Inflorescence an axillary fascicle, 10–15 flowered; flowers c 0.3 cm across; pedicel c 0.4–0.5 cm long, fulvous pubescent. Calyx tube c 0.25 cm across, broad, fulvous pubescent outside; teeth five, c 0.1 cm long, triangular, keeled on the innerside. Petals 5, alternating with sepals, c 0.08 cm long, cuneate at base, truncate to slightly two lobed at apex, cream coloured. Stamens five, opposite to the petals; filaments c 0.06 cm long, stout at base; anthers white, two celled, globose. Ovary sunken in the disc; styles two, fleshy, slightly recurved at apex. (Fig. 29 A-B; Plate 23 A-B).

Fl. & Fr.: December – February.

Habitat: A climber on other plants in evergreen and semievergreen forest patches.

Distribution: Maharashtra (Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Molem-Anmod); Karnataka (Coorg, Hassan & Dakshin Kannada); Kerala (Cannanore, Palghat, Idukki & Thrissur). (Map 29).

Status: (LR).

Chromosome number: 24. (2n)

Notes: It is a new report to the state of Goa. It is distributed in the northern and central Western Ghats up to Palghat. It is closely related to *V. madraspatana* Gaertn. which is distributed in Peninsular India and Sri Lanka and differs from it as stated below:

<i>Ventilago bombaiensis</i>	<i>Ventilago madraspatana</i> .
Young branches and flowers covered with fulvous tomentum.	Young branches and flowers glabrous or slightly pubescent.
Flowers fascicled in the leaf axil.	Flowers in slender, simple or paniculate spikes.
Leaves glabrous, acute or subacuminate, crenate, glabrous.	Leaves oblong-lanceolate-ovate, acute or sub acute, crenate or entire.

RUBIACEAE

Hedyotis maheshwarii (Sant. & Merch.) Rao & Hemadri in Ind. For. 99 (6): 376. 1973; Rao, Fl. Goa 2: 207. 1986. *Oldenlandia maheshwarii* Sant. & Merch. in J. Ind. Bot. Soc. 42 A: 213 – 215. 1964; Santapau, Fl. Khandala 115. 1967; Almeida, Fl. Savantwadi 1: 221. 1990.

Erect or prostrate herbs up to 18 cm high, slender, brown, hairy, slightly swollen at the nodes. Leaves simple, opposite, sessile, stipulate; stipule c 0.1 cm long, linear, bristly; lamina up to 0.9 cm long, linear, hairy, green with prominent mid

vein; stipule medifixed, forked in to two, c 0.1 cm long, linear, filiform. Flowers arising from the leaf axil. Calyx tube c 0.08 cm long, densely scabrid, truncate at apex; calyx lobes four, c 0.12 cm long, lanceolate, acute at apex, green, hairy. Corolla tube c 0.1 cm long; lobes c 0.22 cm long, oblanceolate, acute at apex, three nerved. Stamens four, alternating with corolla lobes; filaments c 0.2 cm long; anthers c 0.08 cm long. Style c 0.3 cm long; stigma cup like, forked in to two. Capsule c 0.1-cm long, enclosed inside the calyx tube; seeds many, flattened, compressed. (Fig. 30 A-F).

Fl. & Fr.: August – October.

Habitat: Open grasslands.

Distribution: Maharashtra: (Sindhudurg & Thane); Goa (Surla); Karnataka (Uttar Kannada). (Map 29).

Status: (R).

Notes: It is distributed in the northern and central Western Ghats. Although this species is reported by Rao (l.c.) for Goa, could not be collected during the course of study from the study area. However it was collected from out side the state of Goa, but included here as it is reported for Goa by Rao (l.c.). Ayyangar et al.(1967) wrongly reported it from Madras. It is closely related to *Oldenlandia stocksii* Hook. f. which is distributed in the Bababudan hills and differs from it as stated below:

<i>Hedyotis maheshwarii</i>	<i>Oldenlandia stocksii</i>
Stem pubescent.	Stem glabrous.
Flowers solitary.	Flowers in di- or trichotomous cymes.
Calyx teeth ovate –oblong, longer than corolla.	Calyx teeth linear–lanceolate to ovate, equaling the corolla.,
Corolla white, c 0.2 cm long.	Corolla blue, 0.4 -0.6 cm long.

Ixora brachiata Roxb. ex DC. Prodr. 4: 488. 1830; Hook. f., Fl. Brit. India 3: 142. 1880; Cooke, Fl. Bombay 39. 1967 (repr. ed.); Gamble, Fl. Madras 2: 445. 1967 (repr. ed.); Santapau, Fl. Khandala 118. 1967, Shah, Fl. Gujarat 355. 1978; Arora et al., Bot. South Kanara 34. 1981; Swaminathan in Henry et al., Fl. Tamil Nadu 2: 10. 1987; Rao, Fl. Goa 2: 208. 1986; Kulkarni, Fl. Sindhudurg 199. 1988; Nair & Nayar, Fl. Courtallum 2: 316. 1988; Ramachandran & Nair, Fl. Cannanore 219. 1988; Husain & Paul, J. Econ. Tax. Bot. 6: 161. 1989; Almeida, Fl. Savantwadi 1: 206. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 220. 1990; Vajravelu, Fl. Palghat 233. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 244. 1991; Kothari & Moorthy, Fl. Raigad 192. 1993; Mohanan & Henry, Fl. Thiruvananthapuram 234. 1994; Deshpande et al., Fl. Mahabaleshwar 281. 1995; Sasidharan & Sivarajan, Fl. Thrissur 225. 1996; Naithani et al., Forest Fl. Goa 343. 1997.

Small trees; bark grey, woody. Leaves simple, opposite, petiolate; petiole c 1 cm long, glabrous; lamina up to 11 x 5 cm, coriaceous, elliptic-oblong, dark green adaxially, pale green abaxially with prominent midrib. Inflorescence a terminal branched cyme, up to 12 cm long; peduncle pubescent, pale reddish green; bracts c 0.3 cm long, linear, pale brown, glabrous, upper bracts very small, ciliate; pedicel very short, c 0.1 cm long. Calyx tube c 0.2 cm long, green, pubescent, urceolate; teeth 4, minute, triangular, purple (echinate or pubescent). Corolla tube c 1 cm long; lobes 4, c 0.3 x 0.2, orbicular, creamish white, Stamens 4, alternating with corolla lobes; filaments very short; anthers c 0.2 cm long, two celled, yellow. Style c 0.6 cm long, white, hairy, exerted outside the corolla tube; stigma 2, divided at the base. (Fig .30 F-H; Plate 23 D).

Fl. & Fr.: December–January.

Habitat: Common in lowland moist deciduous and semievergreen forests.

Distribution: Gujarat; Maharashtra (Nasik, Ratnagiri, Raigad, Sindhudurg & Thane); Goa: (Colem, Molem & Nirankarichi rai); Karnataka (Belgaum, Chikmagalur, Coorg, Hassan, Shimoga, Uttar & Dakshin Kannada); Kerala (Cannanore, Idukki, Kasaragod, Kottayam, Mallapuram, Palghat, Pathanamthitta, Quilon, Thrissur & Thiruvananthapuram); Tamil Nadu (Coimbatore, Kanniyakumari, Nilgiri, Tirunelveli). (Map 29).

Status: (LR).

Chromosome number: 22. (2n)

Notes: It is distributed throughout the Western Ghats. It is closely related to *I. parviflora* Vahl, which is distributed in India and Sri Lanka and differs from it as shown below:

<i>Ixora brachiata</i>	<i>Ixora parviflora</i>
Floral buds globose.	Floral buds ellipsoid.
Cymes sessile or shortly pedunculate.	Cymes sessile.
Leaves thinly coriaceous, elliptic, oblong or lanceolate, narrow at base, obtuse at apex, up to 17 cm long.	Leaves thinly coriaceous, elliptic or obovate, obtuse, rounded or cordate at base, up to 10 cm long.

Mussaenda laxa Hutchin. ex Gamble, Fl. Pres. Madras 2: 610. 1921 (2: 430. 1967, repr. ed); Gandhi in Saldanha & Nicolson, Fl. Hassan 582. 1976; Yoganarasimhan et al., Fl. Chikmagalur 176. 1981; Manilal & Sivarajan, Fl. Calicut 145. 1982; Rao, Fl. Goa 2: 212. 1986; Subramaniam et al., Fl. Palghat 66. 1987; Kulkarni, Fl. Sindhudurg 203. 1988; Kothari & Moorthy, Fl. Raigad 185. 1993; Deshpande et al., Fl. Mahabaleshwar 2: 283. 1995; Nayar & Nair, Fl. Courtallum 2: 319. 1986. *Mussaenda frondosa* var. *laxa* Hook. f. in Fl. Brit. India 3: 89. 1753; Cooke, Fl. Bombay 2: 467. 1967 (repr. ed).

Shrubs, up to 3 m, high much branched; stem woody, sparsely pubescent. Leaves simple, opposite, decussate, petiolate; petiole up to 2.5 cm long, reddish, softly pubescent; lamina up to 13 x 8 cm, oblong-ovate, obtuse at base, margins entire, acuminate at apex with lateral veins of 8-9 pairs, dark green, hairy adaxially, glabrous with hairs on veins abaxially; stipules interpetiolate, hairy, horn like up to 0.8 cm. Inflorescence a terminal umbell, subtended by 2 bracts; bracts similar to stipule; pedicel up to 0.3 cm long. Calyx five, 4 linear - lanceolate up to 1.5 cm long, 1 modified in to leaf like structure, up to 3.5 x 2 cm, white. Corolla 5, fused at base to form a tube; tube pale green; throat bright orange, pubescent. Stamens 5; filaments c 0.2 cm long; anthers up to 0.5 cm long, linear. Ovary two locular, placentation axile; ovules four. (Fig. 30 I- M; Plate 23 C).

Fl. & Fr: August - November.

Habitat: On plateaus, open areas and along streams.

Distribution: **Maharashtra** (Raigad, Sindhudurg & Thane); **Goa** (Taleigao; Molem; Masarde hill near Valpoi, Betim, Sanguem, Colem, Quepem, Budsari, Gaodongri, Ordofond); **Karnataka** (Coorg, Hassan, Dakshin Kannada); **Kerala** (Cannanore, Calicut, Wyanad, Quilon, Thrissur, Thiruvananthapuram & Palghat); **Tamil Nadu** (Tirunelveli). (Map 29).

Status: (LR).

Notes: It is distributed almost throughout the Western Ghats except in Tamil Nadu. It is a very common shrub in the study area. It is closely related to *M. glabrata* (Hook. f.) Hutchinson which is also endemic to Western Ghats and differs from it as stated below:

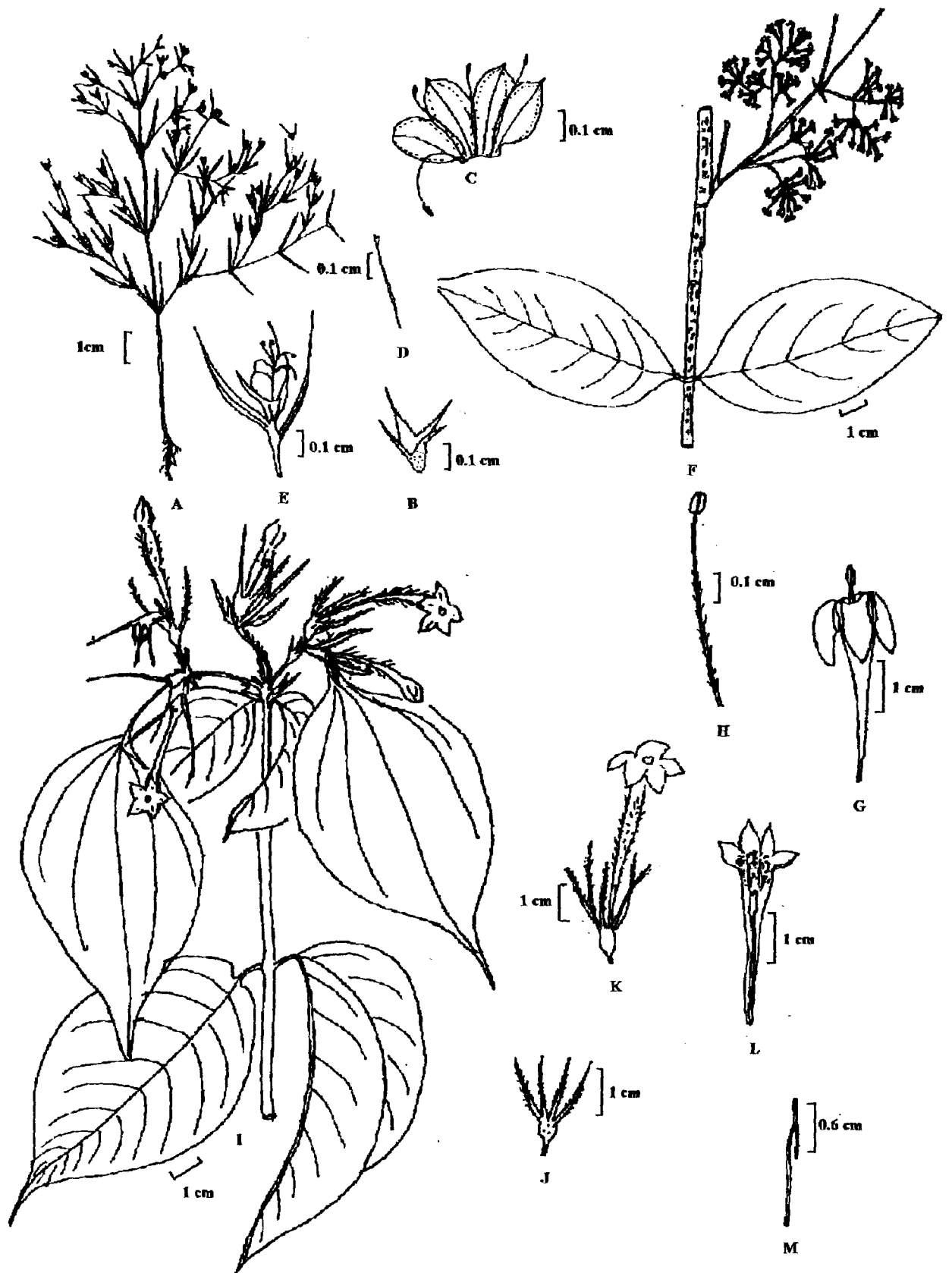
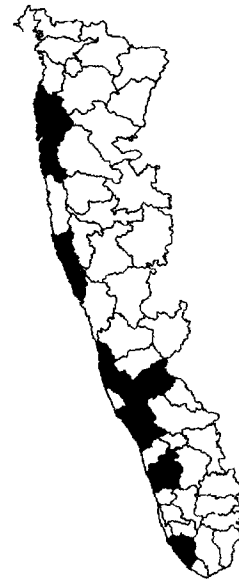
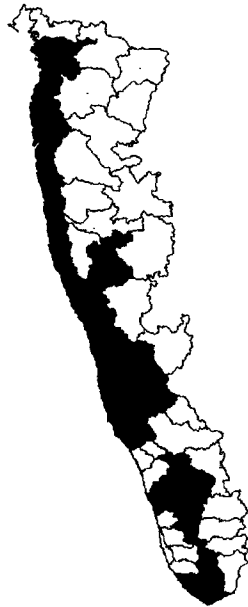
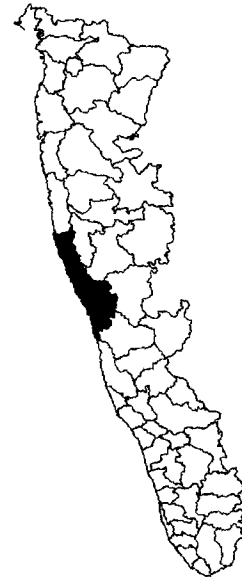
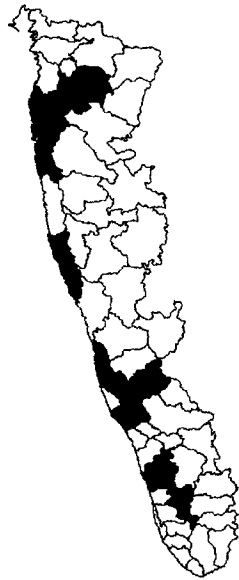


Figure 30: *Hedyotis maheshwarii* (Sant. & Merch.) Rao & Hemadri: A. Habit; B. Calyx; C. L.S of corolla; D. Style & Stigma; E. Fruit. *Ixora brachiata* Roxb.: F. Habit; G. Flower; H. Style & Stigma. *Mussaenda laxa* Hutchin.: I. Habit; J. Calyx; K. Flower; L. L.S of corolla; M. Stamen.



PLATE 23: A & B. *Ventilago bombaiensis* Dalz., C. *Mussaenda laxa* Hutchin. ex Gamble, D. *Ixora brachiata* Roxb. ex DC., E. *Neanotis foetida* (Dalz.) Lewis, F. *Neanotis rheedei* (Wall. ex Wight & Arn.) W. H. Lewis

Map 29: Distribution of *Ventilago bombaiensis*, *Hedyotis maheshwarii*, *Ixora brachiata* and *Mussaenda laxa* along Western Ghats.



● *Ventilago bombaiensis* Dalz.

● *Ixora brachiata* Roxb. ex DC.

● *Hedyotis maheshwarii* (Sant. & Merch.) Rao & Hemadri

● *Mussaenda laxa* Hutchin.

<i>Mussaenda laxa</i>	<i>Mussaenda glabrata</i>
Branches softly hairy.	Branches nearly glabrous except at the nodes.
Leaves sparsely pubescent abaxially.	Leaves minutely villous only on nerves abaxially.
Stipules bifurcated about half way down, teeth curved outward.	Stipules shortly bifurcated at the top.
Berry sparsely hirsute.	Berry glabrous.

Neanotis foetida (Dalz.) Lewis. in Ann. Missouri Bot. Gard. 53: 38. 1966; Gandhi in Saldanha & Nicolson, Fl. Hassan 583. 1976; Shah, Fl. Gujarat 356. 1978; Manilal & Sivarajan, Fl. Calicut 143. 1982; Rao, Fl. Goa 2: 213. 1986; Almeida, Fl. Savantwadi 1: 208. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 247. 1991. *Hedyotis foetida* Dalz. in Hooker's J. Bot. Kew Gard. Misc 2: 134. 1850. *Anotis foetida* (Dalz.) Benth. & Hook. f. Gen Pl. 2: 59. 1873; Hook. f.; Fl. Brit. India 3: 74. 1880; Cooke, Fl. Bombay 2: 23. 1967 (repr. ed.); Gamble, Fl. Madras 2: 427. 1967 (repr. ed.); Santapau, Fl. Khandala 116. 1967.

Erect or prostrate herbs, up to 25 cm long; stem flattend, branched. Leaves simple, opposite, sessile, interstipular; stipules hairy; lamina up to 1.7 cm long, linear-lanceolate, acute at apex, ⁰scabrous adaxially, glabrous abaxially. Inflorescence terminal and axillary cyme; cymes up to 2 cm. Flowers c 0.7 cm across, sessile, regular. Sepals 4, c 0.2 cm long, green, margin hairy, acute at apex; hairs red, calyx persistent. Corolla tube up to 0.3 cm long; lobes 4, purple, with a ring of white hairs on the throat. Stamens 4, filaments short, attached to corolla tube; anthers not exerted. Ovary 2-locular; ovules 2, one in each locule; style long, filiform; stigma capitate, purple. Capsule c 0.2 cm long, with persistent calyx, 2 seeded; seeds elliptic-orbicular, compressed, black. (Fig. 31 C; Plate 23 E).

Fl. & Fr.: September – October.

Habitat: On open lateritic plateaus.

Distribution: Gujarat (Bulsar, Dang); Maharashtra (Nasik, Ratnagiri, Satara, Sindhudurg & Thane); Goa (Bhati forest, Chopora, Goa University Campus, Sanguem, Usgao – Onda, Vasco Naval office plateau, Vageri); Karnataka (Belgaum, Hassan, Uttar & Dakshin Kannada); Kerala (Calicut & Kasaragod). (Map 30).

Status: (LR).

Notes: It is distributed in the northern and central Western Ghats. Flowers show variation in colour. It is pollinated by bees in the morning around 8.30 AM. This species is distinct from all the species collected in the study area. It is closely related to *Anotis ritchiei* Hook. f. whose exact locality and the present status is unknown, as no recent floras have reported it.

Neanotis rheedei (Wall. ex Wight & Arn.) W. H. Lewis in Ann. Missouri. Bot. Gard. 53: 40. 1966; Shah, Fl. Gujarat 356. 1978; Rao, Fl. Goa 2: 213. 1986; Swaminathan in Henry et al., Fl. Tamil Nadu 2: 16. 1987; Kulkarni, Fl. Sindhudurg 205. 1988; Ramachandran & Nair, Fl. Cannanore 226. 1988; Almeida, Fl. Savantwadi 1: 210. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 249. 1991; Kothari & Moorthy Fl. Raigad, 186. 1993; Deshpande et al., Fl. Mahabaleshwar 287. 1993. *Hedyotis rheedei* Wall. ex Wight & Arn. Prodr. 409. 1834. *Anotis rheedii* (Wall. ex Wight & Arn.) Hook. f., Fl. Brit. India 3: 73. 1880; Cooke, Fl. Bombay 2: 21. 1967 (repr. ed.). *H. latifolia* Dalz. in Kew J. Bot. 2: 133. 1850.

Erect herbs, up to 25 cm long; stem glabrous, quadrangular. Leaves simple, opposite, decussate, petiolate; petiole c 0.5 cm long, flat; lamina up to 5 x 2 cm, cuneate at base, entire along margins, acute at apex, veins more prominent abaxially.

Inflorescence terminal or axillary racemes, 2–3 cm long; pedicel 0.1–0.2 cm long. Calyx tube c 0.05 cm long, densely hairy; teeth 4, c 0.02 cm long, densely hairy, acute. Corolla tube c 0.2 cm long; lobes four, concave, acute, lilac. Stamens 4, alternating with petals, inserted at the base of corolla tube; filaments very stout; anthers two celled. Style short, c 0.01 cm; stout; stigma two lobed; lobes c 0.03 cm long. Capsule c 0.1 x 0.3 cm, two lobed, echinulate with transverse ridge. (Fig. 31 D-G; Plate 23 F).

Fl. & Fr.: August- October.

Habitat: In moist deciduous forests.

Distribution: Gujarat; Maharashtra (Kolhapur, Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Belgaum road, Bhati - Sidha, Chandranath, Margao hills, Molem, Pernem, Sanguem, Tisca – Usgao & Verem); Kerala (Cannanore & Kasaragod); Tamil Nadu (Coimbatore). (Map 30).

Status: (LR).

Notes: It is distributed throughout the Western Ghats. It is closely related to *N. lancifolia* (Hook. f.) W. H. Lewis which is distributed in Peninsular India and differs from it as shown below:

<i>Neanotis rheedei</i>	<i>Neanotis lancifolia</i>
Annual herb with quadrangular stem.	Perennial herb with terete stems.
Calyx teeth minute.	Calyx teeth large.
Capsules globose.	Capsules broader than longer.

Psychotria dalzellii Hook. f., in Fl. Brit. India. 3: 163. 1880; Vartak, Enum. Pl. Gomantak 62. 1966; Cooke, Fl. Bombay 2: 45. 1967 (repr. ed.); Gamble, Fl. Madras 2: 451. 1967 (repr. ed.); Gandhi in Saldanha & Nicolson, Fl. Hassan 588. 1976; Arora et al., Bot. South Kanara 35. 1981; Rao, Fl. Goa 2: 215. 1986; Kulkarni, Fl.

Sindhudurg 210. 1988; Ramachandran & Nair, Fl. Cannanore 232. 1988; Almeida, Fl. Savantwadi 1: 214. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 231. 1990; Naithani et al., Forest Fl. Goa 349. 1997. *P. bracteata* Wight & Arn. Prodr. 434. 1834, non DC. 1830

Erect shrubs up to 3 m high. Leaves simple, opposite, decussate, petiolate, stipulate; stipule inter petiolate, up to 2 x 1 cm long, broad at base, ovate, acute at apex, green; petiole up to 1 cm long; lamina up to 20 x 7 cm, obovate-oblongate, thick, coriaceous, cuneate at base, entire along margins, apiculate at apex, shining, darkgreen adaxially, palegreen abaxially, midvein prominent with 12-15 lateral veins. Inflorescence a terminal cyme, each cyme has 2-3 whorls; each whorl with 4 branches surrounded by 4 bracts; each branch in turn is surrounded by 2 more bracts. Each branch is further divided into 3-5 branches; branches surrounded by 2 bracts enclosing 3-5 flowers. Cymes ending with one terminal branch with same arrangement as above. Calyx 5 lobed, c 0.5 cm long, campanulate, glabrous; teeth c 0.45 cm long, rounded at apex, margins dentate, ciliate. Corolla tube very short, white; lobes 5, oblong, densely hairy on throat. Stamens 5; filaments very short; anthers two celled. Ovary two locular; style filiform; stigma bifid. Fruits covered by persistent calyx; seeds planoconvex, black, with one dorsal ridge. (Fig. 31 A-B; Plate 24 C).

Fl. & Fr.: April – October.

Habitat: Undergrowth in low land moist deciduous and semievergreen forests.

Distribution: Maharashtra (Sindhudurg); Goa (Ambeachogol, Butpal, Codal, Colem, Cotigao, Dudhsagar, Molem-Belgaum Road, Nadquem, Poshi forest; Saterem,

Sanguem, Surla, Talauli & Verlem); **Karnataka** (Belgaum, Coorg, Hassan, Shimoga, Uttar & Dakshin Kannada); **Kerala** (Cannanore, Kasaragod & Cochin). (Map 30).

Status: (LR).

Notes: It is distributed almost throughout the Western Ghats except Tamil Nadu. It is closely related to *P. truncata* Wall. which is distributed in Western Peninsula and differs from it as stated below:

<i>Psychotria dalzellii</i>	<i>Psychotria truncata</i>
Calyx teeth distinct.	Calyx truncate, teeth 0 or obscure.
Seeds with one dorsal ridge.	Seeds without dorsal ridge.

Tricalysia sphaerocarpa (Dalz.) Gamble, Fl. Madras 2: 620. 1921 (2: 437. 1996 repr. ed.); Sharma et al., Biol. Mem 2 (1 & 2): 73. 1977; Rao, Fl. Goa 2: 216. 1986; Swaminathan in Henry et al., Fl. Tamil Nadu 2: 26. 1987. *Discospermum sphaerocarpum* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 2: 257. 1850. *Diplospora sphaerocarpa* (Dalz.) Bedd. For. Man. Bot. 134. 3. 1872 excl. syn; Hook. f., Fl. Brit. India 3: 123. 1880; Dalgado, Fl. Savantwadi 97. 1898; Vartak, Enum. Pl. Gomantak 61. 1966; Cooke, Fl. Bombay 2: 32. 1967 (repr. ed.).

Trees, up to 10 m high; bark pale brown. Leaves simple, opposite, petiolate, stipulate; petiole 1 cm long, narrow; stipules triangular, long pointed, c 0.5 cm long; lamina up to 11 x 6 cm, cuneate at base, entire along margins, obtusely acuminate at apex, ovate-elliptic, darkgreen, shining adaxially, pale green with more prominent veins abaxially; veins 4-7 pairs with glands in axil of the leaf; gland surrounded by ciliate hairs. Flowers sessile, in axillary fascicles. Calyx four lobed, c 0.15 x 0.2 cm, rounded-truncate with fine ciliate hairs at apex, scabrous resigenous. Corolla lobes four, c 0.25 x 0.25 cm, fused at the base, each lobe notched in the centre, glabrous, creamish white. Stamens three, two c 0.2 cm long, one much smaller; filaments absent

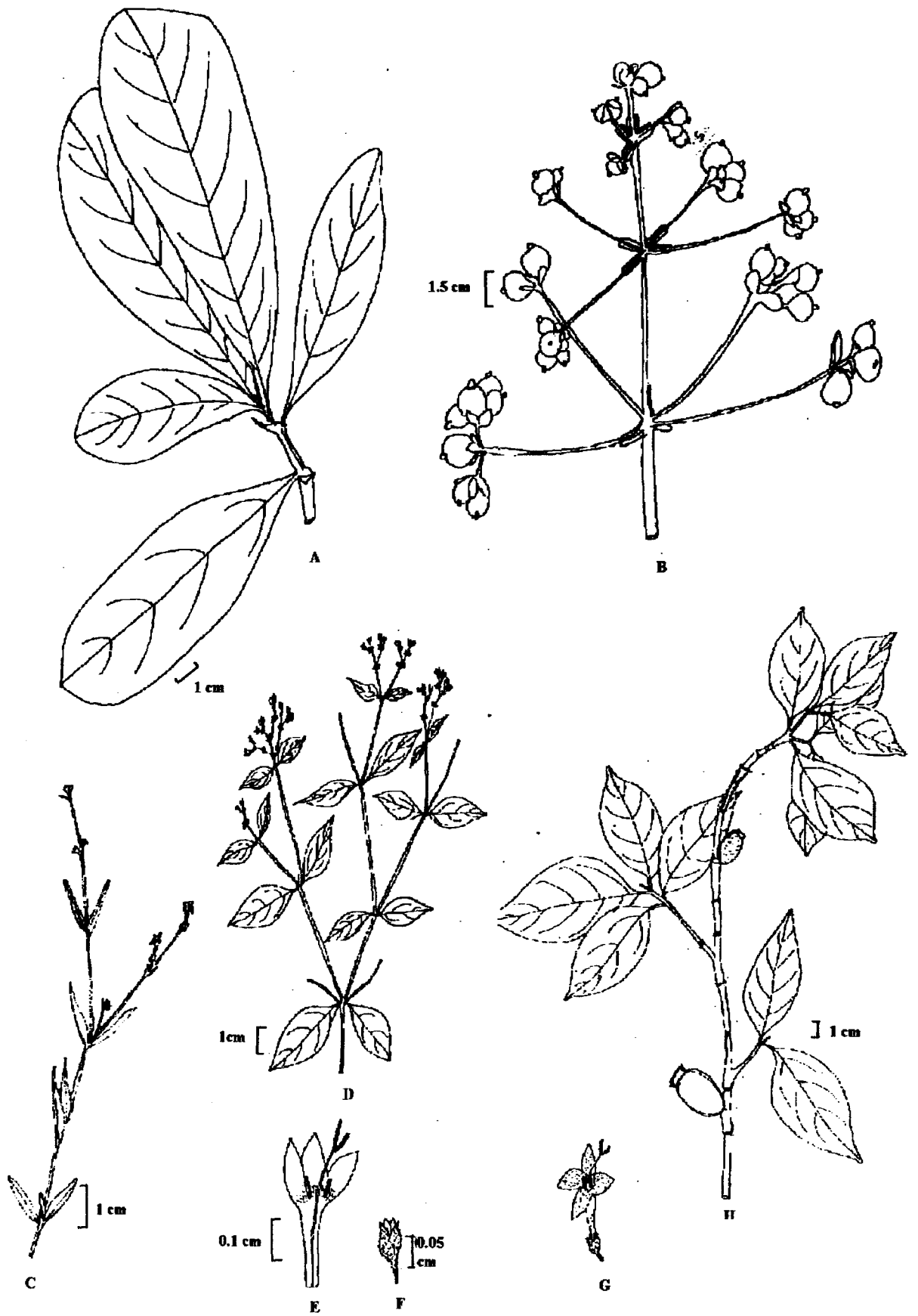
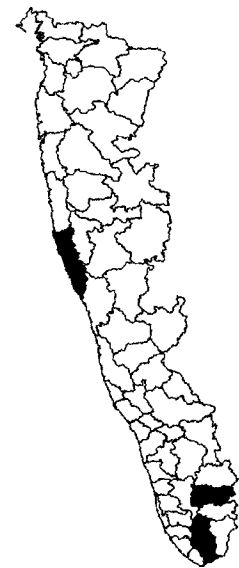
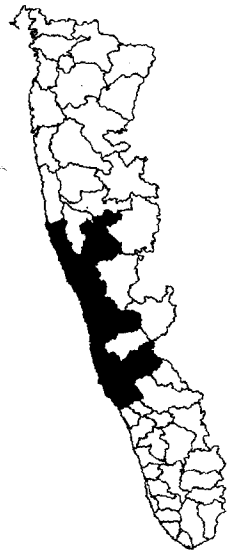
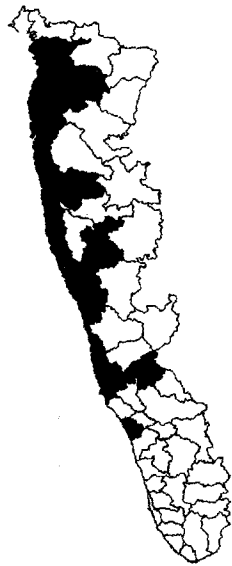


Figure 31: *Psychotria dalzellii* Hook. f.: A. Leaves; B. Inflorescence. *Neanotis foetida* (Dalz.) Lewis.: C. Habit. *Neanotis rheedei* (Wall. ex Wight & Arn.) W. H. Lewis: D. Habit; E. L.S of corolla; F. Calyx; G. Flower. *Tricalysia sphaerocarpa* (Dalz.) Gamble: H. Habit.



PLATE 24: A & B. *Tricalysia sphaerocarpa* (Dalz.) Gamble (A. Flowers, B. Fruits), C. *Psychotria dalzellii* Hook. f., D. *Lindernia manilaliana* Sivarajan, E. *Lindernia estaminodosa* (Blatt. & Halb.) Mukherjee

Map 30: Distribution of *Neanotis foetida*, *Neanotis rheedei*, *Psychotria dalzellii* and *Tricalysia sphaerocarpa* along Western Ghats



- *Neanotis foetida* (Dalz.) Lewis.
- *Psychotria dalzellii* Hook. f.

- *Neanotis rheedei* (Wall. ex Wight & Arn.) W. H. Lewis
- *Tricalysia sphaerocarpa* (Dalz.) Gamble

or reduced; anthers recurved. Ovary small enclosed inside the calyx, stigma short. Berry c 2 x 1.5 cm, green with short beak; fruiting peduncle c 0.4 long with persistent calyx; seeds few, compressed, irregularly arranged, with membranous partition in between. (Fig. 31 H; Plate 24 A-B).

Fl. & Fr.: October – December.

Habitat: Evergreen forest patch.

Distribution: Maharashtra (Sindhudurg); Goa: (Molem – Anmod); Tamil Nadu: (Madurai & Tirunelveli). (Map 30).

Status: (R).

Notes: It is discontinuously distributed throughout the Western Ghats. It is closely related to *T. apiocarpa* (Dalz.) Gamble, which is also endemic to Western Ghats though many characters of leaf and fruit are overlapping. These two species differ as shown below:

<i>Tricalysia spherocarpa</i>	<i>Tricalysia apiocarpa</i>
Flowers fascicled.	Flowers in small cymes.
Calyx lobes oblong – orbicular; stamens sessile.	Calyx minutely toothed; stamens with long filaments
Berry globose; seeds flat, smooth, much compressed with membranous partition in between.	Berry ovoid or globose; seeds irregular, compressed, rugose.
Leaves ovate-elliptic, obtusely acuminate, main nerves six–eight pairs, both main nerves and reticulation not prominent.	Leaves elliptic–lanceolate, acuminate, the main nerves about five pairs, both main nerves and reticulation prominent.

SCROPHULARIACEAE

Lindernia estaminodosa (Blatt. & Hallb.) Mukherjee in J. Ind. Bot. Soc 24: 133. 1945; Almeida, Fl. Savantwadi 1: 200. 1990; Sivarajan & Mathew in J. Bombay Nat. Hist. Soc. 80: 131 – 140. 1980; Cook, Aqua. Wetland Pl. India 354. 1996. *Bonnaya estaminodosa* Blatt. & Hallb. in J. Bombay Nat. Hist. Soc 25: 416. 1918.

Annual, erect herbs, up to 40 cm long. Stems four angled, sparsely hairy. Leaves opposite, decussate, subsessile; lamina up to 2.5 x 0.4 cm, oblong-ob lanceolate, acute at apex, serrate along margins, penninerved. Flowers in terminal bracteate, racemes; bracts c 0.3 cm long; pedicel c 0.5 cm long. Sepals five, c 0.28 cm long, unequal, free from base, linear, acute, purple at apex. Corolla c 0.8 cm long, tube c 0.3 cm long, cylindrical; upper lip entire, lower lip three lobed. Stamens two, arising from the throat; filaments c 0.1 cm; anthers white. Staminodes two, minute arising from throat, linear. Ovary oblong; style c 0.3 cm long, swollen at base; stigma two. Capsule c 0.3 cm long, ellipsoid, beaked; seeds c 0.02 cm, scrobiculate, pointed at both ends. (Fig. 32 A-E; Plate 24 E).

Fl. & Fr.: June – October.

Habitat: This species was observed in brackish water pools in the study area. It was also collected in Vengurla in temporary water pools on gneiss boulders.

Distribution: Maharashtra: (Sindhudurg); Goa: (St.cruz); Kerala (Calicut). (Map 31).

Status: (LR).

Notes: It is distributed in the northern and central Western Ghats. Its distribution is sporadic.

Lindernia manilaliana Sivarajan in Kew Bull. 31: 151. 1976; Manilal & Sivarajan, Fl. Calicut 201. 1982; Bhat in J. Bombay Nat. Hist. Soc. 90 (1): 137 – 139. 1993; Cook, Aqua. Wetland Pl. India 353. 1996.

Erect or prostrate herbs, up to 15 cm long, rooting at lower nodes; stems quadrangular, succulent, stout, smooth. Leaves simple, opposite, decussate, exstipulate; lamina up to 1 x 0.5 cm, serrate, ovate-elliptic, entire, acute at apex,

three nerved from base. Flowers solitary, axillary, ebracteate, two lipped, pedicelate; pedicel c 1.5 cm long. Sepal 5, c 0.2 x 0.1 cm, linear, acute. Corolla lilac with purple tinge, tube c 0.7 cm long, plae lilac, upper lip with two fused petals; lower lip with three lobes, middle lobes c 0.3 x 0.25 cm, obtuse-truncate at apex; lateral lobes c 0.3 x 0.15 cm, acute at apex. petals free at tip; tip acute, pale lilac. Perfect stamens 2, attached on the throat of corolla tube; anthers white, fused at tip; filaments c 0.2 cm long, glabrous. Corolla lobes lilac with purple tinge. Sterile stamens 2, with numerous, pale yellow, glandular hairs. Ovary c 0.1 cm long, oblong with yellowish disc at the base; style c 0.25 cm long; stigma flat, hooked like, filiform, flattened. (Fig. 32 F-I; Plate 24 D).

Fl. & Fr.: July – October.

Habitat: Marshy areas in temporary puddles on plateaus and also in fallow fields.

Distribution: Goa (Taleigao); Karnataka (Uttar Kannada); Kerala (Calicut & Cannanore). (Map 31).

Status: (LR).

Notes: It is distributed in the northern and central Western Ghats. It is a new report to the state of Goa. It is closely related to *L. parviflora* (Roxb.) Haines which is distributed in Indo-China, Africa and major parts of India and *L. hyssopioides* (Linn.) Haines and it can be differentiated from them as follows (Sivarajan l.c.).

<i>L. manilaliana</i>	<i>L. parviflora</i>	<i>L. hyssopioides</i>
Branches stout, not lax.	Branches slender, lax	Branches slender, lax
Leaves ovate – elliptic, sessile, up to 1 x 0.6 cm, upper ones not reduced	Leaves oblong or lanceolate, sessile or petiolate.	Leaves oblong to oblong lanceolate, upper reduced or sessile.
Pedicels not deflexed in fruits up to 1 cm long	Pedicels deflexed in fruits, up to 2 cm long.	Pedicel deflexed in fruits up to 3 cm long.
Sepals linear acute c 0.2 cm long, in fruits	Sepals linear-lanceolate, acute, c 0.3 cm long in fruits.	Sepals linear-lanceolate acute c 0.4 cm long in fruit
Corolla 0.7 cm long.	Corolla up to 0.6 cm long.	Corolla up to 1.2 cm long.
Staminodes not lobed.	Staminodes two lobed.	Staminodes two lobed.

Rhamphicarpa longiflora (Arn.) Benth. in Hook. Camp. Bot. Mag. 1: 368. 1836; Cooke, Fl. Bombay 2: 377. 1967 (repr. ed.); Gamble, Fl. Madras 2: 681. 1967 (repr. ed.); Santapau, Fl. Khandala 184. 1967; Shah, Fl. Gujarat 504. 1978; Manilal & Sivarajan, Fl. Calicut 192. 1982; Rao, Fl. Goa 2: 303. 1986; Subramaniam et al., Fl. Palghat 90. 1987; Kulkarni, Fl. Sindhudurg 303. 1988; Almeida, Fl. Savantwadi 2: 303. 1990; Vajravelu, Fl. Palghat 325. 1990; Lakshminarasimhan & Sharma, Fl. Nasik 345. 1991; Deshpande et al., Fl. Mahabaleshwar 1: 416. 1993; Kothari & Moorthy, Fl. Raigad 280. 1993; Cook, Aqua. Wetland Pl. India 362. 1996. *Buchnea longiflora* Arn. in November. Act. Nat. Cur. 18: 356. 1836.

Erect herbs, up to 15 cm high. Stems quadrangular, branched. Leaves up to 5–6 cm long, decussate, exstipulate, dissected; segments linear, filiform. Flowers axillary, solitary, sessile. Sepals 5, c 1.5 cm long; lobes lanceolate, acuminate at apex. Corolla tube c 4 cm long, cylindrical, slender, hairy within, throat hairy, lobes subequal, white; corolla lobes 5, c 6 cm long. Stamens 4, included inside corolla tube; filaments c 0.2 cm long; anthers cream. Ovary ellipsoid, ovules many; style up to 3.5 cm, long; stigma c 0.8 cm long, clavate, hairy. Capsule c 1.5 cm long, curved, beaked with persistent calyx; seeds c 1 cm long, elongate, black. (Fig. 32 K-N; Plate 25 A-B).

Fl. & Fr.: July – September.

Habitat: On soil covered lateritic plateaus during monsoons.

Distribution: Gujarat (Dharmapur & Balsad); Maharashtra (Nasik, Raigad, Satara, Sindhudurg & Thane); Goa (Goa University Campus, Loliem, Margao & Verna); Karnataka (Belgaum, Chikmagalur, Uttar & Dakshin Kannada); Kerala (Calicut & Palghat). (Map 31).

Status: (LR).

Note: It is distributed in the northern and central Western Ghats. Its flowers open in the evenings and the whole plant turns black on drying. The plateaus appear white when it is in full bloom. Although reported by Pullaiah (l.c.) for Andhra Pradesh, as he has not given any collection details, it is considered endemic to Western Ghats in this work.

Torenia bicolor Dalz. in Hooker's J. Bot. Kew Gard. Misc. 3: 38. 1851; Hook. f., Fl. Brit. India 4: 278. 1884; Saldanha, Bull. Bot. Surv. India 8: 129. 1966; Vartak, Enum. Pl. Gomantak 78. 1966; Cooke, Fl. Bombay 2: 364. 1967 (repr. ed.); Gamble, Fl. Madras 2: 672. 1967 (repr. ed.); Saldanha in Saldanha & Nicolson, Fl. Hassan 527. 1976; Arora et al., Bot. South Kanara 45. 1981; Manilal & Sivarajan, Fl. Calicut 196. 1982; Rao, Fl. Goa 2: 306. 1986; Nair & Nayar, Fl. Courtallum 278. 1986; Henry & Chitra in Henry et al., Fl. Tamil Nadu 2: 126. 1987; Kulkarni, Fl. Sindhudurg 306. 1988; Ramachandran & Nair, Fl. Cannanore 322. 1988; Manilal, Fl. Silent valley 198. 1988; Nair & Nayar, Fl. Courtallum 2. 278. 1988; Almeida, Fl. Savantwadi 305. 1990; Keshava Murthy & Yoganarasimhan, Fl. Coorg 315. 1990; Vajravelu, Fl. Palghat 327. 1990; Sasidharan & Sivarajan, Fl. Thrissur 326. 1996.

Prostrate herbs, rooting at lower nodes; stem succulent, quadrangular, glabrous, greenish-purple, slightly swollen at base near nodes; nodes with fine ciliate hairs. Leaves simple, opposite, decussate, petiolate; petiole c 1.2 cm long, pale green-purple, dense ciliate when young, almost glabrous at maturity; lamina up to 2.2 x 1.3 cm, ovate, alternate, cuneate at base, serrate along margins, acute at apex, dark green adaxially with sparsely placed caducous hairs, silvery white abaxially with prominent mid veins, ciliate along vein. Flowers axillary, solitary, rarely in pairs; pedicel c 1.2

cm long, quadrangular, green, sparsely ciliate; hair falling at maturity. Calyx tube c 1 cm long, green; calyx 2 lipped, upper lip 3 lobed, c 0.3 cm long, lower 2, c 0.4 cm long, slightly longer than than the upper. Corolla tube c 1.7 cm long, dark purple, funnel shaped; upper lip 2, lobed, c 0.7 cm x 0.4 cm, dark purple-violet, lower lip 3-lobed, c 0.7 cm long, rounded-truncate at apex, white with lilac patches. Stamens 4, didynamous; filaments unequal, two long, two short, purple; lower filaments adnate to the throat of corolla tube. Ovary two celled; ovules many in each cell; style slender, flat, pale pink-brown; stigma two lobed amellate. Capsule c 1.5 x 0.5 cm, oblongoid, pointed, winged, green; fruiting pedicel much enlarged in fruits, c 2 cm long. (Fig. 32 O- P; Plate 25 C).

Fl. & Fr.: August – November.

Habitat: Adjacent to streams in marshy areas.

Distribution: Gujarat (Bulsar & Dangs); Maharashtra (Sindhudurg); Goa: (Codal forest; Nirankarichi rai; Ordofond & Vageri Hills -Valpoi); Karnataka (Belgaum, Chikmagalur, Coorg, Hassan, Shimoga, Uttar & Dakshin Kannada); Kerala (Calicut, Cannanore, Quilon, Idukki, Kottayam, Palghat & Thrissur); Tamil Nadu (Coimbatore, Madurai, Nilgiri & Tiruneleveli). (Map 31).

Status: (LR).

Notes: This beautiful herb, distributed throughout the Western Ghats, can be grown as ornamental plant. It is closely related to *T. asiatica* L. which is distributed in W. Peninsula, Sri Lanka, China and Java and differs from it by its long petiole and cuneate leaf base.

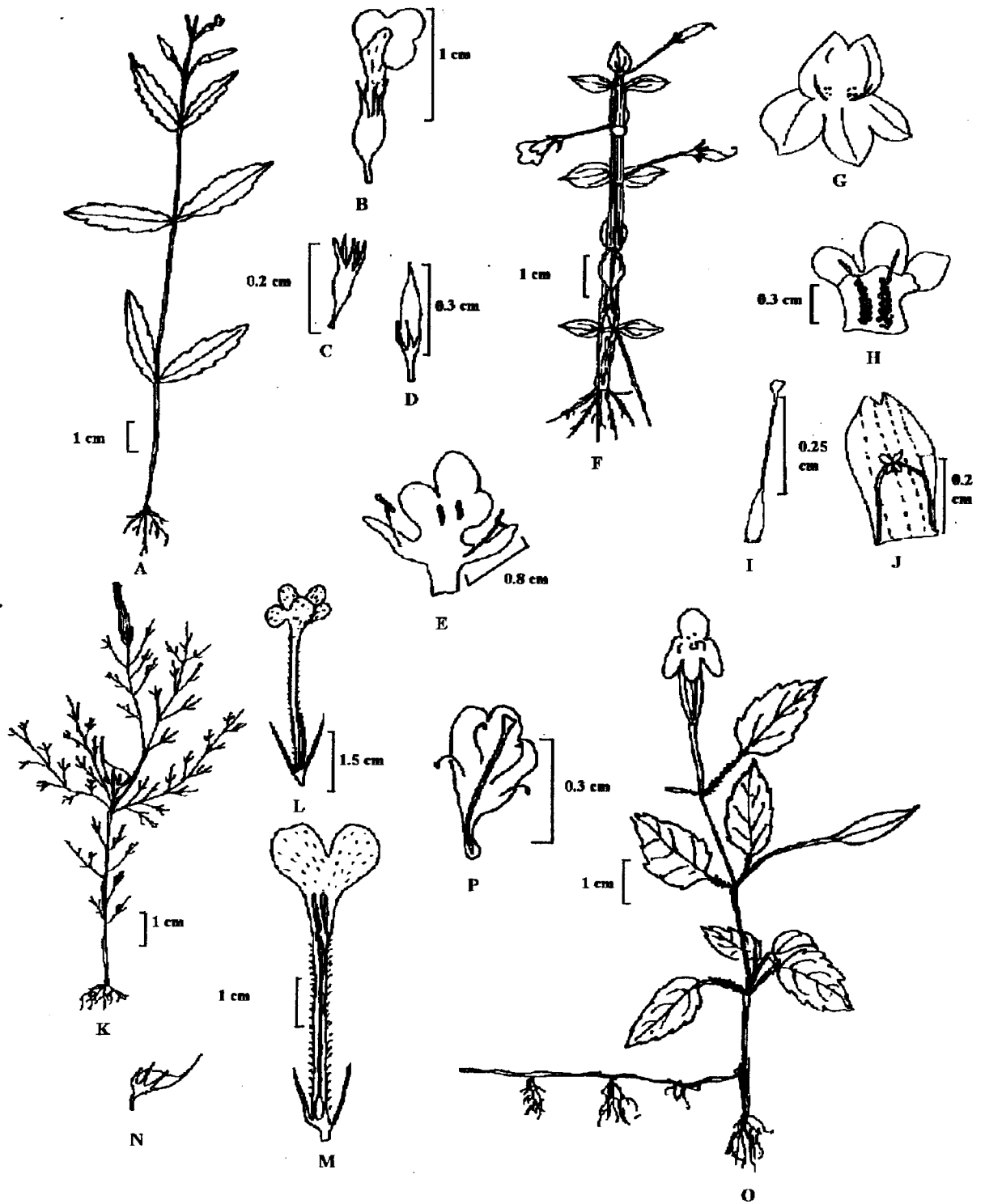


Figure 32: *Lindernia estaminodosa* (Blatt. & Hallb.) Mukherjee: A. Habit; B. Flower; C. Calyx; D. Capsule; E. L.S of flower. *Lindernia manilaliana* Sivarajan: F. Habit; G. Flower; H. L S of corolla; I. Pistil. *Rhamphicarpa longiflora* (Arn.) Benth.: K. Habit; L. Flower; M. L.S of flower; N. Capsule. *Torenia bicolor* Dalz.: O. Habit; P. L.S of flower.

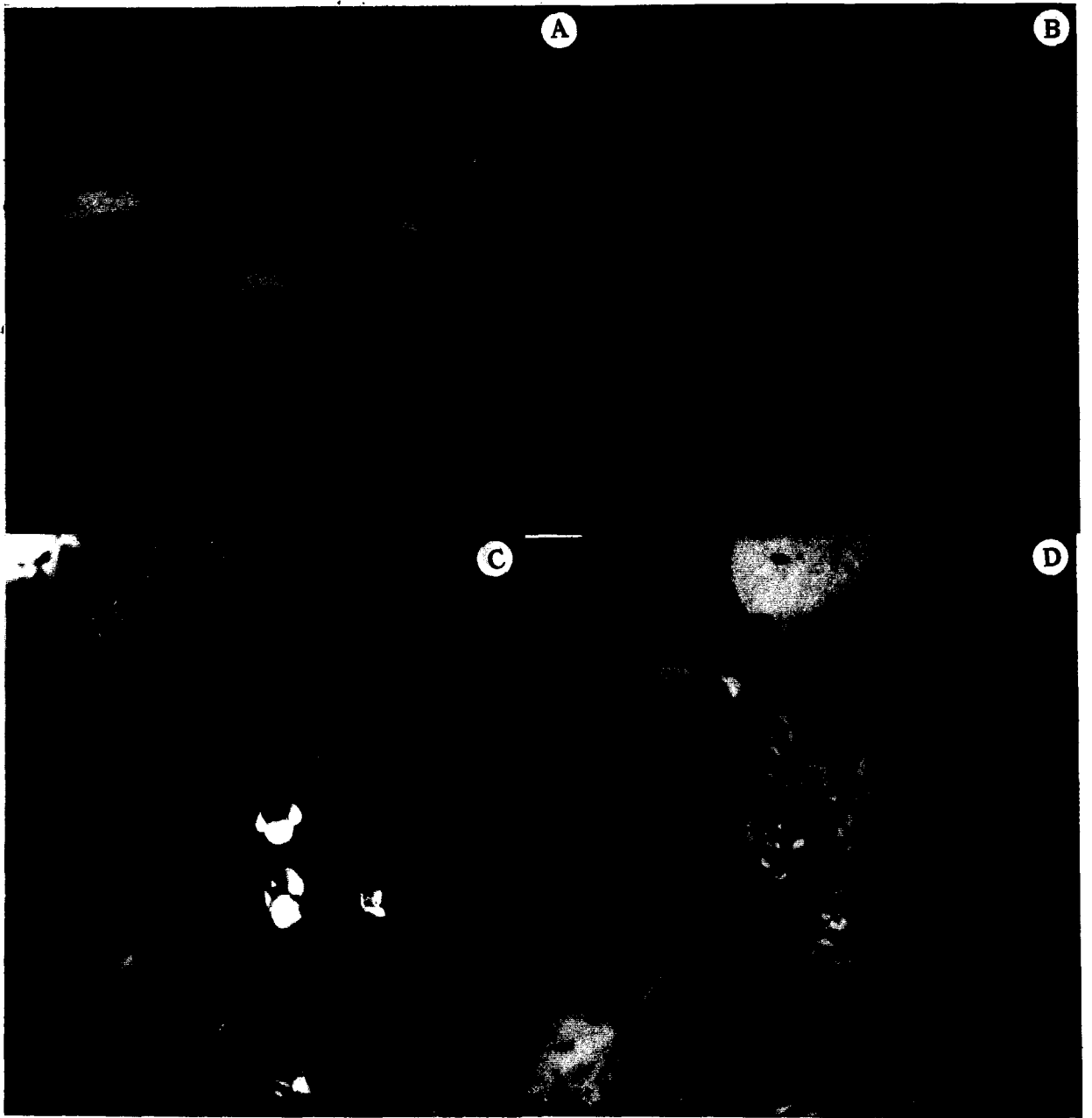
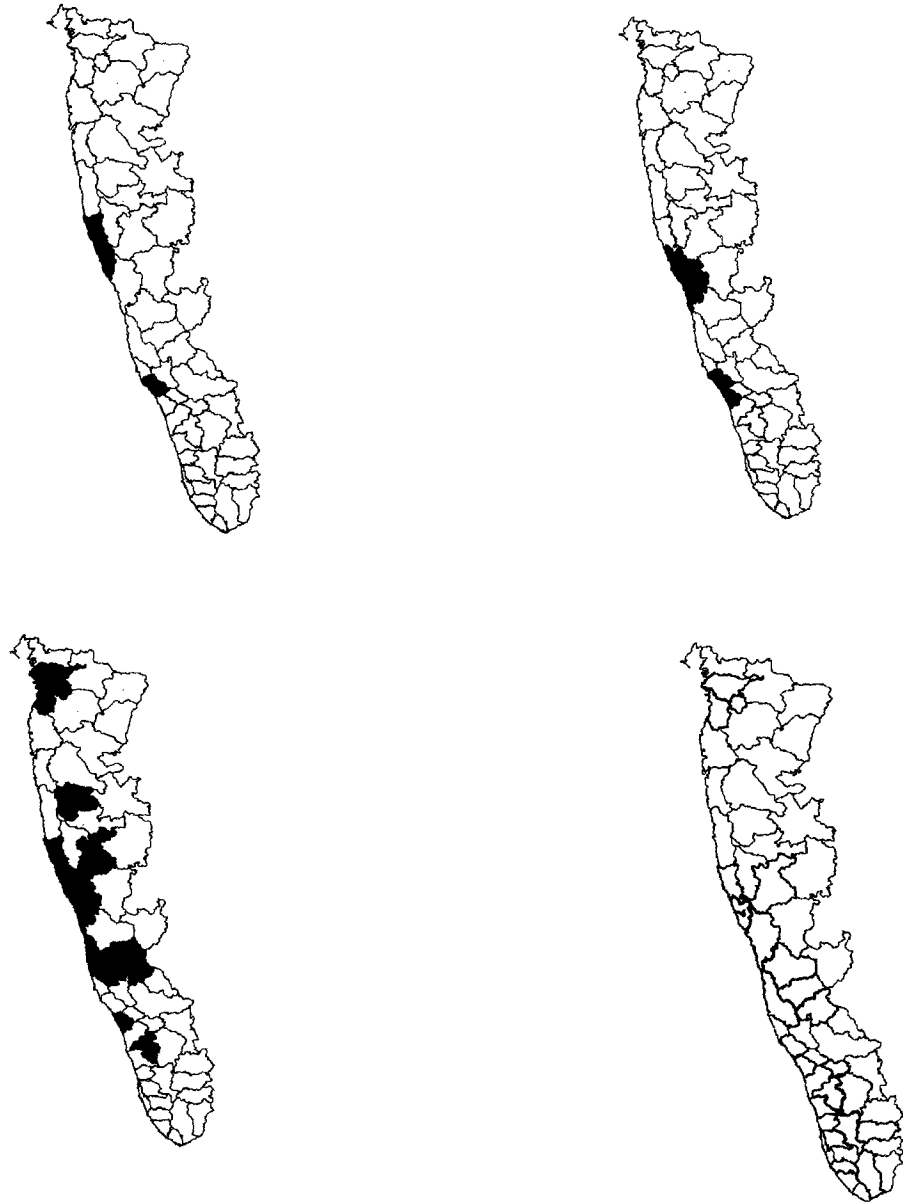


PLATE 25: A & B. *Rhamphicarpa longiflora* (Am.) Benth., C. *Torenia bicolor* Dalz., D. *Zingiber neesanum* (Graham) Ramamoorthy

Map 31: Distribution of *Lindernia estaminodosa*, *Lindernia manilaliana*, *Rhamphicarpa longiflora* and *Torenia bicolor* along Western Ghats.



● *Lindernia estaminodosa*
(Blatt. & Hallb.) Mukherjee

● *Rhamphicarpa longiflora*
(Arn.) Benth.

● *Lindernia manilaliana* Sivarajan

○ *Torenia bicolor* Dalz.

ZINGIBERACEAE

Zingiber neesatum (Graham) Ramamoorthy in Saldanha & Nicolson, Fl. Hassan 769. 1976; Kulkarni, Fl. Sindhudurg 445. 1988; Karthikeyan et al., Fl. Ind. Enum. Mono. 299. 1989; Ramachandran & Nair, Fl. Cannanore 470. 1988; Manilal, Fl. Silent valley. 314. 1988; Almeida, Fl. Savantwadi 2: 27. 1990; Jacob et al. J. Eco. Tax. Bot. 22 (2): 477. 1990; Kothari & Moorthy, Fl. Raigad 396. 1993; Mohanan & Henry, Fl. Thiruvananthapuram 474. 1994; Deshpande et al., Fl. Mahabaleshwar 2: 585. 1995; Lakshminarasimhan, in Sharma et al., Fl. Maharashtra Monocot. 85. 1996; Sasidharan & Sivarajan, Fl. Thrissur 463. 1996; Lakshminarasimhan, in Sharma et al., Fl. Maharashtra Monocot. 85. 1996. *Alpinia neesana* Graham, Cat. Pl. Bombay 207. 1839. *Zingiber macrostachyum* Dalz. in Hooker's. J. Bot. Kew Gard. Misc 4: 342. 1852; Baker in Hook. f., Fl. Brit. India 6: 247. 1892; Cooke, Fl. Bombay 3: 241. 1967 (repr. ed.); Gamble, Fl. Madras 3: 1041. 1967 (repr. ed.)

Herbs, rhizome fleshy, short. Stem up to 70 cm high. Leaves simple, alternate, sessile up to 30 x 6.5 cm, oblong-lanceolate, dark green and glabrous adaxially, pale green and puberulous abaxially, acute at apex, entire along margins; ligules 2-lobed, c 0.5 cm long, obtuse at apex, puberulous; leaf sheath puberulous above, glabrous inside. Spike produced on a elongated peduncle arising from the base of the rhizome; peduncle up to 15 cm long with sheaths; sheath up to 5 cm long, oblong, acute, green, turning red on maturity, slightly pubescent; spike up to 17 cm long, cylindrical; bracts c 3 x 2 cm, green, turning red on maturity, margins transparent; bracteoles c 3 x 1.5 cm. Calyx c 2 cm long, enclosing the corolla tube, pubescent with long stiff hairs at the base, glabrous above, hyaline with nerves, two lobed at apex. Corolla tube c 3 cm long, white; dorsal lobes c 2.7 x 1 cm long, acute, white, with 7-8 nerves, acute at

apex; lateral lobes c 2.5 x 0.5 cm long, acute 4–5 nerved; labellum 3 lobed, two lateral lobes c 1 x 0.5 cm, yellow, acute, frilly along margins, middle lobe c 2 x 1.5 cm, margins crumpled, yellow with purple lines in the center. Anthers subsessile c 1.5 cm long; connective c 1.2 cm long, white; filaments very short. Capsule obovoid, red; seeds black with white aril. (Fig. 29 G-L; Plate 25 D).

Fl. & Fr.: July – October.

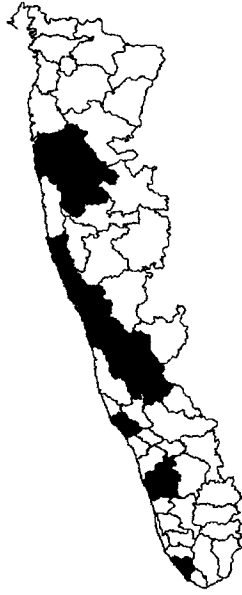
Habitat: In semievergreen forests.

Distribution: **Maharashtra** (Pune, Raigad, Satara & Sindhudurg); **Goa** (Molem – Anmod); **Karnataka** (Chikmagalur, Hassan, Shimoga & Uttar Kannada); **Kerala** (Cannanore, Palghat, Thrissur & Thiruvananthapuram). (Map 32).

Status: (LR).

Notes: It is distributed almost throughout the Western Ghats except in Tamil Nadu. Grahams name is validly published and cited by Dalzell (l.c.), but inaccurately as “Mesana” from “Meesum” instead of “Neesanum” as done by Graham (Saldanha & Nicolson, l.c.).

Map 32: Distribution of **Zingiber neesatum** along Western ghats.



Zingiber neesatum (Graham) Ramamoorthy

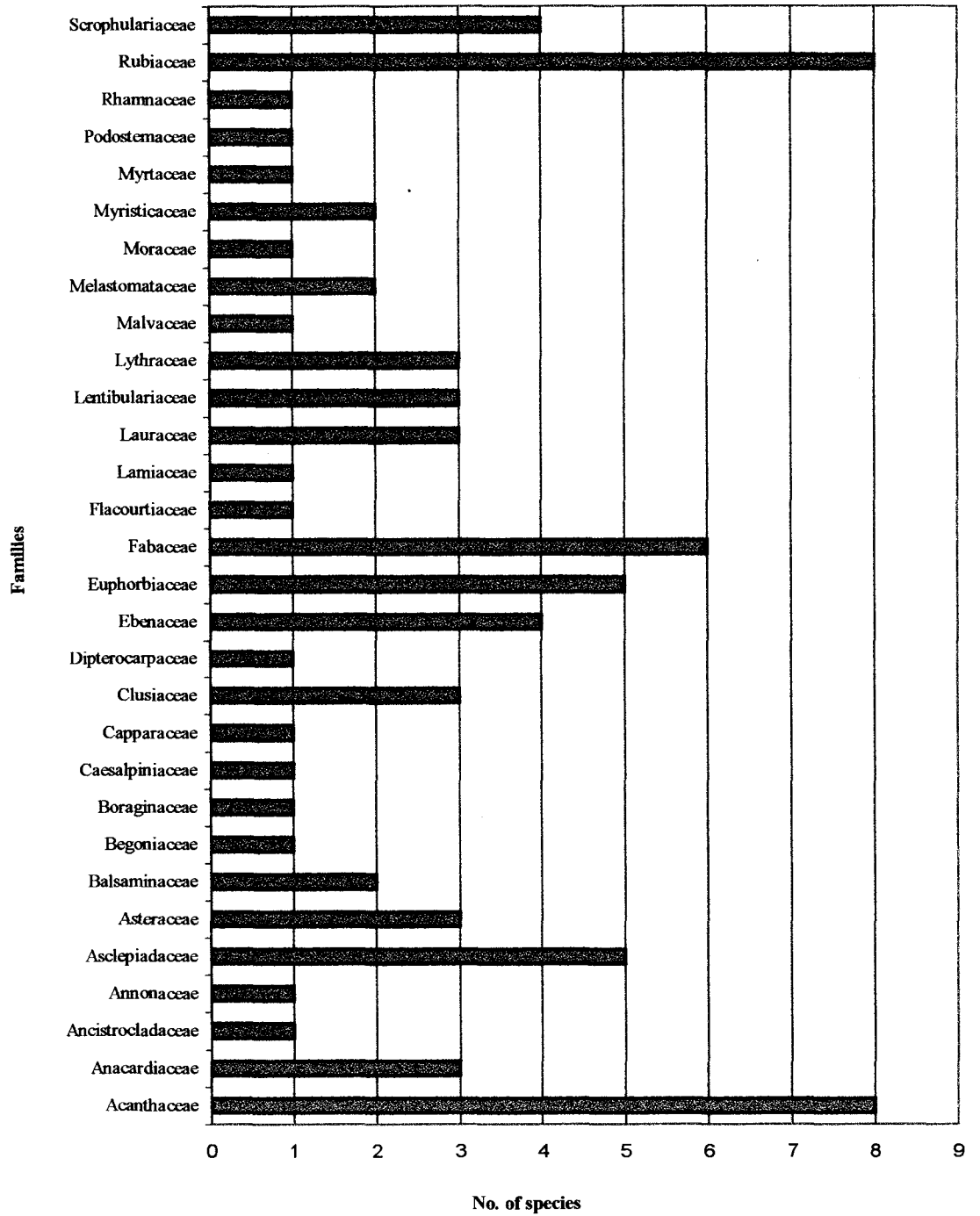
ii) ANALYSIS

Survey of endemic plants of Western Ghats and the West Coast distributed in Goa resulted in the collection of 113 endemic species. Bar graphs were constructed to evaluate family wise distribution of endemics of Western Ghats distributed in Goa (Graph 2 & 3). It was observed that 75 of the collected endemics of Western Ghats distributed in Goa are dicotyledons and 38 are monocotyledons. The family Poaceae has maximum number of endemic species (13 spp.) followed by Acanthaceae and Rubiaceae with eight species in each. There are 16 genera (Graph 4) with two or more species and *Eriocaulon* has maximum number of endemic species of Western Ghats distributed in Goa. To evaluate the habit wise distribution of endemic species of Western Ghats distributed in Goa, a pie graph was constructed (Graph 5) and it is found that the herbaceous endemics are dominant in the study area. To understand habit wise distribution of these endemic species in major habitats of Western Ghats a bar graph was constructed (Graph 6). It shows that the endemic herbs are most dominant on plateaus whereas trees dominate in semievergreen and evergreen forests. The endemic shrubs are more in number in moist deciduous and semievergreen forests. Again to understand the familywise distribution of endemics in major habitats a bar graph was constructed (Graph 7). The families Poaceae, Fabaceae and Eriocaulaceae are distributed more on Plateaus, Rubiaceae and Acanthaceae in moist deciduous, Ebenaceae, Euphorbiaceae and Orchidaceae in semievergreen and Orchidaceae in evergreen forests than any other family (Table 1). A matrix was drawn to find the number of endemic species that are exclusively restricted to their habitats (major & minor) and it is found that 64 species are exclusively distributed in one or the other habitat and the remaining are common to two or more habitats (Table 2). In order to understand flowering season of endemics in relation to their habit and habitat,

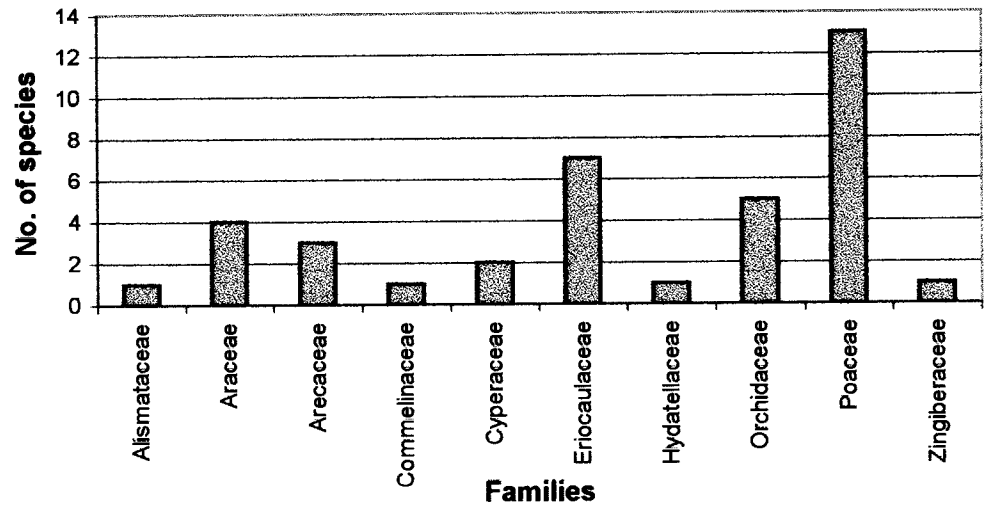
line graphs were constructed (Graph 8 & 9). It was observed that the endemics on plateaus show peak flowering in the month of September and it coincides with the peak flowering of herbs. Graph 10 shows the peak flowering of endemic trees in major habitats of Goa showing slight shift in season. To understand the habit wise distribution pattern of endemic species along the Western Ghats maps were constructed. Map 33 shows that the endemic herbs of Western Ghats present in Goa are distributed more to the Northern Western Ghats, whereas trees and shrubs are distributed more to the Southern Western Ghats (Map 34 & 35). However, climbers do not show any distinct pattern of distribution (Map 36). The endemic species show different patterns of distribution along the Western Ghats. Certain endemic species are distributed only in the Northern and Central Western Ghats (Table 3) and some in the southern Western Ghats (Table 4). About 25 endemic species (Table 5) are distributed throughout the Western Ghats, whereas 19 species show discontinuous distribution (Table 6). In addition to these are some endemic species that are restricted to just one to three districts along the Western ghats (Table 7 & 8). During the present study, it was observed that some of the endemic species collected in the study area are not reported by recent works on endemism (Table 9). Whereas some other species (Table 10) reported to be endemic, were observed to have a wider distribution and they are not endemic any more. Table 12 show endemic species of Western Ghats present in Goa which are new records to Goa as they were not collected by previous workers. All the collected endemic species have been assigned categories as per the IUCN norms and only two fall under endangered category and others in remaining categories (Table 13). Some of the endemics species distributed in Goa and figuring in the Red data book are reported in Table 14. As the taxonomic and nomenclature stability is an index of distinctness of species, a bar graph was constructed to find out

the years in which the maximum number of endemic species were first published (Graph 11). It is found out that most of them were published between 1826 –1875. Table 15 shows that Dalzell first published more number of endemic species of Western Ghats distributed in Goa. Most of the endemics in the study area were observed to be taxonomically distinct and only a few endemics had more than three synonyms (Table 11). Using the distribution of herbs along the Western Ghats as criterion, a dendrogram (Fig. 33) was constructed using Cosine of Vectors of Values and Average Linkage (between groups) method in Statistical Package for Social Sciences. It shows distinct clusters in which Goa shares similarity with Sindhudurg than any other locality.

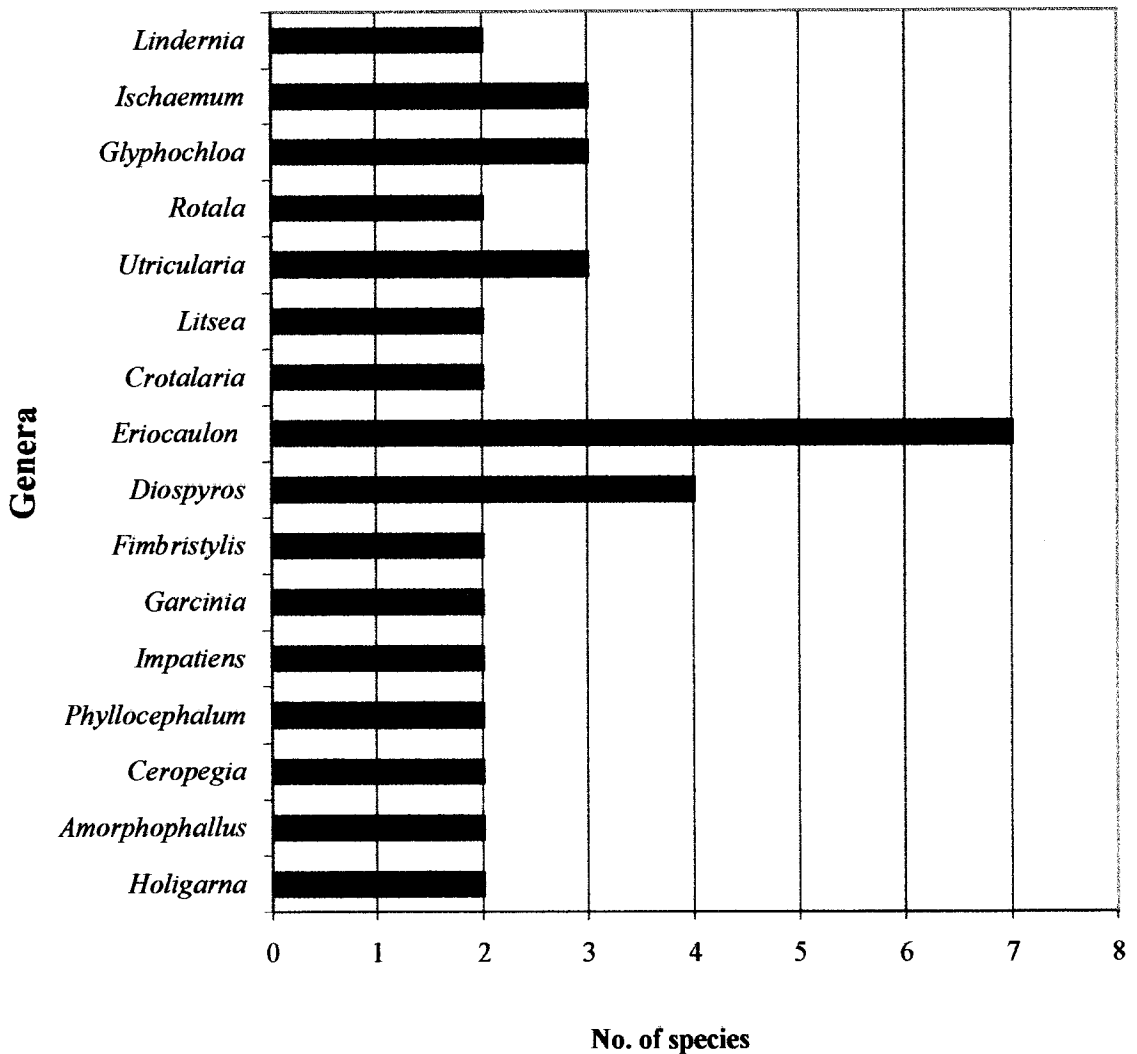
Graph 2: Familywise distribution of endemic species of Western Ghats in Goa (Dicotyledons)



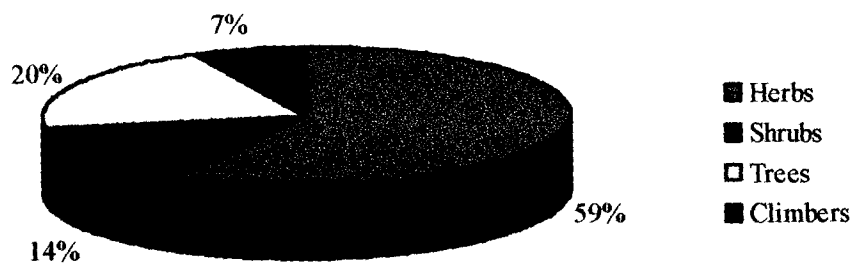
Graph 2: Familywise distribution of endemic species of Western Ghats in Goa (Monocotyledons)



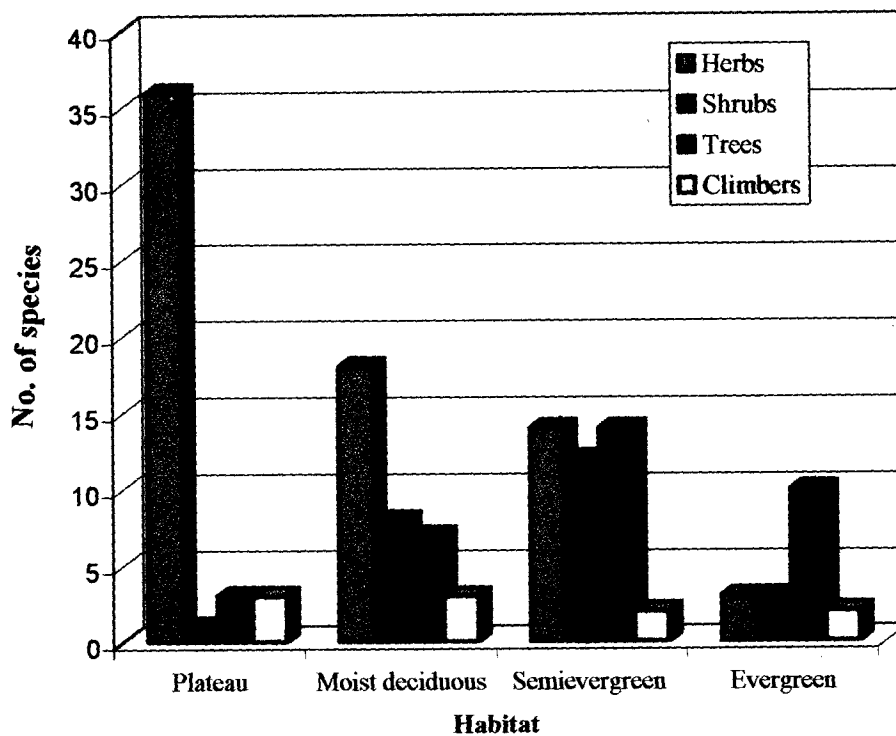
Graph 3: Genera with more than one endemic species of Western Ghats in Goa



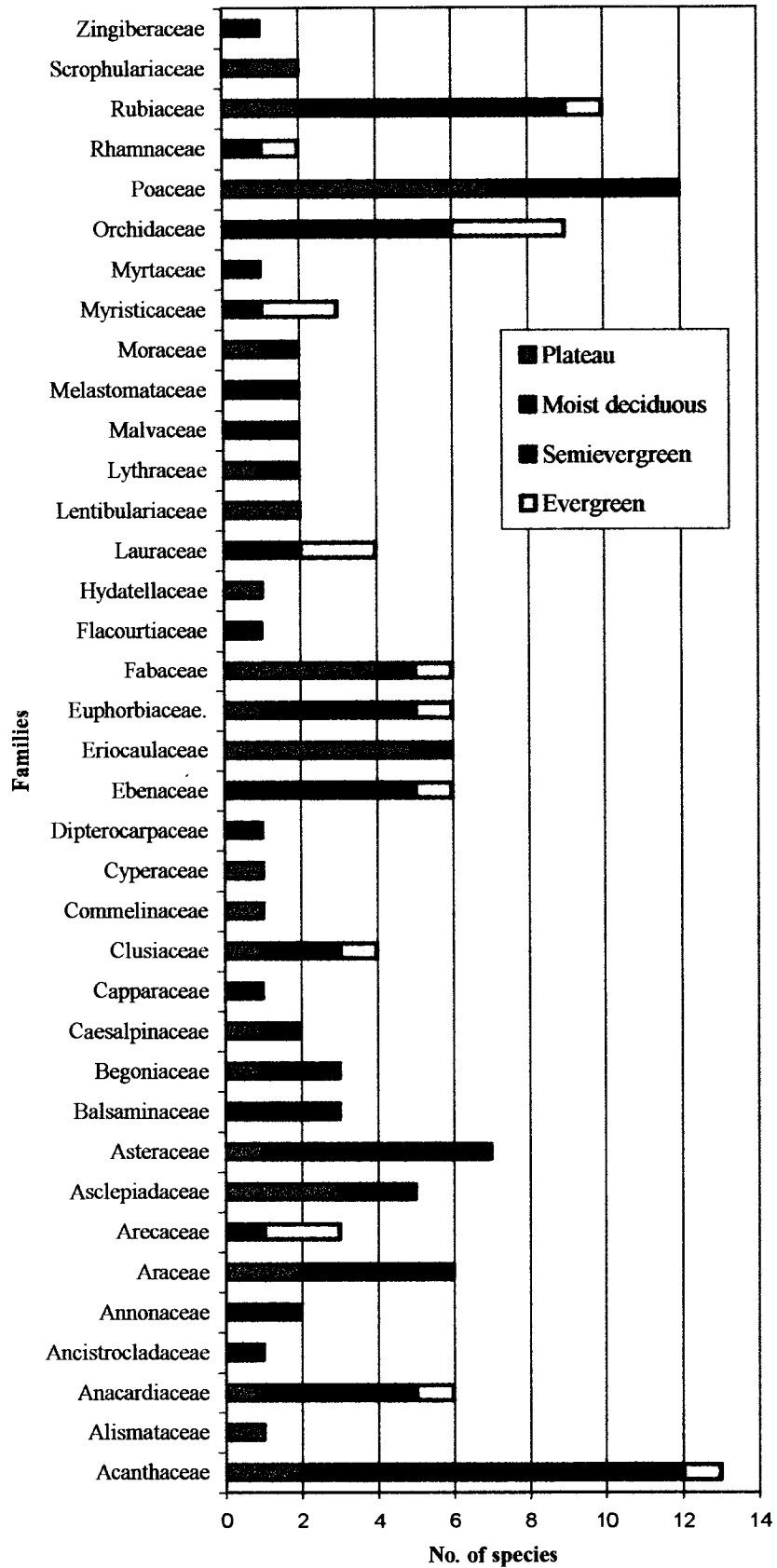
Graph 5: Habitwise distribution of endemic species of Western Ghats in Goa



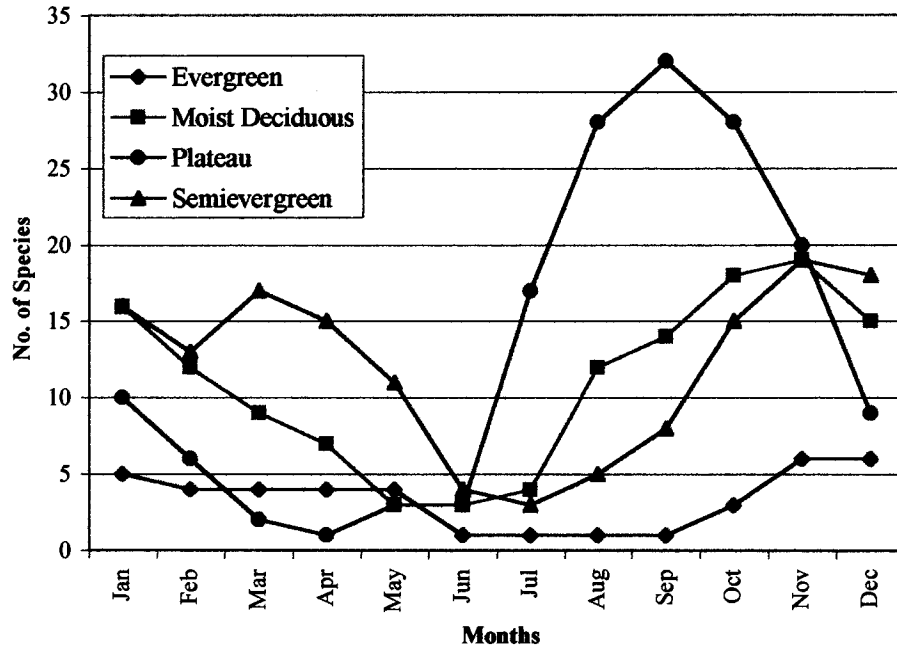
Graph 6: Habitwise distribution of endemic species of Western Ghats in different habitats of Goa.



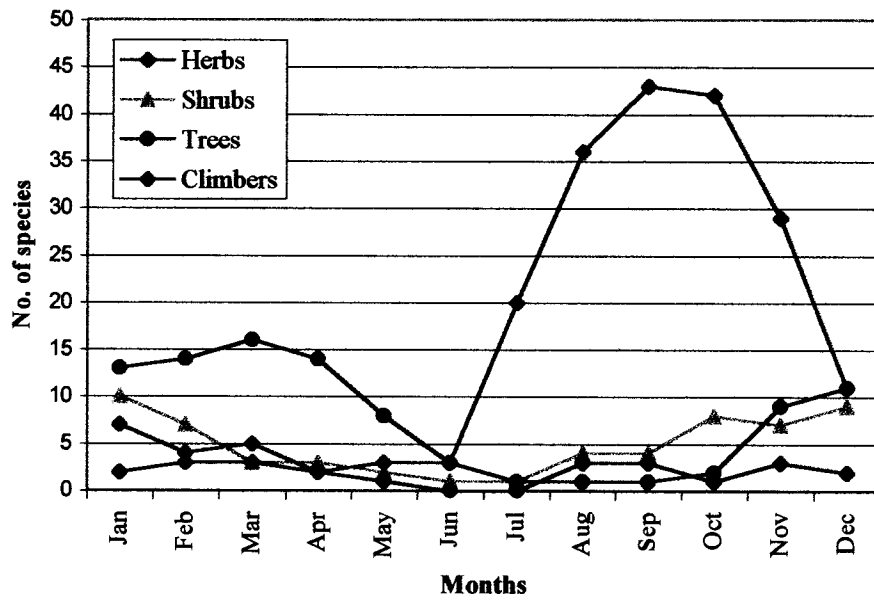
Graph 7: Familywise distribution of endemic species of Western Ghats in major habitats of Goa



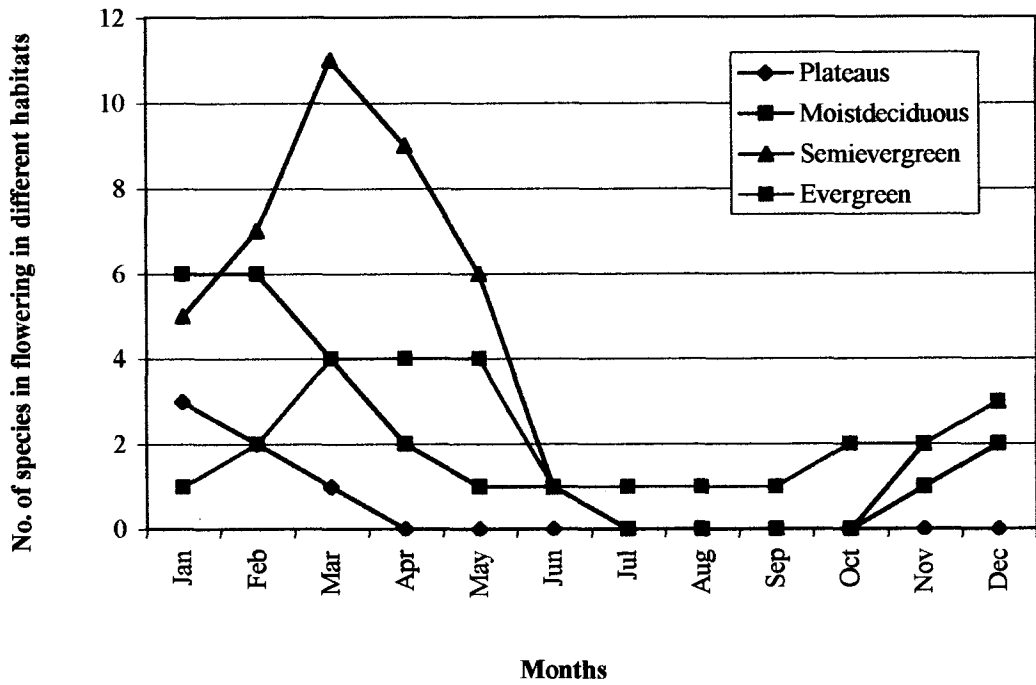
Graph 8: Monthwise flowering pattern of endemic species of Western ghats in major habitats of Goa



Graph 9: Monthwise flowering pattern (habitwise) of endemic species of Western ghats in Goa



Graph 10: Monthwise flowering pattern of endemic trees of Western Ghats in major habitats of Goa



Graphs 11: Number of first published species for each quarter century *

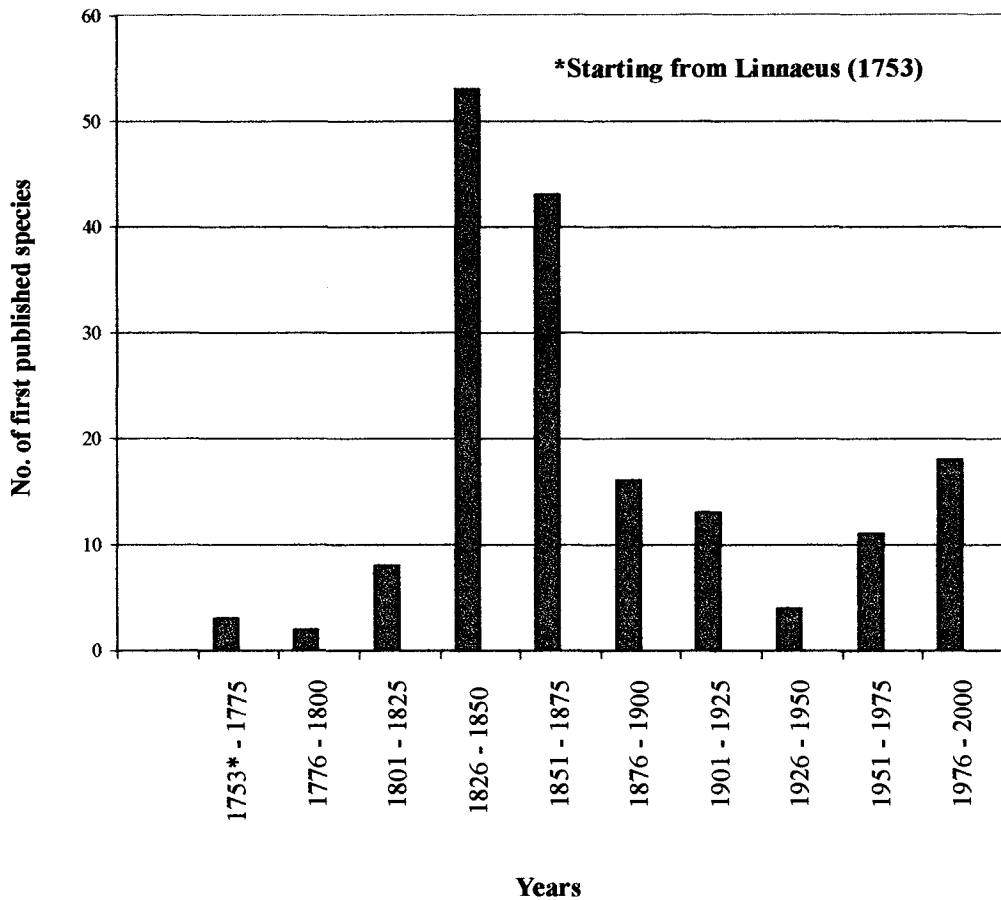


Table 1: Dominant families in major habitats of Goa

Habitats	Families
Plateau	Eriocaulaceae, Fabaceae & Poaceae
Moist deciduous	Acanthaceae & Rubiaceae
Semievergreen	Acanthaceae, Ebenaceae & Orchidaceae
Evergreen	Areaceae, Myristicaceae, Lauraceae & Orchidaceae

Table2: Distribution of Endemic species of Western Ghats in different habitats of Goa

A	26							
B	11	9						
C	2	16	9					
D	0	0	11	7				
E	2	0	0	0	3			
F	0	0	2	0	0	7		
G	7	7	0	0	0	0	2	
H	0	0	0	0	0	0	0	1
	A	B	C	D	E	F	G	H

A = Plateau, **B** = Moist deciduous, **C** = Semievergreen,

D = Evergreen, **E** = Fields, **F** = Stream, Lakes and Rivers,

G = Open area other than Plateau, **H** = Beaches

Table 3: Endemic species predominantly distributed in the Northern and Central Western Ghats

Species	Families
<i>Barleria strigosa</i> Willd. var. <i>terminalis</i> (Nees) Clarke	Acanthaceae
<i>Gymnostachyum glabrum</i> (Dalz.) T. Ander.	Acanthaceae
<i>Mackenzia integrifolia</i> (Dalz.) Bremek.	Acanthaceae
<i>Neuracanthus sphaerostachyus</i> (Nees) Dalz.	Acanthaceae
<i>Amorphophallus commutatus</i> (Schott) Engl.	Araceae
<i>Amorphophallus konkanensis</i> Hetterschied et al.	Araceae
<i>Arisaema sivasadanii</i> Yadav et al.	Araceae
<i>Cryptocoryne cognata</i> Schott	Araceae
<i>Calamus thwaitesii</i> Becc. & Hook. f.	Arecaceae
<i>Hyphaene dichotoma</i> (Wight) Furtado	Arecaceae
<i>Brachystelma malwanense</i> Yadav & Singh	Asclepiadaceae
<i>Ceropegia attenuata</i> Hook.	Asclepiadaceae
<i>Ceropegia fantastica</i> Sedgw.	Asclepiadaceae
<i>Heterostemma dalzellii</i> Hook. f.	Asclepiadaceae
<i>Phyllocephalum ritchiei</i> (Hook. f.) Narayana	Asteraceae
<i>Senecio belgaumensis</i> (Wight) Clarke	Asteraceae
<i>Impatiens kleiniformis</i> Sedgw.	Balsaminaceae
<i>Impatiens pulcherrima</i> Dalz.	Balsaminaceae
<i>Moullava spicata</i> (Dalz.) Nicolson	Caesalpiniaceae
<i>Garcinia indica</i> (Dupetite – Thouars) Choiss.	Clusiaceae
<i>Murdannia versicolor</i> (Dalz.) Brueckner	Commelinaceae
<i>Fimbristylis lawiana</i> (Boeck.) Kern	Cyperaceae
<i>Eriocaulon cuspidatum</i> Dalz.	Eriocaulaceae
<i>Eriocaulon dalzellii</i> Koern.	Eriocaulaceae
<i>Eriocaulon eurypeplon</i> Koern.	Eriocaulaceae
<i>Eriocaulon fysonii</i> Ansari & Balakr.	Eriocaulaceae
<i>Eriocaulon lanceolatum</i> Miq. ex Koernick	Eriocaulaceae
<i>Euphorbia notoptera</i> Boiss.	Euphorbiaceae
<i>Phyllanthus talbotii</i> Sedgwick	Euphorbiaceae
<i>Crotalaria filipes</i> Benth.	Fabaceae
<i>Crotalaria lutescens</i> Dalz.	Fabaceae
<i>Geissaspis tenella</i> Benth	Fabaceae
<i>Indigofera dalzellii</i> Cooke	Fabaceae
<i>Trithuria konkanensis</i> Yadav & Janarthanam	Hydatellaceae
<i>Utricularia lazulina</i> Taylor	Lentibulariaceae
<i>Utricularia malabarica</i> Janathanam & Henry	Lentibulariaceae
<i>Utricularia praeterita</i> Taylor	Lentibulariaceae
<i>Decaschistia trilobata</i> Wight	Malvaceae
<i>Eugenia macrocephala</i> Duthie	Myrtaceae
<i>Aerides dalzelliana</i> (Sant.) Garay	Orchidaceae
<i>Arthraxon lanceolatus</i> (Roxb.) Hochst var. <i>meeboldii</i> (Stapf.) Welzen	Poaceae
<i>Arundinella metzii</i> Hochst. ex Miq.	Poaceae
<i>Dimeria woodrowii</i> Stapf	Poaceae
<i>Glyphochloa acuminata</i> (Hack.) Clayton var. <i>woodrowii</i> (Bor) Clayton	Poaceae
<i>Glyphochloa goaensis</i> (Rao & Hemadri) Clayton	Poaceae
<i>Glyphochloa talbotii</i> (Hook. f.) Clayton	Poaceae
<i>Ischaemum dalzellii</i> Stapf ex Bor	Poaceae
<i>Ischaemum jayachandranii</i> Ansari et al.	Poaceae
<i>Panicum paianum</i> Nair & Patunkar	Poaceae
<i>Paspalum canarae</i> (Steud.) Veldk. var. <i>fimbriatum</i> (Bor.)	Poaceae
<i>Griffithella hookeriana</i> (Tulasne) Warming	Podostemaceae
<i>Ventilago bombatensis</i> Dalz.	Rubiaceae
<i>Hedyotis maheshwarii</i> (Sant. & Merch.) Rao & Hemadri	Rubiaceae
<i>Neanotis foetida</i> (Dalz.) Lewis.	Rubiaceae
<i>Lindernia estaminodosa</i> (Blatt. & Hallb.) Mukherjee	Scrophulariaceae
<i>Lindernia manilaliana</i> Sivarajan	Scrophulariaceae
<i>Rhamphicarpa longiflora</i> (Arn.) Benth.	Scrophulariaceae

Table 4: Endemic species predominately distributed in Southern Western Ghats

Species	Families
<i>Nilgirianthus barbatus</i> (Nees) Bremek.	Acanthaceae
<i>Holigarna arnottiana</i> Hook. f.	Anacardiaceae
<i>Arenga wightii</i> Griff.	Arecaceae
<i>Capparis rheedii</i> DC.	Capparaceae
<i>Hopea ponga</i> (Dennst.) Mabberley	Dipterocarpaceae
<i>Diospyros paniculata</i> Dalz.	Ebenaceae
<i>Diospyros pruriens</i> Dalz.	Ebenaceae
<i>Litsea coriacea</i> (Heyne ex Meisner) Hook. f.	Lauraceae
<i>Rotala malampuzhensis</i> Nair	Lythraceae
<i>Artocarpus hirsutus</i> Lam.	Lythraceae
<i>Gymnacantha farquhariana</i> (Hook. & Thom.) Warburg	Myristicaceae
<i>Oberonia brachyphylla</i> Blatter & McCan.	Orchidaceae

Table 5: Endemic species distributed throughout Western Ghats

Species	Families
<i>Haplanthodes neilgherryensis</i> (Wight) Majumdar	Acanthaceae
<i>Justicia wynaadensis</i> (Nees) Wall. ex T. Anders.	Acanthaceae
<i>Thelepaepale ixiocephala</i> (Benth.) Bremek.	Acanthaceae
<i>Holigarna grahamii</i> (Wight) Kurz.	Anacardiaceae
<i>Ancistrocladus heyneanus</i> Wall. ex Graham	Ancistrocladaceae
<i>Sageraea laurina</i> Dalz.	Annonaceae
<i>Tylophora dalzellii</i> Hook. f.	Asclepiadaceae
<i>Begonia crenata</i> Dryand.	Begoniaceae
<i>Adelocaryum coelestinum</i> (Lindl.) Brand	Boraginaceae
<i>Calophyllum calaba</i> Linn.	Clusiaceae
<i>Bruxanellia indica</i> Dennst. ex Kostel	Euphorbiaceae
<i>Dimorphocalyx glabellus</i> Thw. var. <i>lawianus</i> (Hook. f.) T. Chakrab. & Balakr.	Euphorbiaceae
<i>Hydnocarpus pentandra</i> (Buch. - Ham.) Oken,	Lauraceae
<i>Lagerstroemia microcarpa</i> Wight	Lythraceae
<i>Memecylon talbotianum</i> Brandis	Melastomataceae
<i>Sonerila rheedii</i> Wight & Arn.	Melastomataceae
<i>Knema attenuata</i> (Wall. ex Hook. f., & Thoms) Warb	Myristicaceae
<i>Porpax jerdoniana</i> (Wight) Rolfe	Orchidaceae
<i>Dendrobium ovatum</i> (Willd.) Kranzl	Orchidaceae
<i>Ixora brachiata</i> Roxb.	Rubiaceae
<i>Mussaenda laxa</i> Hutchin. ex Gamble	Rubiaceae
<i>Neanotis rheedei</i> (Wall. ex Wight & Arn.) W. H. Lewis	Rubiaceae
<i>Psychotria dalzellii</i> Hook. f.	Rubiaceae
<i>Torenia bicolor</i> Dalz.	Scrophulariaceae
<i>Zingiber neesanum</i> (Graham) Ramamoorthy	Zingiberaceae

Table 6: Endemic species of Western Ghats with discontinuous distribution

Species	Family
<i>Wiesneria triandra</i> (Dalz.) Micheli	Alismataceae
<i>Phyllocephalum tenue</i> (Clarke) Narayana	Asteraceae
<i>Garcinia talbotii</i> Raiz.	Clusiaceae
<i>Fimbristylis dauciformis</i> Govind.	Cyperaceae
<i>Diospyros angustifolia</i> (Miq.) Kosterman	Ebenaceae
<i>Diospyros saldanhae</i> Kosterman	Ebenaceae
<i>Eriocaulon redactum</i> Rhuland	Eriocaulaceae
<i>Eriocaulon stellulatum</i> Koern.	Eriocaulaceae
<i>Drypetes venusta</i> (Wight) Pax & Hoffm.	Euphorbiaceae
<i>Derris heyneana</i> (Wight & Arn.) Benth.	Fabaceae
<i>Spatholobus purpureus</i> Benth. ex Baker	Fabaceae
<i>Eusteralis tomentosa</i> (Dalz.) Panig.	Lamiaceae
<i>Cryptocarya lawsonii</i> Gamble	Lauraceae
<i>Litsea ghatica</i> Saldanha	Lauraceae
<i>Rotala macrandra</i> Koehne	Lythraceae
<i>Eria dalzellii</i> (Hook. ex Dalz.) Lindl.	Orchidaceae
<i>Ischaemum travancorense</i> Stapf ex C. E. C. Fischer	Poaceae
<i>Ophiuros bombaiensis</i> Bor	Poaceae
<i>Tricalysia sphaerocarpa</i> (Dalz.) Gamble	Rubiaceae

Table 7: Endemic species of Western Ghats distributed in only one district other than Goa

Species	Distribution
<i>Amorphophallus konkanensis</i> Hettterschied et al.	Sindhudurg
<i>Brachystelma malwanense</i> Yadav & Singh	Sindhudurg
<i>Ceropegia fantastica</i> Sedgw.	Uttar Kannada
<i>Cryptocoryne cognata</i> Schott.	Sindhudurg
<i>Eriocaulon redactum</i> Rhuland	Thiruvananthapuram
<i>Fimbristylis dauciformis</i> Govind.	Palghat
<i>Garcinia talbotii</i> Raiz. ex Santapau	Sindhudurg

Table 8: Endemic species of Western Ghats distributed in two or three districts other than Goa

Species	Districts
<i>Aerides dalzelliana</i> (Sant.) Garay	Belgaum, Satara & Thane
<i>Arisaema sivadasanii</i> Yadav et al.	Sindhudurg
<i>Dimeria woodrowii</i> Stapf.	Sindhudurg & Ratnagiri
<i>Diospyros angustifolia</i> (Miq.) Kosterman	Sindhudurg, Hassan & Thane
<i>Eriocaulon eurypeplon</i> Koern.	Kasargod, Satara & Thane
<i>Eriocaulon fysonii</i> Ansari & Balakr	Uttar Kannada & Ratnagiri
<i>Eriocaulon stellulatum</i> Koern.	Uttar Kannada, Kolhapur & Satara
<i>Eugenia macrocephala</i> Duthie	Uttar Kannada, Shimoga & Mysore
<i>Fimbristylis lawiana</i> (Boeck.) Kern	Belgaum & Thane
<i>Lindernia manilaliana</i> Sivarajan	Kolhapur & Calicut
<i>Oberonia brachyphylla</i> Blatter & McCan.	Hassan, Chikmagalur & Palghat
<i>Phyllanthus talbotii</i> Sedgwick	Uttar Kannada, Mysore & Shimoga
<i>Phyllocephalum ritchiei</i> (Hook. f.) Narayana	Sindhudurg, Belgaum & Uttar Kannada
<i>Trithuria konkanensis</i> Yadav & Janarthanam	Sindhudurg & Dakshin Kannada

Table 9: Species added to the endemic plant species list of Western Ghats

Species	Distribution
<i>Amorphophallus konkanensis</i> Hetterschied et al.	Sindhudurg - Goa
<i>Arisaema sivasadanii</i> Yadav et al.	Sindhudurg - Goa
<i>Barleria strigosa</i> Willd. var. <i>terminalis</i> (Nees) Clarke	Thane - Hassan
<i>Brachystelma malwanense</i> Yadav & Singh	Sindhudurg - Goa
<i>Gymnostachyum glabrum</i> (Dalz.) T. Ander.	Satara - Uttar Kannada
<i>Heterostemma dalzellii</i> Hook. f.	Pune - Goa

Table 10: Species declared endemic to Western Ghats by earlier workers but showing extended distribution outside the Western Ghats

Species	Previous distribution	Extended distribution
<i>Asystasia dalzelliana</i> Sant.	Western Ghats	Salem & Erode
<i>Blepharis asperrima</i> Nees	Northern & Central Western Ghats	Madhya Pradesh
<i>Canscora pauciflora</i> Dalz.	Western Ghats	Andhra Pradesh
<i>Canscora perfoliata</i> Lam.	Western Ghats	Andhra Pradesh
<i>Carvia callosa</i> (Nees) Brem.	Central & Northern Western Ghats	Madhya Pradesh & Rajasthan
<i>Curcuma decipiens</i> Dalz.	Western Ghats	Arcot
<i>Ervatamia alternifolia</i> (L.) Almeida	Western Ghats	Madhya Pradesh
<i>Exacum pumilum</i> Griseb.	Central Western Ghats	Throughout India
<i>Glochidion ellipticum</i> Wight	Western Ghats	Madhya Pradesh
<i>Habenaria multicaudata</i> Sedgw.	Uttar Kannada – Anamalais & Southern Western Ghats	Tamil nadu (Eastern Ghats)
<i>Helicanthus elastica</i> (Desr.) Danser.	Western Ghats	Ramnathapuram
<i>Hoya wightii</i> Hook. f.	Southern Western Ghats	Madhya Pradesh
<i>Hymenodictyon obovatum</i> Wall.	Western Ghats	Tamil Nadu, Andhra Pradesh, Orissa and Assam
<i>Jasminum malabaricum</i> Wight	Western Ghats	Andhra Pradesh Madhya Pradesh and Tamil Nadu
<i>Justicia trinervia</i> Vahl	West coastal Plains	Andhra Pradesh & Rajasthan
<i>Nilgirianthus heyneanus</i> (Nees) Bremek.	Western Ghats	Andhra Pradesh, Madhya Pradesh and Rajasthan
<i>Theriophonum dalzellii</i>	Western Ghats	Salem

Table 11: Endemic species of Western Ghats present in Goa with three or more than three synonyms

Species	No. of synonyms
<i>Aerides dalzelliana</i> (Sant.) Garay	6
<i>Eriocaulon cuspidatum</i> Dalz.	5
<i>Eria dalzellii</i> (Hook. ex Dalz.) Lindl.	4
<i>Haplanthodes neilgherryensis</i> (Wight) Majumdar	3

Table 12: Endemic species of Western Ghats, which were not collected by earlier workers in the study area

Species	Family
<i>Nilgirianthus barbatus</i> (Nees) Bremek.	Acanthaceae
<i>Wiesneria triandra</i> (Dalz.) Micheli	Alismataceae
<i>Ancistrocladus heyneanus</i> Wall. *	Ancistrocladaceae
<i>Arisaema sivadasanii</i> Yadav et al.	Araceae
<i>Arenga wightii</i> Griff.	Arecaceae
<i>Brachystelma malwanense</i> Yadav & Singh	Asclepiadaceae
<i>Phyllocephalum ritchiei</i> (Hook. f.) Narayana	Asteraceae
<i>Fimbristylis dauciformis</i> Govind.	Cyperaceae
<i>Fimbristylis lawiana</i> (Boeck.) Kern	Cyperaceae
<i>Eriocaulon dalzellii</i> Koern.	Eriocaulaceae
<i>Eriocaulon eurypeplon</i> Koern.	Eriocaulaceae
<i>Eriocaulon fysonii</i> Ansari & Balakr.	Eriocaulaceae
<i>Eriocaulon lanceolatum</i> Miq. ex Koernick	Eriocaulaceae
<i>Eriocaulon redactum</i> Rhuland	Eriocaulaceae
<i>Drypetes venusta</i> (Wight) Pax & Hoffm.	Euphorbiaceae
<i>Spatholobus purpureus</i> Benth. ex Baker	Fabaceae
<i>Trithuria konkanensis</i> Yadav & Janarthanam	Hydatellaceae
<i>Cryptocarya lawsonii</i> Gamble	Lauraceae
<i>Litsea ghatica</i> Saldanha	Lauraceae
<i>Utricularia lazulina</i> Taylor	Lauraceae
<i>Rotala macrandra</i> Koehne	Lythraceae
<i>Rotala malampuzhensis</i> Nair	Lythraceae
<i>Sonerila rheedii</i> Wight & Arn.	Melastomataceae
<i>Aerides dalzelliana</i> (Sant.) Garay	Orchidaceae
<i>Dendrobium ovatum</i> (Willd.) Kranzl. *	Orchidaceae
<i>Eria dalzellii</i> (Hook. ex Dalz.) Lindl.	Orchidaceae
<i>Oberonia brachyphylla</i> Blatter & McCan.	Orchidaceae
<i>Porpax jerdoniana</i> (Wight) Rolfe	Orchidaceae
<i>Dimeria woodrowii</i> Stapf	Poaceae
<i>Ischaemum dalzellii</i> Stapf ex Bor	Poaceae
<i>Ischaemum jayachandranii</i> Ansari et al.	Poaceae
<i>Ischaemum travancorense</i> Stapf ex C. E. C. Fischer	Poaceae
<i>Ophiuros bombaiensis</i> Bor	Poaceae
<i>Panicum paianum</i> Nair & Patunkar	Poaceae
<i>Paspalum canarae</i> (Steud.) Veldk. var. <i>fimbriatum</i> (Bor.) Veldk.	Poaceae
<i>Tricalysia sphaerocarpa</i> (Dalz.) Gamble	Rubiaceae
<i>Lindernia estaminodosa</i> (Blatt. & Hallb.) Mukherjee	Scrophulariaceae
<i>Lindernia manilaliana</i> Sivarajan	Scrophulariaceae

* Mentioned by Rao (1985-86), but not collected in the study area.

Table 13: The current status of endemic plants of Western Ghats in Goa

IUCN Category	No. of Species
Endangered (E)	2
Vulnerable (V)	5
Rare (R)	21
Low Risk (LR)	85

Table 14: Endemic species of Western ghats present in Goa and reported in the Red data book

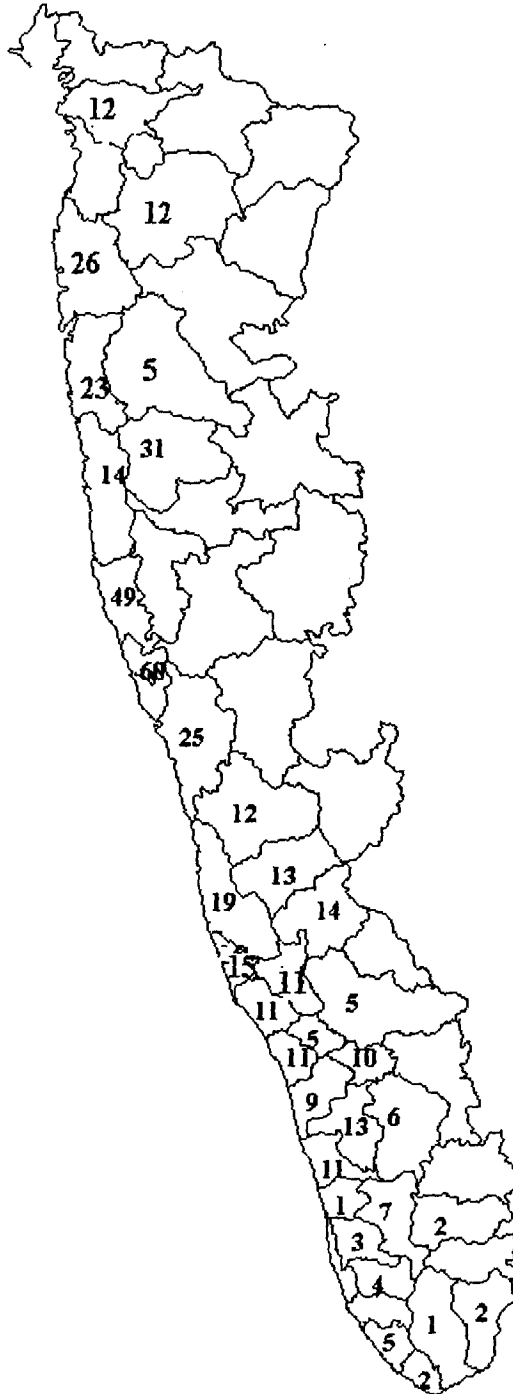
Species	Status in Red Data Book	Assigned status (present work)
<i>Capparis rheedii</i> DC.	Rare	Low risk
<i>Ceropegia attenuata</i> Hook. f.	Rare	Low Risk
<i>Ceropegia fantastica</i> Sedgw.	Endangered or possibly extinct.	Endangered
<i>Crotalaria lutescens</i> Dalz.	Rare	Low risk
<i>Decaschistia trilobata</i> Wight	Rare	Rare
<i>Dimeria woodrowii</i> Stapf.	Rare	Low risk
<i>Glyphochloa talbotii</i> (Hook. f.) Clayton	Vulnerable	Low risk
<i>Oberonia brachyphylla</i> Blatter & McCan.	Rare	Rare
<i>Phyllanthus talbotii</i> Sedgwick	Rare	Rare
<i>Wiesneria triandra</i> (Dalz.) Micheli	Rare	Low risk

Table 15: Number of first published endemic species by major workers

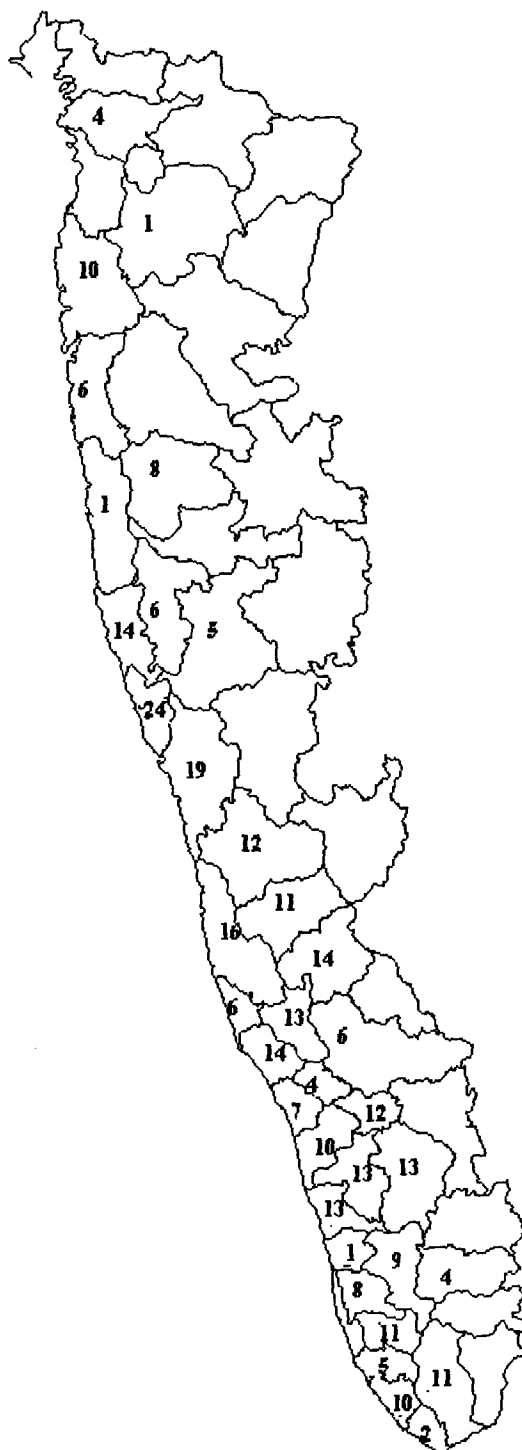
Authors	No. of first Published
Dalzell	21
Wight	14
Hook. f.	10
Graham	6
Wight & Arnott	5
Dalzell & Gibson	4

Map 33. The distribution pattern of endemic herbs of Western Ghats present in Goa

(The number in each district refers to the no. of species common with Goa)

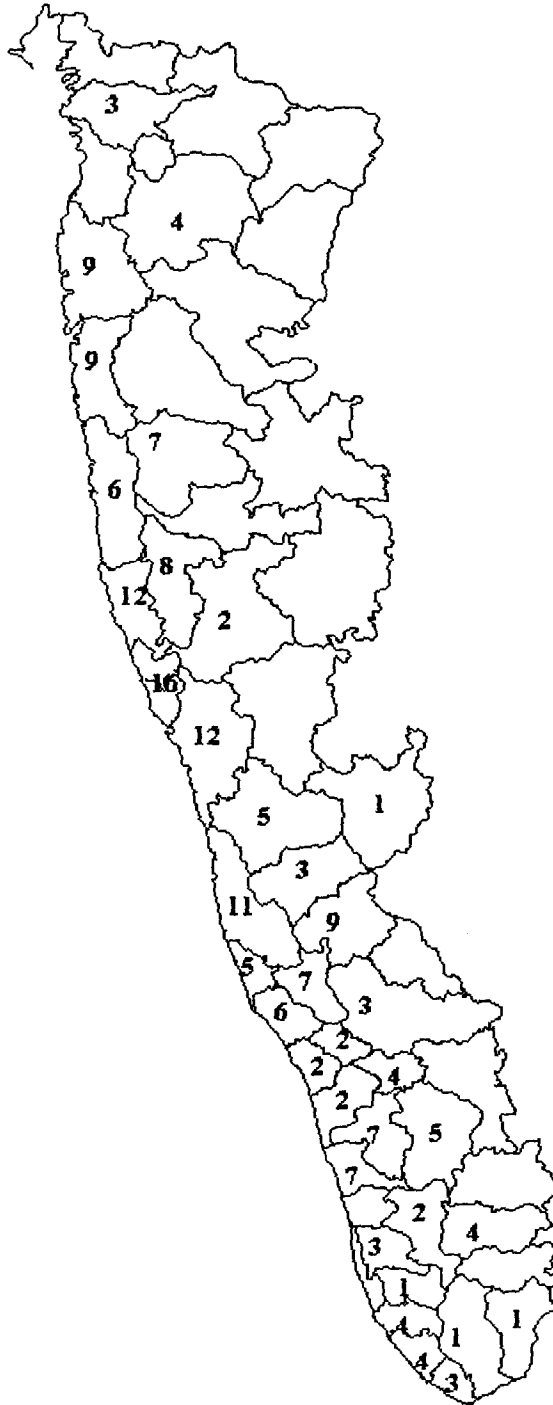


Map 34. The distribution pattern of endemic trees of Western Ghats present in Goa
 (The number in each district refers to the no. of species common with Goa)



Map 35. The distribution pattern of endemic shrubs of Western Ghats present in Goa

(The number in each district refers to the no. of species common with Goa)



Map 36. The distribution pattern of endemic climbers of Western Ghats present in Goa
 (The number in each district refers to the no. of species common with Goa)

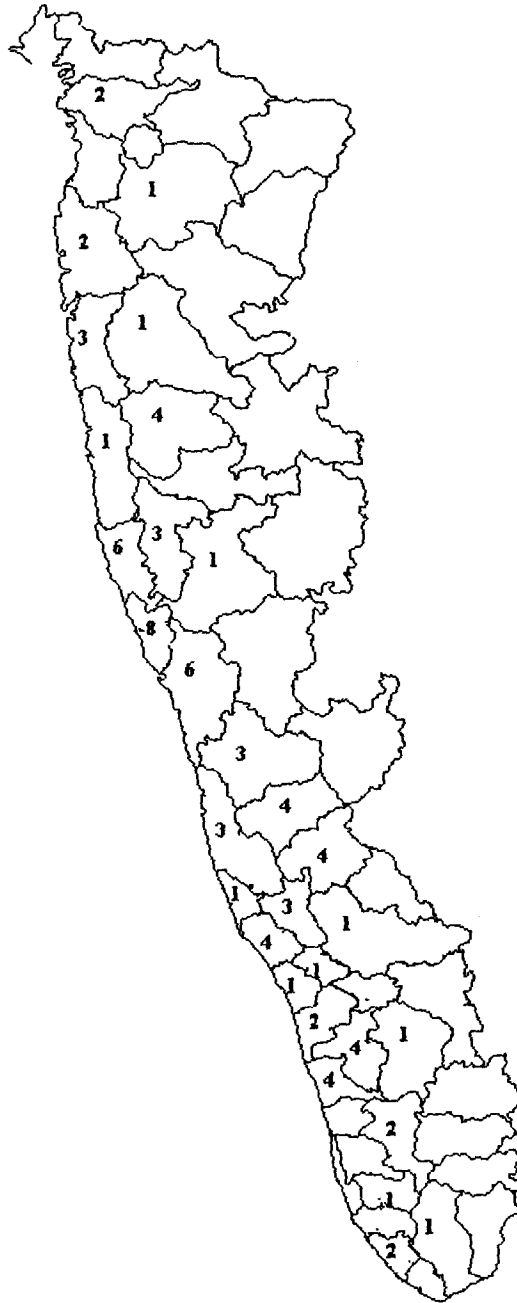
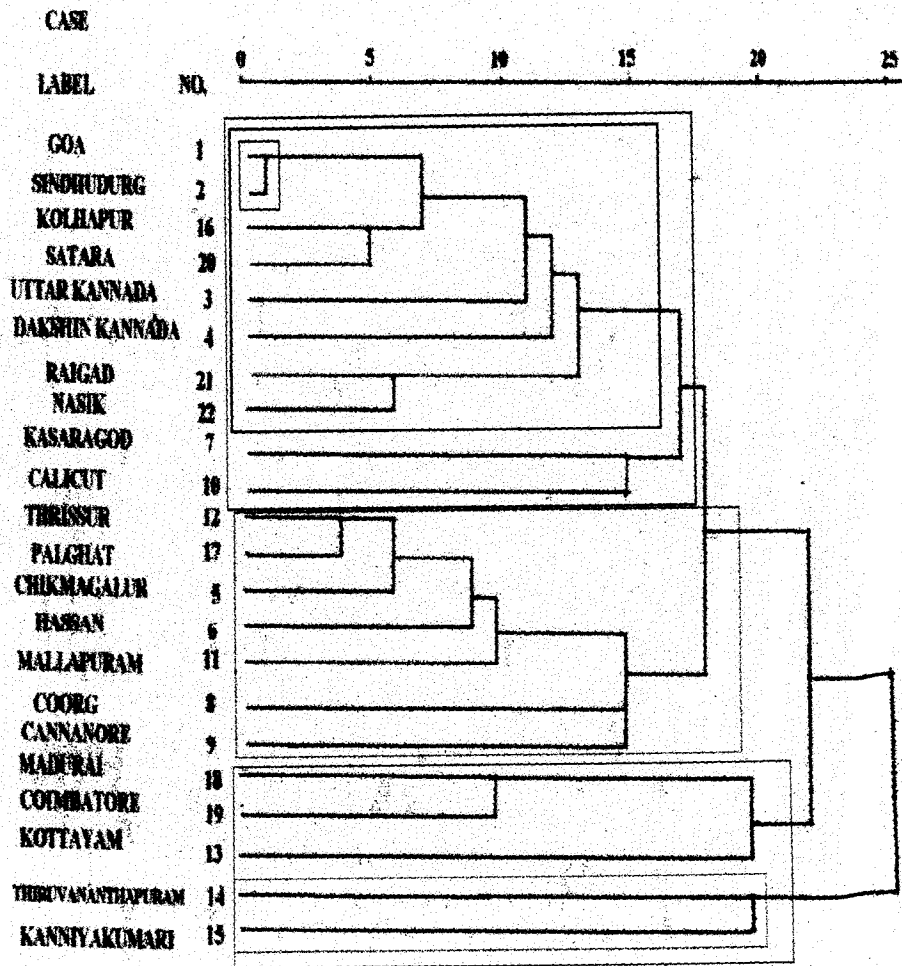


Fig. 33: Tree diagram showing similarity of Goa with other districts of Western Ghats based on endemic herbs

[Constructed using Cosine of Vectors of Values and Average Linkage method]



- Closest
- Northern Western Ghats
- Northern Western Ghats & coastal districts of Central Western Ghats
- Predominantly hilly districts of Central Western Ghats
- Southern Western Ghats
- Southern most districts

VI. DISCUSSION

In India, there are 148 endemic genera and 5,725 endemic species (Nayar, 1996). These are mostly distributed in two “hotspots” recognized in India out of total 25 by Myers et al (2000). The Western Ghats, one of the hotspots harbour about 1,500 endemic species and 60 endemic genera (Nayar, l.c.). Survey for endemic plants of Western Ghats and West Coast distributed in Goa resulted in the collection of 113 endemic species, of which 75 are dicotyledons and 38 are monocotyledons and belong to 40 families (Graph 2 & 3).

In the study area, the family Poaceae has maximum number of endemic species (Graph 3), as it is the most dominant family in the Western Ghats (Parthasarathy, 1983; Karthikeyan, 1983; Rao, 1985 –86; Nair & Daniel, 1986; Sreekumar & Nair, 1991). The families Acanthaceae, Rubiaceae and Fabaceae with eight endemic species each and Orchidiaceae with six endemic species follow the order (Graph 2 & 3). This observation shows that the number of endemics in each family is generally in proportion to the number of species present in the area. The dominance of these families with regard to the number of species in each has been confirmed in various publications (Arora, 1964; Nayar, 1980a, 1984, 1996; Ahmedullah & Nayar, 1986; Karthikeyan, 1996; Vajravelu & Vivekananthan, 1996; Venu, 1998; Pathasarathy, l.c.).

Though the families such as Araceae, Eriocaulaceae and Lentibulariaceae are not dominant in the study area, the recent reversionary works and occasional publications (Janarthanam and Henry, 1992; Ansari & Balakrishnan, 1994; Hettterscheid et al., 1994) have added to the number of endemic species in these families.

These 113 endemic species belong to 86 genera, of which 66 genera have only one endemic species in the study area. There are 60 endemic genera in Peninsular India of which 49 are monotypic (Nayar, l.c.). In the study area, only three endemic genera could be collected. *Moullava* is the only monotypic genus found in the study area, which is mostly restricted to the Northern and Central Western Ghats. The other endemic genera are *Glyphochloa* and *Nilgirianthus*. Though the genus *Nilgirianthus* has 20 species endemic to Peninsular India (Nayar, 1980b), only one could be collected from the study area. This is due to the general restricted distribution of *Nilgirianthus* species to the evergreen forests of Central and Southern Western Ghats and only relatively small area is occupied by evergreen forests in Goa. The endemic genus *Glyphochloa* (with one species extending up to Madhya Pradesh) is well represented in the study area by four taxa including varieties. This paleoendemic genus which might have originated in Peninsular India (Jain, 1970) is restricted to plateaus, one of the major land forms in the study area. The observations in the present work show that most of them are restricted to South western Maharashtra and Goa, which pinpoints to the center of origin of the genus.

At the generic level it was observed that the genus *Eriocaulon* with seven species has a maximum number of endemic species (Graph 4) followed by *Diospyros* with four endemic species. The splitting of genus *Strobilanthus* has resulted in more number of endemic genera in the family Acanthaceae. These kind of taxonomic changes are more frequent at generic level than at species level (Daniels, 1997).

Shrub flora in the Western Ghats is richer in endemics as compared to trees (Krishnan and Davidar, 1996; Ramesh & Pascal, 1991). In the study area, the endemic herbs are the most dominant (Graph 5), followed by trees, shrubs and climbers unlike

the evergreen forests of southern Western Ghats, where the trees are dominant and herbs are the least (Ganesh et al., 1996).

Endemic species are niche – specific, have restricted distribution and they become extinct when their habitat are disturbed (Nair, 1991). The best way to conserve the species is to conserve its habitat and this is particularly true for the species having habitat preference (Sasidharan, 1991). In order to plan strategies for conservation of species, a thorough understanding of their habitat is essential.

The endemic species in the study area were collected from different habitats. The plateaus, moist deciduous, semi evergreen and evergreen forests are some of the dominant habitats in the study area. Other habitats include rivers, lakes, streams, open areas other than plateaus, brackish water, beaches and cultivated fields.

Plateaus: Plateaus occupy major portion of the land area in the state of Goa (Gune, 1979). The major plateaus in Goa are at Verna, Taleigao, Cotigao, Dodamarg and Tiska. They are between the Western Ghats and the coastal plains. Although, these plateaus are known to harbour high species diversity (Yadav & Janarthanam, 1994; Braganza, 1998; Janarthanam et al., 1999) they are highly neglected and are under constant threat (Joshi & Janarthanam, 1997).

Plateaus in the study area harbour 41 endemic species of which 34 are herbs (Graph 6). This shows that the majority of the endemics on plateaus are herbs an observation also made by Raghavan and Singh (1984) with regard to characteristic flat hill tops which resemble low land rocky plateaus. Further analysis shows that there are 21 endemic species, which are found exclusively on plateaus (Table 2). It is observed that 11 species are found both on plateaus and moist deciduous forests. As shown by Steyermark (1979) with regard to the endemic flora of Venezuela Tepus, in the present study also it is observed that habitats are not mutually exclusive.

Hard lateritic rocks are characteristic of plateaus and often these rocks are covered with a thin layer of acidic and relatively nutrient poor soil and do not have any water holding capacity. These generally barren plateaus support numerous annuals during the monsoon (Braganza, l.c.). With the onset of monsoon, they show complete transformation in physiognomy and get covered with beautiful flowers (Santapau, 1966). The plants inhabiting such rocky habitats are light demanding, usually disappearing if covered by tree canopies, drought resistant and survive as seeds or as under ground parts and they have the ability to regenerate from below ground parts after an extending period of drought (Tyler, 1996). During their vegetative growth they also come under temporary drought period of 2 –5 days which sometimes extends beyond 2 –3 weeks when the monsoon fails temporarily. During this period, plants that grow in temporary pools can survive without any additional adaptation, whereas others which grow on exposed rocks have either tubers or thick succulent leaves as adaptations. The month of August has been observed as general peak flowering season of herbs on plateaus (Braganza, l.c.). The present study shows that the flowering of endemic species on plateaus begin in the month of June and reaches its peak in the month of September (Graph 8) and again show a steady decrease in the month of December after which again the plateaus are dry and present a forbidding appearance. This observed shift in flowering season is due to i) the scope of present study is restricted to endemic species, whereas Braganza (l.c.) included all the herbaceous plants and ii) the Poaceae members which constitute major component of endemic herbs on plateaus flower best in the month of September (Pandey, 1998). All the herbaceous endemic species on the Plateaus do not flower at the same time (Braganza, l.c.) and the seasonal availability of pollinators can be a selective force shaping flowering phenology in animal pollinated species (Kochmer & Handel,

1986). The endemic plants such as *Amorphophallus commutatus*, *Fimbristylis lawiana*, *Indigofera dalzellii*, *Crotalaria filipes*, *Crotalaria lutescens*, *Geissaspis tenella* and *Eriocaulon eurypeplon* are very common on plateaus. Whereas some of the plants occurring on plateaus viz. *Wiesneria triandra*, *Ceropegia attenuata*, *Dimeria woodrowii*, *Glyphochloa talbotii* and *Crotalaria lutescens* have appeared in Red Data Book (Nayar & Sastry 1987, 1988, 1990) under various threat categories. Though most of them were described as rare, during the present study it is observed that they are very common on the plateaus.

Moist deciduous forests: Moist deciduous type is the major vegetation type in Goa (Rao, 1985; Gune, 1979). These forests are around Tudal, Ordofond, Butpal, Molem, Kodal and Ambechagol. These moist deciduous forests are more heterogeneous with a lot of secondary growth and opening (Daniels, 1989). In the present study 38 endemic species are recorded in the moist deciduous forests. Nine endemic species are restricted to moist deciduous forests (Table 2), 11 are common to the plateaus and moist deciduous forests and seven are common to open areas and moist deciduous forests. As on the plateaus, endemic herbs are predominant in number with 18 species (Graph 6), followed by shrubs (9 spp.), trees (7 spp.) and climbers (4 spp.). The herbaceous vegetation in the moist deciduous forest revives after the first shower of rains (Saldanha, 1984) and survive longer as compared to open plateaus. Some of the common endemic shrubs in the moist deciduous forests are *Thelepáepale ixiocephala*, *Mussaenda laxa* and *Ixora brachiata*. The family Acanthaceae tops the list with more number of endemic species in the moist deciduous forests (Graph 7). Members of Orchidaceae are also very common in this habitat and most of them are epiphytic. The flowering of endemic species in moist deciduous forests steadily increases from August (Graph 8) and reaches it's peak in

the month of November and steadily decreases from the month of December. This slight shift as compared to plateaus may be due to increased number of trees, shrubs and epiphytic herbs in moist deciduous forests, which flower in different seasons. Another factor for early steep decrease in flowering on plateaus is due to exposed areas, which dry soon after the monsoons. As observed on plateaus, flowering of endemic species starts with the onset of monsoons. Even after the monsoons, flowering is observed in moist deciduous forests due to closed canopy, which conserves atmospheric humidity and filters sunlight on shrubs and herbs (Saldanha, 1984).

Semievergreen: In the study area there is no clear-cut demarcation between moist deciduous and semievergreen forest an observation also made by Saldanha (l.c.) in Karnataka. Forty endemic species of Western Ghats are recorded from the semievergreen forests of Goa. Nine endemic species collected in the study area are restricted to the semievergreen forests (Table 2) and 16 are common to the moist deciduous as well as semievergreen forests and two are common with the plateaus As observed on plateaus and moist deciduous forests, the herbaceous endemics (15 spp.) are more in number in the semievergreen forests (Graph 6). More number of endemic tree species (12 spp.) and shrubs (11 spp.) differentiate semievergreen forests from moist deciduous forests. Unlike plateaus and moist deciduous forests, the flowering pattern of the endemic species in the semievergreen forests show two peaks, one in the month of November and another in March (Graph 8). The peak in the month of March may be due to more number of endemic trees in semievergreen forests, which flower during the dry months. Some of the common endemic trees found in Semievergreen forest are *Calophyllum calaba*, *Sageraea laurina*, *Eugenia macrocephala* and *Drypetes venusta*. Common herbs in semievergreen forests are

Phyllocephalum tenue, *Zingiber neesatum*, *Decaschistia trilobata* and *Porpax jerdoniana*. *Capparis rheedii* figures as a rare plant in the Red Data Book (Raghavan, 1987).

Evergreen forests: Evergreen forests are restricted to only few patches in the study area due to the lengthening of dry season in the northern Western Ghats as compared to the southern Western Ghats (Gadgil & Meher-Homji, 1986a, Pascal & Pelissier, 1996). Evergreen forest here survives only under special edaphic conditions at higher elevation, where dew and mist provides additional moisture (Ramesh & Pascal, 1997). Eighteen endemic species were collected in the evergreens forests of Goa and seven of them are restricted to evergreen forests alone (Table 2), whereas 11 occur both in semievergreen and evergreen forests. Unlike in other habitats, endemic herbs (3 spp.) are poorly represented in the evergreen forests as there is no sufficient light reaching the ground due to dense canopy (Ganesh et al., l.c.). All these endemic herbs viz. *Aerides dalzelliana*, *Oberonia brachyphylla* and *Porpax jerdoniana* in the evergreen forests are epiphytic. It was observed that endemic trees (10 spp.) are most dominant in evergreen forests (Graph 6) whereas endemic shrubs (3 spp.) and climbers (2 spp.) are poorly represented. This is in contrast to Krishnan & Davidar (l.c.) who observed endemic shrub flora in Western Ghats to be richer than endemic trees. Trees restricted to evergreen forests are *Cryptocarya lawsonii*, *Gymnacantha farquhariana*, *Garcinia talbotii* and *Arenga wightii* and shrubs such as *Nilgiranthus barbatus*. Endemic climbers such as *Spatholobus purpureus*, *Calamus thwaitesii* are seen in the evergreen forests. Some of the families that are dominant in the evergreen forest are Arecaceae, Myristicaceae and Lauraceae and Orchidaceae (Graph 7 & Table 1). The flowering of endemic species in the evergreen is uniformly distributed throughout the year except during June to September (Graph 8), which is the monsoon

season. This may be either due to the lack of survey in the evergreen forests during monsoons or due to flowering of trees (which are dominant in evergreen forest) during drier months (Borchert, 1980).

In addition to these major habitats in the study area, the endemic species are also distributed in some minor habitats.

Open areas: These include open areas other than plateaus and harbour 11 endemic species. Two species are exclusively restricted to open areas other than plateaus. Here, as on plateaus, herbs (4 spp.) are the most dominant, whereas trees and shrubs are represented by two species each and climbers by three species. Some of the rare herbs in the open areas are *Brachystelma malwanense* and *Haplanthodes neilgherryensis*.

Cultivated Fields: Five endemic herbs were collected from the cultivated fields (Table 2), of which *Eusteralis tomentosa*, *Ischaemum jayachandranii* and *Ophiuros bombaiensis* are exclusively restricted to the paddy fields, whereas *Murdannia versicolor* and *Fimbristylis dauciformis* are common to plateaus and fields.

Streams, Rivers and Lakes: Seven endemic species are found growing along the streams. Trees and shrubs are poorly represented. The dominant herbs in the streams and riverbeds are *Eriocaulon dalzellii* and *Cryptocoryne cognata*. The latter is found on gravely beds in streams during monsoon and post monsoon season. Shrubs such as *Phyllanthus talbotii* are found along the riverbeds. *Calophyllum calaba* is also seen along the riverbanks and streams in moist deciduous forests and semievergreen forests.

Beaches: The only endemic species seen along the beaches is *Hyphaene dichotoma* and is well adapted to the sandy sea shores.

Influence of rainfall on the flowering of endemic species:

In order to understand the distribution of animals and plants in time and space there is a need for the information on the Phenological patterns in the ecosystem (Sarminento, 1983; Schwartz & Walker, 1986). Analysis of flowering of endemic species in the study area show peak and lean seasons of flowering (Graph 8). Similar peaks are observed with regard to the tree species in the Neotropics (Smythe, 1970; Frankie et al., 1974; Croat, 1978; Milton, 1980; Milton et al., 1982). Such fluctuations are often correlated with environmental factors such as rainfall pattern (Mitton, 1980, 1982). The length of the dry season also plays an important role in the selection of the species and the length of the dry season depend on the duration of the monsoon and not on the amount of rainfall (Ramesh & Pascal, 1991).

In the study area, rainfall steadily increases from the month of May and is maximum during the month of June and July and then shows a steady decrease from August to October (Graph 1). The flowering of endemic herbaceous species starts from June and reaches its peak in the month of September and October and then again shows a steady decrease (Graph 9). This is in accordance with the general flowering pattern of the herbs observed in the region (Sivaraj & Krishnamurthy, 1989; Braganza, l.c.). This shows that the herbaceous flora which is predominant on the plateaus survive on the moisture available during monsoons. The endemic trees are observed to be flowering from November to May with the peak during March (Graph 9). This pattern of flowering is similar to that observed in trees of the tropical moist deciduous forest, which also flower in the dry season (Rawitscher, 1948; Webb, 1959; Boaler, 1966; Daubenmire, 1972; Longman & Jenik, 1974; Borchert, 1980; Reich & Borchert, 1982). Borchert (1980) hypothesized that during early drought transpiration, water loss exceeds water absorption by roots and tree water declines causing leaf

senescence and subsequent leaf shedding. After the reduction in transpiration water loss, slow absorption of residual soil moisture increases tree water potential and permits bud breaking. In the study area it was observed that trees in different habitats show different peak flowering seasons (Graph 10). The trees on the plateaus show peak flowering in January followed by trees in moist deciduous forests in the month of January – February. This is because the plateaus are open areas covered with lateritic rocks and have very little water holding capacity, hence dry early. The moist deciduous forests in Goa are characterized by lateritic substrate sharing the same phenomena. So the trees here reach peak flowering early as compared to semievergreen and evergreen forests which are characterized by absence of lateritic substrate and usually present along the streams or in higher elevations which receive mist providing additional moisture (Ramesh & Pascal l.c.). Thus the moisture content of the soil is the main determinant of the phenological patterns (Prins, l.c.). Whereas maximum number of endemic shrubs flower in the month of January and show gradual sloping of graph on either side (Graph 9). It is observed that these endemic shrubs are mostly located in semievergreen and moist deciduous forests (Graph 6). The endemic climbers do not show any peak flowering season.

Patterns of geographical distribution:

Environmental factors result in uneven distribution of the species, which give rise to patterns of distribution (Cox & Moore, 1980; Daniels, 1992). Each species has its own pattern of distribution, which is influenced by the amount of rainfall, altitude, habitat and availability of pollinators.

a) Endemic species distributed in the Northern, Central or Southern Western Ghats:

The herbaceous endemic flora is distributed more to the Northern Western Ghats as compared to the southern Western Ghats (Map 33) whereas trees (Map 34)

and shrubs (Map 35) are distributed more to the Southern Western Ghats. Climbers do not show any clear picture of skewed distribution either to the North or South (Map 36). It is observed that in the study area, unlike the southern Western Ghats (Ganesh et al., 1996) more number of endemic species are restricted to plateaus, moist deciduous and semievergreen forests as compared to evergreen. As Goa is a part of Northern Western Ghats, the number of rainy days are less or there are more number of drier months as compared to Southern Western Ghats (Ramesh & Pascal, 1991, 1997). In addition to this, the altitude here is also much low as compared to the southern Western Ghats. So, unlike the southern Western Ghats, the evergreen forests here are in patches and restricted to higher altitudes (Arora, 1964; Rao, 1978; Ramesh & Pascal, l.c.). The evergreen forests start from Goa and are rich towards south (Pascal, l.c.). Hence, the skewed distribution of trees towards south and that of herbs towards north. There are 57 endemic species present in Goa whose distribution is restricted to the Northern and Central Western Ghats (Table 3). All these are either herbs or shrubs. Of the 57 endemic species restricted to Northern and Central Western Ghats, 20 species are restricted to plateaus and remaining mostly to moist deciduous forests and associated open areas. *Hyphaene dichotoma* is the only tree which is restricted to the northern Western Ghats, that too along the beaches. Whereas another 12 endemic species present in the study area are predominantly distributed in the southern Western Ghats (Table 4) and they are restricted to the semievergreen or evergreen forests of Western Ghats.

b) Endemic species distributed almost through out the Western Ghats:

In the study area, there are 25 endemic species, which are distributed almost throughout the Western Ghats (Table 5). This number is relatively less, as compared to that observed by Nair, K. (1991) in Courtallum where there are 50 (out of 115)

endemic species that are distributed throughout Western Ghats. This wider distribution may be due to their wider ecological amplitude, as species that have broad environmental tolerance and are able to use wide range of resources are able to survive in more places and hence cover larger area (Brown, 1984; Thompson et al., 1999).

c) Endemic species of Western Ghats with discontinuous distribution:

The patchy distribution is known to result from local extinction and an inability of organism to disperse (Diamond, 1973) or could be due to patchy distribution of some of the crucial resources or inadequate studies conducted along the entire range (Daniels l.c). In the present study, 19 endemic species are with discontinuous distribution along the Western Ghats (Table 8). *Wiesneria triandra* is an annual, which is found common in the temporary water pools on plateaus during the monsoons. Lack of adequate investigations by earlier workers resulted in its discontinuous distribution. Whereas species such as *Fimbristylis dauciformis* and *Litsea ghatica* Saldanha are newly published species and further investigation on these species along the Western Ghats may result in continuous distribution of the species. Where as *Garcinia talbotii* is often confused with *G. spicata* and several authors could not distinguish the former from the latter. As mentioned by Daniels (l.c.) lack of adequate studies along the Western Ghats could be the main reason for discontinuous distribution. Most of the endemic species of family Poaceae, Cyperaceae and Eriocaulaceae are generally considered difficult to identify. Whereas other families such as Clusiaceae, Lauraceae and Ebenaceae are poorly worked out families and families such as Asteraceae and Fabaceae are large, difficult but well worked out though difficulty exist in identification of species. These may be some of

the reasons why the endemic species of these families show discontinuous distribution.

d) Endemic species of Western Ghats distributed in only one districts other than Goa:

In the present study it is observed that eight species are distributed in only one district other than Goa (Table 7). Among these, *Amorphophallus konkanensis* and *Brachystelma malwanense* are newly published species from the Northern Western Ghats and so are known only from their type locality and Goa. Extensive survey in the neighboring districts may result in gathering further distribution data on these species. Other species such as *Cryptocoryne cognata*, *Glyphochloa talbotii* are only distributed in Goa and in Sindhudurg district of Maharashtra. These species are highly habitat specific and are found in gravely beds of streams and on plateaus respectively. Sindhudurg is a neighboring district and has similar habitat as that of Goa. *Ceropegia fantastica* is another endemic species, whose distribution is known only from Goa and Uttar Kannada (type locality) which are neighboring areas with similar vegetation type. It is observed that there is no collection from Karnataka after the type collection. Poor ability to disperse and high habitat specificity could be some of the reasons for their localization (Kunin, 1997). Such species with restricted geographic range are most vulnerable to habitat loss or degradation as a single disturbance can carry away an endemic (Kurceberg & Rabinowitz, 1985; Pendergast et al., 1993). However, *Eriocaulon redactum* is also distributed in two districts, that is in Goa and Thiruvananthapuram, but are far apart. This is a minute ephemeral and obviously has missed collectors' attention.

e) Endemic species of Western Ghats restricted to two to three districts other than Goa:

In the study area 13 endemic species have distribution restricted to two or three districts other than Goa (Table 8). Species such as *Phyllocephalum ritchiei*, *Eriocaulon fysonii*, *Eriocaulon stellulatum*, *Phyllanthus talbotii*, *Eugenia macrocephala* and *Trithuria konkanensis* are restricted to three districts and *Dimeria woodrowii* in two districts and their distribution is somewhat continuous. Their narrow distribution range may be due to their habitat specificity. Whereas, *Diospyros angustifolia*, *Eriocaulon eurypeplon* and *Aerides dalzelliana* are discontinuously distributed in Goa and three more districts along the Western Ghats. *Fimbristylis lawiana* is an annual endemic species restricted to plateaus which appears during the monsoons. Lack of investigation on the plateaus during the monsoon may be the reason why this species is recorded discontinuously. Whereas *Oberonia brachyphylla* is a minute epiphytic herb in the evergreen forest, because of its small size it might have been overlooked by collectors as in the case of *Eriocaulon redactum* and hence discontinuously distributed. *Lindernia manilaliana* is a newly described species along the Western Ghats. Though habitat specificity as a reason is not ruled out, intensive collections strategy might fill the gap in the distribution.

f) Distribution pattern of endemic herbs of Western Ghats which are present in Goa:

Distribution pattern of endemic plants of Western Ghats present in Goa was analyzed with regard to herbs by constructing a tree diagram (Fig. 33). For this purpose their distribution throughout Western Ghats (especially districts which are well studied floristically) was taken into account. It was observed that Goa and Sindhudurg form a distinct cluster and are the closest as these are the neighboring districts and share similar habitats, especially the plateaus and their proximity to the sea. Kanniyakumari and Thiruvananthapuram districts form farthest cluster, as they are also the farthest spatially. Madurai, Kottayam and Coimbatore, other three

districts studied from Southern Western Ghats are the closest with Kanniyakumari and Thiruvananthapuram. It is also observed that hilly districts of Central Western Ghats form a distinct cluster, while coastal districts of Central Western Ghats cluster with the districts of Northern Western Ghats due to the presence of vast plateaus. The inland districts of Kolhapur and Satara cluster with coastal districts due to the low elevation of the hills and presence of tablelands (plateaus) on hill tops which harbour enormous herbaceous vegetation. As herbaceous endemic species are predominantly on plateaus, this habitat needs much more attention with regard to studies and conservation (Joshi & Janarthanam, 1997).

Close relatives of the collected endemic species:

It was observed that 29 of the collected endemic species of Western Ghats distributed in Goa also have their closely related species distributed in the study area. Most of these closely related species have a wider distribution range, whereas *Diospyros saldanhae* and *Diospyros pruriens*, *Eriocaulon cuspidatum* and *Eriocaulon fysonii* are closely related to each other respectively and are endemic to Western Ghats. The closely related species though somewhat similar in their morphology show different flowering phenology leading to temporal and reproductive isolation. For example, *Dendrobium ovatum* and *D. barbatulum*, two closely related orchids share the same habitats but show different flowering seasons, the former in the month of December and the latter during May-June. Whereas, *Memecylon talbotianum* and *M. umbellatum*, closely related species apart from having different habitats also flower in different seasons. Certain related species such as *Litsea ghatica* and *L. deccanensis* on one hand and *Diospyros pruriens* and *D. saldanhae* on the other, share the same habitats and flowering seasons. As discussed under systematic treatment they also

have intermediate characters, hence their taxonomic status has to be investigated further.

Species added to the endemic plant list of Western Ghats:

During the present investigation, six species collected from Goa (Table 9) have been added to the existing list of endemic plants of Western Ghats (Ahmedullah & Nayar, l.c.; Nayar, l.c.). All these species were observed to be endemic to northern Western Ghats of which three were newly described in the last one or two decades.

Species declared endemic to Western Ghats by earlier workers but showing extended distribution beyond Western Ghats:

Some species (Table 10) which were hitherto considered to be endemic to Western Ghats (Ahmedullah & Nayar, l.c.; Nayar, l.c.) now found to be distributed well beyond the Western Ghats. This indicates that the complete reinvestigation of all the endemic plants along the Western Ghats and neighboring districts outside Western Ghats is essential and the results might drastically alter the number by the way of addition and deletion. This has a greater bearing, as "Hotspots" are defined either based on the number of endemic plants as a sole criterion (Myers, 1988, 1990) or number of endemic plants as one of the criteria (Myers et al. 2000).

Current status of endemic plants of Western Ghats distributed in Goa:

The current status of all the endemic species of Western Ghats distributed in Goa has been evaluated using IUCN norms (1995, 1997) (Table 13) and given under Systematic treatment. Two endemic species viz. *Ceropegia fantastica* and *Cryptocoryne cognata* come under endangered category (E) while five species come under Vulnerable (V) and twenty-five come under rare (R). The remaining eighty-five endemic species of Western Ghats distributed in Goa come under low risk (LR) and are very common, have no threat in the near future.

Endemic species of Western Ghats present in Goa and reported in the Red data book:

Eleven endemic species (Table 14) collected in the study area are reported in the Red data book (Nayar & Sastry, l.c.). Plants such as *Ceropegia fantastica*, are under endangered category (Nayar & Sastry, l.c.) as it is restricted to only two districts with small populations restricted to open areas on plateaus and periphery of moist deciduous forests. In the study area, this species was observed only in two localities one along railway line and other near a national highway, which are under constant human threat. *Cryptocoryne cognata* (Singh & Kulkarni, 1990) and *Glyphochloa talbotii* (Deshpande, 1987) are under vulnerable category in the red data book. *Cryptocoryne cognata*, could be collected in the study area from only one locality, where the population is restricted to few individuals in seasonal streams. Recently reduction in population was observed due to developmental activities adjacent to the locality. *Glyphochloa talbotii* unlike *Cryptocoryne cognata* although being habitat specific, is abundant on plateaus in Goa and Sindhudurg district and could come under vulnerable category only if its habitat is destroyed. Species such as *Ceropegia fantastica* and *Cryptocoryne cognata* Schott. are species with "Suffusive" rarity (Brown, 1984; Schoener, 1987), as they are rare throughout their range of distribution. In the red data book, *Oberonia brachyphylla* (Vajravelu, 1988) is reported to be rare and was reported only from North Kanara, the Hills of Hassan and Palghat district. But in addition to these districts it was also observed in Goa and Chikmagalur district (Joshi et al., (in press), but is rare in the study area as it could be collected from only one locality in a evergreen forest patch. *Dimeria woodrowii* is reported to be very rare in the Red data book (Deshpande, 1987), but it was observed to be very common on rocky plateaus during the monsoons. Other rare species such as *Ceropegia attenuata*, *Crotalaria lutescens*, *Decaschistia trilobata* and *Capparis*

rheedii are restricted to specific habitats. Although they are not rare right now, habitat destruction could be a greater concern for their survival.

Endemic species of Western Ghats which are not collected by earlier workers in the study area:

In the present investigation, out of the total 113 endemic species of Western Ghats collected, 38 are new records to the study area, working out to 33.04 % (Table 12). Thirty of the newly reported endemic species in Goa are herbs. Species such as *Arisaema sivasadanii*, *Brachystelma malwanense*, *Fimbristylis dauciformis*, *Eriocaulon fysonii*, *Eriocaulon redactum*, *Trithuria konkanensis*, *Litsea ghatica*, *Utricularia lazulina*, *Utricularia malabarica*, *Rotala malampuzhensis*, *Ischaemum jayachandranii* and *Lindernia manilaliana* were all described within the last two decades. This is one of the reasons why these species were not reported by earlier workers. Most of the newly collected endemic plants are from under explored habitats like plateaus, open areas and fields. Intensive collections made in these areas helped to add more species to the existing list (Janarthanam et al., 1999). Lack of inventory along the plateaus and moist deciduous forest during monsoons could be the reason why these endemic species were not reported previously. All the three endemic shrubs and one climber, which are new records to the study area were collected from evergreen forests. Whereas tree species have been collected from evergreen, semievergreen and moist deciduous forests.

Chronology of Publication, Nomenclature and Taxonomy:

Analysis of nomenclature of all the collected endemic species in the study area also gives a clear clue to their taxonomic stability. For about 57 species the first published names have remained as correct names and for another 47 endemic species, the combination names have become correct names. This indicates that 104 endemic

species collected in the study area are taxonomically distinct and there was never any problem either with their identity or their nomenclature. New names had been proposed for nine endemic species mainly because they were later homonyms at the time of publication or later when they were transferred to other genera, once again providing the clue that they were taxonomically distinct.

During 1826 – 1875 botanical activity along the Western Ghats was at its peak (Graph 11) as several administrators, army officers, surgeons working for British India used to carry out adventurous botanical exploration in their free time. As a result more than 90 endemic taxa were first published between 1826 and 1875 from Western Ghats (some of them have become synonyms later). It was observed that maximum number of endemic species of Western Ghats collected in the study area were first published by Dalzell. He is the author of 21 endemic species of Western Ghats (Table 15) distributed in the study area. Majority of Dalzell's collections were from Malvan and Vengurla, which are in neighboring districts to the study area and have similar habitat as that of Goa. This could be the reason, why more number of endemic species of Western ghats distributed in the study area are first published by Dalzell. In between 1925–1950 (Graph 11) botanical activity along the Western Ghats had come to stand still. In 1954 The Botanical Survey of India was reorganized and new line of activity began. A new emphasis laid on exploration resulted in revisionary works, monographs, regional and district Floras and publication of several new species. Twenty eight endemic species distributed in the study area were first described between the years 1951 and 2000. This also shows that a lot more floristic works have to be carried out in the region as new species are still being described.

Although most of the species are taxonomically distinct, some species such as *Holigarna arnottiana*, *Litsea ghatica*, *Diospyros saldanhae*, and *Diospyros pruriens*

show a lot of intermediates with their closely related species as shown under systematic treatment. Hence, further studies at population level throughout the distribution range are required in solving the existing problem.

Species needing refuge:

In the study area, endemic species such as *Ceropegia fantastica* and *Cryptocoryne cognata* are under constant threat and come under endangered category. Other endemic species such as *Brachystelma malwanense* and *Wiesneria triandra* come under vulnerable category. As species with restricted geographical range and facing constant threat due to human activities (Cincotta et al., 2000) are more prone to extinction (Rabinowitz, 1981; Dobson et al., 1997). Hence, steps need to be taken to conserve these species by protecting their habitats.

Present study resulted in the collection of 113 species that are endemic to Western Ghats. Recently, Myers et al. (2000) considered Western Ghats and Sri Lanka together as one 'hotspot'. If these are considered together as a single unit, the number of endemic species in this phytogeographical unit will show steep increase as several species are common to Western Ghats and Sri Lanka.

VII. SUMMARY AND CONCLUSIONS

Myers (1989, 1990) used endemic plant species to identify 'hotspots', the areas of global concern. Western Ghats is one of the hotspot and the second largest center of endemism in India. In order to prioritise areas for conserving biodiversity a thorough understanding of the endemics species is essential. But, it was observed that the information on endemic plants of Western Ghats distributed in Goa and their phytogeographical relationship with the rest of the area was minimal. Survey for endemic plants of Western Ghats and West Coast distributed in Goa resulted in the collection of 113 endemic species (75 dicotyledons and 38 monocotyledons) which belong to 40 families and 86 genera. In the study area, the family Poaceae has maximum number of endemic species followed by Acanthaceae, Rubiaceae and Fabaceae with eight endemic species each and Orchidaceae with six. In the study area, three endemic genera could be collected. *Moullava* is the only monotypic genus found in the study area. The other endemic genera are *Glyphochloa* and *Nilgirianthus*. The genus *Eriocaulon* (7 spp.) has a maximum number of endemic species in the area.

The herbaceous endemics were the most dominant followed by trees, shrubs and climbers. Plateaus in the study area harbour maximum number of endemic species. Most of the endemic species on plateaus are herbs, as members of family Poaceae are the most dominant on plateaus. In the moist deciduous forests, as on the plateaus, endemic herbs are predominant in number followed by shrubs, trees and climbers. The family Acanthaceae has maximum number of endemic species here. Maximum number of endemic trees are observed in semievergreen forests. The evergreen forests in the study area are restricted to few patches. Unlike in other habitats, endemic herbs are poorly represented in the evergreen forests. In addition to

these major habitats in the study area, the endemic species are also distributed in some minor habitats like open areas, cultivated fields, streams, rivers & lakes, and beaches.

Endemic species in the study area show peak and lean seasons of flowering. Plateaus show peak flowering in the month of September and moist deciduous forests in the month of November. Semievergreen forests show bimodal flowering, one in the month of November and another in March, while in evergreen it is almost uniform except during monsoons. The herbaceous endemic species reach their peak flowering in the month of September, whereas the endemic trees are observed to be in peak flowering during March. Most of the endemic shrubs flower in the month of January. Certain closely related species temporal isolation, while the species which do not show temporal isolation show lot of taxonomically overlapping characters.

The endemic species in the study area show different patterns of geographical distribution. Maximum number (57 spp.) of endemic species of Western Ghats collected in the study area are restricted to the Northern and Central Western Ghats as compared to the southern Western ghats (12 spp.). The herbaceous endemic flora is distributed more to the Northern Western Ghats, whereas trees and shrubs are distributed more to the Southern Western Ghats. Climbers do not show any clear picture of skewed distribution either to the North or South. Another 25 spp. are distributed almost throughout the Western Ghats and 19 endemic shown discontinuous distribution. Where as 21 endemic species of Western Ghats are distributed in only one-three districts other than Goa. Phytogeographical analysis based on the distribution of endemic herbs show that districts of Northern Western Ghats and coastal districts of Central Western Ghats form a single unit, whereas the hilly districts of Central Western Ghats and districts of Southern Western Ghats form

separate units. Sindhudurg district of Maharashtra is very close to Goa with regard to composition of herbs than any other area.

The analysis of nomenclature of the endemic species collected in the study area gives a clear clue to their taxonomy and distribution. Most of the endemic species (104 spp.) collected in the study area are taxonomically distinct as first published names still remain as correct names or basionyms of correct names. During 1826 – 1875 more than 90 endemic were first published as botanical activity along the Western Ghats was at its peak during this period. Dalzell alone published 21 endemic species of Western Ghats present in the study area.

During the present investigations six species collected from Goa have been added to the existing list of endemic plants of Western Ghats. Similarly, 17 species, which hitherto considered endemic to Western Ghats, are now found to be distributed well beyond the Western Ghats. This indicates that the complete reinvestigation of all the endemic plants along the Western Ghats and neighboring districts outside Western Ghats might drastically alter the number by the way of addition and deletion. In the present investigation, 38 endemic species of Western Ghats distributed in Goa are reported as new records to the study area. Eleven endemic species collected in the study area are already figuring in the Red data book. Based on the present study, their status along with all other species collected has been revised based on IUCN norms. Two endemic species viz. *Ceropegia fantastica* and *Cryptocoryne cognata* collected in the study area come under endangered category (E). Other endemic species such as *Brachystelma malwanense* and *Wiesneria triandra* come under vulnerable category (V). These species have a restricted geographical range and are facing constant threat due to human activities and hence in need of refuge. It is recommended that immediate steps be taken to conserve these species by protecting their habitats.

Based on the present study it is concluded that a thorough taxonomic and phytogeographical investigation of endemic plants of Western Ghats is very important and essential, as there is a likelihood of drastic revision in number of endemic plants. As the hotspots are defined on the basis of number of endemic plants, the alteration in number has got a greater bearing in assigning conservation priority to the area at global as well as local level.



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SPECIES	Goa	Sindhudurg	Uttar Kannada	Dakshin Kannada	Chikmagalur	Hassan	Kasargod	Coorg	Cannanore	Calicut	Mallapuram	Thrissur	Kottayam	Thiruvananthapuram	Kanniyakumari	Kolhapur	Palghat	Madurai	Coimbatore	Satara	Raigad	Nasik
<i>Griffithella hookeriana</i>	1	1	1	1	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
<i>Haplanthodes neilgherryensis</i>	1	1	0	1	1	0	1	0	0	1	1	1	0	0	0	1	1	0	1	1	1	1
<i>Hedyotis maheshwarii</i>	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Impatiens kleiniformis</i>	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Impatiens pulcherrima</i>	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0
<i>Indigofera dalzellii</i>	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
<i>Ischaemum dalzellii</i>	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
<i>Ischaemum jayachandranii</i>	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Ischaemum travancorensis</i>	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
<i>Justicia wynaadensis</i>	1	1	1	1	1	1	0	1	1	0	1	1	0	0	0	1	1	1	1	1	0	0
<i>Lindernia estaminodosa</i>	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Lindernia manilaliana</i>	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
<i>Murdannia versicolor</i>	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0
<i>Neanotis foetida</i>	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1
<i>Neanotis rheedei</i>	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	1	1	1
<i>Oberonia brachyphylla</i>	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
<i>Oberonia iridifolia</i>	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Ophiuros bombaiensis</i>	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Panicum paianum</i> var. <i>paianum</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Paspalum canarae</i> var. <i>fimbriatum</i>	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
<i>Phyllocephalum ritchiei</i>	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Phyllocephalum tenue</i>	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
<i>Porpax jerdoniana</i>	1	1	1	1	1	1	0	0	0	0	1	1	0	1	1	0	1	0	0	1	1	0
<i>Rhamphicarpa longiflora</i>	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1
<i>Rotala macrandra</i>	1	1	0	0	1	1	1	0	1	1	1	1	0	0	0	1	0	0	1	0	0	0
<i>Rotala malampuzhensis</i>	1	0	1	0	0	0	0	0	0	1	1	1	0	0	0	1	1	0	0	0	0	0
<i>Senecio belgaumensis</i>	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0
<i>Sonerila rheedii</i>	1	0	1	0	0	1	1	1	1	1	1	1	0	1	0	1	0	0	0	1	0	0
<i>Torenia bicolor</i>	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	1	1	1	0	0	0
<i>Trithuria konkanensis</i>	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Utricularia lazulina</i>	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
<i>Utricularia malabarica</i>	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Utricularia praeterita</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Wiesneria triandra</i>	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
<i>Zingiber neesanum</i>	1	1	1	0	1	1	0	0	1	0	0	1	0	1	0	0	1	0	0	1	1	0

APPENDIX - II

Specimens Examined:

Barleria strigosa Willd. var. **terminalis** (Nees) Clarke

Goa: Anmod, 5. 11. 1962, R. S. Rao 84335 (BSI); Butpal, Kanpal hills, 10. 11. 1962, R. S. Rao 84627 (BSI); Molem, on way to Margao, 20. 11. 1962, R. S. Rao 84987 (BSI); Avelde jungle, 22. 11. 1962, R. S. Rao 85001 (BSI); Badsare – Wagal forest, 17. 3. 1964, K. C. Kanodia 96338 (BSI); Codal, 6. 10. 1964, R. S. Raghavan 103277 (BSI); Natravali, 11. 10. 1970, N. P. Singh 125308 (BSI); Verlem, 12. 10. 1970, N. P. Singh 125337 (BSI); Molem – Anmod, 19. 10. 1997, Vaishali C. Joshi 1137 (GU). **Maharashtra:** Foot of Bhima hill, Khandala, 23. 12. 1962, R. S. Rao 83409 (BSI); Ravine above Burhi Lake, 28. 12. 1964, B. Venket Reddi 101148 (BSI); Lonavala, 29. 9. 1964, B. Venket Reddi 100927 (BSI); Amboli Ghat, Ratnagiri, 31. 10. 1969, B. G. Kulkarni 119265 (BSI); Phonda Ghat, 4. 5. 1971, B. G. Kulkarni 129490 (BSI); Koyna, 28. 11. 1978, R. K. Kochar 157926 (BSI).

Gymnostachyum glabrum (Dalz.) T. Ander.

Goa: Badsare - Wagal hill forest, 17. 3. 1964, K. C. Kanodia 96337 (BSI); Caranzol, 16. 4. 1966, John Cherian 107132 (BSI); Dudhsagar, 15. 1. 1997, Vaishali c. Joshi 493 (GU); Anjunem, 16. 3. 1997, Vaishali c. Joshi 627 (GU). **Maharashtra:** Ramghat – Wagotre, 10. 12. 1970, B. G. Kulkarni 120005 (BSI); Hawala Bhedshi, Ratnagiri, 28. 4. 1971, B. G. Kulkarni 129391 A (BSI); Koyna, 16. 12. 1979, R. K. Kochar 154314 (BSI). **Karnataka:** Castle rock, Jan 1891, W. A. Talbot (BSI).

Haplanthodes neilgherryensis (Wight) Majumdar

Goa: Shiroda, 7. 1. 97, Vaishali C. Joshi 478 (GU). **Karnataka:** Yelaner Ghat, Chikmagalur, 25. 2. 1984, E. Vajravelu 27846 (MH). **Kerala:** Parambikulam, Thrissur, 20. 11. 1962, K.M. Sebastine 150659 (MH); Kuppadi, Calicut, 6. 2. 1964, Ellis 18547 (MH); Thirubizhamkunnu, Palghat, 27. 12. 1969, E. Vajravelu 33369 (MH); Peradala, Kasaragod, 7. 5. 1982, Nair 71046 (MH); Meennutty, Malappuram, 13. 3. 1984, N. C. Nair 81212 (MH); Vellaran Kuthu, Idukki, 23. 12. 1988, Bhargavan 90052 (MH). **Tamil Nadu:** Karian Shola, Coimbatore, 25. 2. 1942, S. R. Raj 20294 (MH).

Justicia wynaadensis (Nees) Wall. ex T. Anders.

Goa: Nirankarichi rai, Valpoi, 20. 2. 1997, Vaishali c. Joshi 577 (GU). **Maharashtra:** Gavata, Bhedshi, Ratnagiri, B. G. Kulkarni 108349 (BSI); Koyna, Kumbharli Ghat, 17. 12. 1979, R. K. Kochar 154327 (BSI). **Karnataka:** Someshwar Ghat, Agumbe, 6. 2. 1961, R. S. Raghavan 69370 (BSI); Mercara from Surlicoppa (Coorg), 15. 2. 1963, A. S. Rao 85628 (BSI); Coorg, 7 miles from Bhagamandala, 22. 2. 1963, A. S. Rao 85898 (BSI); Parakatagiri, 27. 2. 1963, A. S. Rao 86747 (BSI); Kilandur near Hulical, 21. 3. 1964, R. S. Raghavan 97048 (BSI); Saklespur Heltur road, Hassan, 29. 1. 1969, C. J. Saldanha 12514 (JCB); Agumbe road, Shimoga, 12. 12. 1978, S. R. Ramesh & P. Prakash 5288 (JCB); Balchonnur – Ulsoor, Chikmagalur, 8. 3. 1979, S. R. Ramesh & P. Prakash 6519 (JCB); Dandeli – Gund road, Uttar Kannada, 9. 2. 1980, K. P. Shreenath & S. R. Ramesh 10822 (JCB). **Kerala:** Sultan Battari, (Wyanad) Calicut, 8. 2. 1964, Ellis 18599 (MH); Bhutharthankettu, 12. 2. 1970, B.V. Shetty 334804 (MH); Manchari, Malappuram, 24. 2. 1970, Ellis 33536 (MH); Kannothe forest, Cannanore, 12. 2. 1978, V. S. Ramachandran 54058 (MH); Mukkali forest, Palghat, 12. 1. 1980, N. C.

Nair 65409 (MH). **Tamil Nadu:** Mount Stoest, Coimbatore, 29. 1. 1962, J. Joseph 13805 (MH); Kombai forest, Madurai, 23. 2. 1978, Chandrabose 54245 (MH).

Mackenzia integrifolia (Dalz.) Bremek.

Goa: Ordofond – Butpal, 23. 4. 1963, K. C. Kanodia 88227 (BSI); Chinchewal on the way to Butpal, 13. 3. 1964, K. C. Kanodia 96229 (BSI); Kumtal near Caranzol, 16. 4. 1966, John Cherian 107138 (BSI); Dudhsagar, 15.1. 1997, Vaishali C. Joshi 497 (GU); Cotigao, 31. 1. 1998, Vaishali C. Joshi 1368 (GU). **Maharashtra:** Lonavala, 21. 5. 1902, G. A. Gammice (BSI); Kadawli – Rajapur, 31. 5. 1904, R. K. Bhide (BSI); Khandala, 21. 3. 1956, S. K. Jain 12092 (BSI). **Karnataka:** Uttar Kannada, W. A. Talbot 1101 (BSI); Agumbe, 20. 2. 1963, R. S. Raghavan 79535 (BSI); Barkana, Shimoga, 27. 12. 1978, K. P. Keshava Murthy, K. P. Sreenath & B. R. Ramesh 5104 (JCB); Agumbe, Shimoga, 14. 12. 1978, S. R. Ramesh & P. Prakash 5336 (JCB). **Kerala:** Vettilapara - Kerala, 21. 2. 1957, G. S. Puri 15729 (MH); Swarnampillar Reserve forest, 11. 5. 1961, K. N. Subramanian 71597 (MH).

Neuracanthus sphaerostachyus (Nees) Dalz.

Goa: Loliem, 10. 3. 1997, Vaishali C. Joshi 941 (GU).

Nilgirianthus barbatus (Nees) Bremek.

Goa: Nirankarichi rai, Valpoi, 20. 2. 1997, Vaishali C. Joshi 576 (GU). **Karnataka:** Uttar Kannada, February 1892, Bhide (BSI); Madanad, 7. 3. 1958, G. S. Puri 31775 (BSI); Chitrikala area along evergreen forest, 21. 3. 1960, R. S. Rao 61358 (BSI); Karigudda in Hulical, Mysore, 16. 2. 1963, R. S. Raghavan 86303 (BSI); Devarunde, Hassan, 21. 8. 1970, C. J. Saldanha & T. P. Ramamoorthy HFP 574 (JCB); Shirada Ghat, 13. 9. 1970, N. Sathyananda 60 (JCB); Bannuhalla, Hassan, 5. 2. 1970, C. J. Saldanha 16215 (JCB). **Kerala:** Kalladi river valley, Tenmalai, 7. 2. 1961, K. N. Subramanian 70356 (BSI); Kodal Reserve forest, Kolattupuzha, 15. 2. 1961, K. N. Subramanian 70735 (BSI); Dhoni forest, Palghat, 21. 10. 1963, J. Joseph 17803 (MH); Kulumar, Idukki, 3. 10. 1983, C. N. Mohanan 79939 (MH); Adukkam, Kottayam, 25. 5. 1984, Antony 551 (MH); Kadam bupira, Quilon, 20. 4. 1984, E. Vajravelu 80531 (MH). **Tamil Nadu:** Walayar estate, Tirunelveli, 24. 2. 1960, K.M. Sebastine 9942 (MH).

Thelepaepale ixiocephala (Benth.) Bremek.

Goa: After Honda village, Valpoi, 16. 11. 1962, John Cherian 84845 (BSI); Tudal, 20. 4. 1963, K. C. Kanodia 88168 (BSI); Jamad forest near Nandore, 3. 5. 1963, K. C. Kanodia 88395 (BSI); Caranzol hill, 7. 5. 1963, K. C. Kanodia 88473 (BSI); Molem – Anmod, 29. 10. 1998, Vaishali C. Joshi 1677 (GU). **Karnataka:** Uttar Kannada, Sirshi – Kumta road, 1. 5. 1956, S. D. Mahajan 1625 (BSI); Uttar Kannada, Kolegar 14 Km from Murdeshwar, 19.12.1962, R. S. Raghavan 79534 (BSI); Mercara – Sidapur road (Coorg), 5. 2. 1963, A. S. Rao 85609 (BSI); Someshwar Ghat, Shimoga, 20. 2. 1963, R. S. Raghavan 86414 (BSI); Hosangaddi near Hulical, 25. 3. 1964, R. S. Raghavan (BSI); Castle rock, 27. 12. 1966, C. J. Saldanha 11011 (JCB); Agumbe – Someshwar, Shimoga, 4. 5. 1978, Sayed Maqsood Ahamed, S. R. Ramesh & N. R. Ravindra 963 (JCB); Ulvi range, Uttar Kannada, 9. 2. 1980, K. P. Sreenath & S. R. Ramesh 10852 (JCB).

Wiesneria triandra (Dalz.) Micheli

Goa: Verna, 17. 8. 1996, Vaishali C. Joshi 53 (GU).

Holigarna arnottiana Hook. f.

Goa: Bambolim, 4. 3. 1998, Vaishali C. Joshi 1392 (GU). **Karnataka:** Koppa, Chikmagalur, 13. 12. 1978, S. R. Ramesh & P. Prakash 5326 (JCB); Dakshin Kannada, 27. 12. 1978, K. P. Sreenath, K. R. Keshava Murthy & B. R. Ramesh 5128 (JCB); Shimoga – Hassan road, 25. 1. 1981, C. J. Saldanha, B. Gurudev Singh & B. Ajay Kumar 12555 (JCB); Singari forest, Chikmagalur, 26. 2. 1984, E. Vajravelu 77857 (MH). **Kerala:** Way to Sappar hill, Palghat, 26. 5. 1964, E. Vajravelu 19075 (MH); Walluvasserai, Mallapuram, 3. 3. 1970, Ellis 33654 (MH); Kottur R. F, Trivandrum, 19. 4. 1973, J. Joseph, 44215 (MH); Kudiram R. F, Thrissur, 10. 4. 1977, Ramamoorthy 49283 (MH); Parappa, Cannanore, 24. 1. 1979, V. S. Ramachandra, 59192 (MH); Aickad, Quilon, 22. 2. 1979, C. N. Mohanan 61174 (MH); Periyamkutti, Idukki, 11. 7. 1988, Bharghavan 87453 (MH). **Tamil Nadu:** Kuzhivayal R. F, Nilgiri, 16. 2. 1973, E. Vajravelu 43743 (MH); Modiramalai, Kanniyakumari, 24. 3. 1979, A. N. Henry 61540 (MH); Kannikatty, Tirunelveli, 4. 5. 1989, Gopalan 90537 (MH); Nagariyar estate, Kamaraj, 12. 10. 1992, Sreenevasan 100008 (MH).

Holigarna grahamii (Wight) Kurz.

Goa: Molem – Anmod, 4. 12. 1997, Vaishali C. Joshi 1258 (GU). **Kerala:** Wyanad, 29. 3. 1953, Sulochand 96624 (MH); Chandanthode, Cannanore, 8. 12. 1967, Ellis 29540 (MH); Cherunalli estate, Palghat, 28. 10. 1976, E. Vajravelu 487535 (MH).

Ancistrocladus heyneanus Wall.

Goa: Gaodongri, 30. 4. 1998, Vaishali C. Joshi 1555 (GU). **Maharashtra:** Dongli, Kolhapur – Ratnagiri road, 11. 5. 1904, R. K. Bhide 6917 (BSI); Phonda Ghat top, 23. 10. 1970, B. G. Kulkarni 121828 (BSI); Amboli Ghat, Sindhudurg, 22. 4. 1971, B. G. Kulkarni 119197 (BSI); Malaya Jungle, Amboli, 22. 4. 1971, B. G. Kulkarni 128872 (BSI); Koyna Jungi – Raigad, 11. 12. 1979, R. K. Kochar C1158337 (BSI). **Karnataka:** Katagal, Yellapur forest, 15. 4. 1958, R. K. Arora 33709 (BSI); Anequrdi forest, 16. 4. 1958, R. K. Arora 33774 (BSI); Makut, Coorg, 9.1. 1959, R. K. Arora 12131 (BSI); Sagar – Jog road, Shimoga, 13. 8. 1959, B. S. Ahryh 31412 (BSI); Agumbe Bus stop, 24. 5. 1960, R. S. Raghavan 62926 (BSI); Malandur, Balchetta forest, 8. 2. 1961, R. S. Raghavan 69465 (BSI); Hulical Shimoga, 25. 5. 1962, R. S. Raghavan 80909 (BSI); Varahi, Shimoga, 17. 2. 1963, R. S. Raghavan 86332 (BSI); Kundadagudda, Agumbe, 29. 3. 1964, Hulical near Tile factory, 23. 3. 1964, R. S. Raghavan 97108 (BSI); Bisle Ghat, Hassan, 4. 4. 1972, T. P. Ramamoorthy & K. N. Gandhi HFP 2723 (JCB); Shirada Ghat, Dakshin Kannada, 19. 11. 1978, A. L. Takhtajan, C. J. Saldanha & K. R. Keshava Murthy 4682 (JCB); Kodachadri, Shimoga, 9. 3. 1979, K. R. Keshava Murthy & B. R. Ramesh 6257 (JCB); Kenmangundi, Chikmagalur, 14. 3. 1979, K. R. Keshava Murthy & B. R. Ramesh 6299 (JCB); Virajpet, Mukut road, Kodagu, 7. 6. 1979, B. R. Ramesh & S. R. Ramesh 8112 (JCB); Mavingundi, Uttar Kannada, 17. 6. 1980, S. R. Ramesh & B. R. Ramesh 11795 (JCB). **Kerala:** Silent valley, Palghat, 21. 4. 1980, V. J. Nair 67214 (MH); Calvery mount, Idukki, 21. 2. 1983, C. N. Mohanan 77908 (MH); Angamoozhy, Pathanamthitta, 7. 5. 1991, Chandrasekeran 88439 (MH).

Sageraea laurina Dalz.

Goa: Butpal – Ordofond, 11. 11. 1962, R. S. Rao 84670 (BSI); Cotigao, 11. 11. 1998, Vaishali C. Joshi 1686 (GU). **Karnataka:** Anshi Ghat, 11. 2. 1980, K. P. Sreenath & S. R. Ramesh 10930 (JCB). **Kerala:** Bhagavathikulam, Malayathoor R.F, Ernakulum, 10. 2. 1970, B. V. Shetty 33457 (MH). **Tamil Nadu:** Nadugani, Nilgiris, 2. 8. 1970, J. L. Ellis 35358 (MH).

Amorphophallus commutatus (Schott) Engl.

Goa: Dodamarg – Assnora, 27.5. 1997, Vaishali C. Joshi 651 (GU). **Maharashtra:** Sakharpa, 18. 5. 1904, R. K. Bhide (BSI); Ambavan, forest near Rest house, 6. 9. 1964, B. Venkata Reddi 68686 (BSI); Amboli Ghat, Kumbheswar, 18.5. 1965, R. D. Pataskar 105213 (BSI); Thana – Khar, 3. 10. 1967, John Cherian 112773 (BSI); Khunvada, R. F, Bordi range, 11. 1. 1968, K. M. Billore 113449 (BSI); Hanuman Ghat, Dukanwadi, Ratnagiri, 6. 6. 1970, B. G. Kulkarni 121088 (BSI). **Karnataka:** Kodlimalai State forest, Dakshin Kannada, 14. 7. 1979, C. J. Saldanha & B. R. Ramesh 8352 (JCB); Talguppa – Sagar, Shimoga, 17. 7. 1980, S. R. Ramesh & B. R. Ramesh 11766 (JCB); Along Bedthi river, Karwar, Uttar Kannada, 26. 6. 1981, S. R. Ramesh & S. Uday Kumar 13151 (JCB); Near Dam Site, Uttar Kannada, 17. 7. 1981, B. R. Ramesh & Shivaprakash, 13215 (JCB).

Amorphophallus konkanensis Hetterschied, Yadav & Patil

Goa: Dodamarg, 15. 5. 1998, Vaishali C. Joshi 1566 (GU).

Arisaema sivadasanii Yadav, Patil & Janarthanam

Goa: Balli – Canacona (Karmal Ghat), 12. 7. 1998, Vaishali C. Joshi 1591 (GU). **Maharashtra:** Amboli, 10.9.1995, S.R. Yadav, 4688D, 4688D (SUK).

Cryptocoryne cognata Schott.

Goa: Bicholim, 31. 8. 1997, Vaishali C. Joshi 901 (GU); Bicholim, 21. 9. 1997, Vaishali C. Joshi 992 (GU).

Arenga wightii Grif.

Kerala: Old Courtallum, Quilon, 19. 12. 1978, C. N. Mohanan 59558 (MH); Vallaparai – Palakaryem, Palghat, 29. 5. 1979, E. Vajravelu 6287D (MH); Panamkutty, Idukki, 4. 5. 1984, C. N. Mohanan 81778 (MH). **Tamil Nadu:** Vallachithodu, Lower Kodayar, 23. 3. 1979, A. N. Henry 62532 (MH).

Calamus thwaitesii Becc. & Hook. f.

Goa: Molem – Anmod, 2. 4. 1998, Vaishali C. Joshi 1479 (GU).

Hyphaena dichotoma (Wight) Furtado

Goa: Miramar, 2. 10. 1999 Vaishali C. Joshi 1710 (GU).

Brachystelma malwanense Yadav & Singh

Goa: Jambavali, 26. 3. 1998, Vaishali C. Joshi 1468 (GU).

***Ceropegia attenuata* Hook.f.**

Goa: Verna, 17. 8. 1996, Vaishali C. Joshi 38 (GU); Loliem, 24. 8. 1996, Vaishali C. Joshi 86 (GU).
Maharashtra: Khandala, 3. 7. 1961, M. Y. Ansari 32789 (BSI); Mumbra hill top, Thane Range, 9. 9. 1967, K.M. Billore 116484 (BSI).

***Ceropegia fantastica* Sedgw.**

Goa: Loliem, 1997, Vaishali C. Joshi 987(GU).

***Heterostemma dalzellii* Hook. f.**

Goa: Ordofond – Butpal forest, 25. 8. 1963, K. C. Kanodia 89544 (BSI); Porvorim forest area, 4. 9. 1963, K. C. Kanodia 44271 (BSI); Assnora, 31. 8. 1997, Vaishali C. Joshi 907 (GU). **Maharashtra:** Math forest 5 miles from Vengurla, 21. 9. 1964, R. D. Pataskar 102220 (BSI).

***Tylophora dalzellii* Hook.**

Goa: Anjunem Dam, 29. 6. 1997, Vaishali C. Joshi 695 (GU); Shiroda, 24. 9. 1997, Vaishali C. Joshi 1033 (GU). **Maharashtra:** Parula, West of Malkapur near Kolhapur, 7. 5. 1904, R. K. Bhide (BSI).
Karnataka: Uttar Kannada, W. A. Talbot s.n. (BSI). **Kerala:** Tirunelli, R.F Cannanore, 6. 3. 1979, V. S. Ramachandran 62092 (MH); Thenmalai, Quilon, 18. 4. 1984, E. Vajravelu 80523 (MH).

***Phyllocephalum ritchiei* (Hook. f.) Narayan**

Goa: Pednem, 3. 9. 1997, Vaishali C. Joshi 930 (GU); Bicholim – Valpoi, 21. 9. 1997, Vaishali C. Joshi 1019 (GU). **Karnataka:** Asoga – Khanapur, Belgaum, 5. 11. 1976, C. J. Saldanha 19234 (JCB); After Londa, Belgaum, 25. 10. 1978, C. J. Saldanha & P. Prakash 3464 (JCB); Sirshi – Siddapur, Uttar Kannada, 10. 11. 1981, B. R. Ramesh, Shivaprakash & S. Udaya Kumar 14156 (JCB).

***Phyllocephalum tenue* (Clarke) Narayan**

Goa: Colem, 9. 10. 1996, Vaishali C. Joshi 215 (GU); Molem, 22. 11. 1996, Vaishali C. Joshi 417 (GU).

***Senecio belgaumensis* (Wight) Clarke**

Goa: Rai, 18. 8. 1963, K. C. Kanodia 89310 (BSI); Ordofond, 24. 8. 1963, K. C. Kanodia 89499 (BSI); Ponda on way to Darbandora, 29. 8. 1963, K. C. Kanodia 89629 (BSI); Sukur village hill, 5. 9. 1963, K. C. Kanodia 89782 (BSI); Mapusa – Thivim, August – October 1965, J. Pallithanam G276 (BSI); Molem - Belgaum road, 19. 9. 1970, N. P. Singh 124406 (BSI); Molem – Anmod, 22. 11. 1996, Vaishali C. Joshi 425 (GU); Tiska - Usgao, 9. 8. 1997, Vaishali C. Joshi 856 (GU). **Maharashtra:** Mahabaleshwar, 11.10. 1960, M. Y. Ansari 67607 (BSI); Amboli Ghat, 4. 10. 1964, R. S. Raghavan 103226 (BSI); Koyna, 13. 9. 1978, R. K. Kochhar 103395 (BSI). **Karnataka:** Shimoga, 2. 10. 1962, R. S. Raghavan 93390 (BSI); Gubbiga near Yedur, 5. 10. 1962, R. S. Raghavan 82986 (BSI); Castle Rock, 7. 11. 1969, B. M. Wadhwa 119529 (BSI); Castle rock on way to Anmod, 19. 9. 1970, M.Y. Ansari 124112 (BSI); Near Londa, Belgaum, 28. 10. 1978, C. J. Saldanha & P. Prakash 3727 (JCB); Gund Ulvi road, Uttar Kannada, 9. 2. 1980, K. P. Sreenath & S. R. Ramesh 10847 (JCB).

***Impatiens kleiniformis* Sedgw.**

Goa: Dodamarg, 4. 9. 1996, Vaishali C. Joshi 128 (GU); Charan – Chorla, 24. 10. 1996, Vaishali C. Joshi 266 (GU).

***Impatiens pulcherrima* Dalz.**

Goa: Bhati Village, 27. 8. 1963, K. C. Kanodia 89577 (BSI); Usgao – Phonda, 8.10. 1964, R. S. Raghavan 103423 (BSI); Usgao – Phonda, 8. 10. 1964, R. S. Raghavan 103423 (BSI); Tudal, 19. 9. 1965, John Cherian 106262 (BSI); Verem, 13. 9. 1965, John Cherian 106138 (BSI); Netravali, 11. 10. 1976, N. P. Singh 125263 (BSI); Chorla, 24. 10. 1996, Vaishali C. Joshi 256 (GU). **Maharashtra:** Amboli Ghat, Ratnagiri, 17. 9. 1964, R. D. Pataskar 102096 (BSI); Amboli Ghat Ratnagiri, 25. 8. 1965, B.G. Kulkarni 10638 (BSI); Malvan dara, near Bhivadi Khurd, Junnar, 23. 9. 1968, Hemadri 118032 (BSI); Phonda Ghat, 4. 10. 1970, B. G. Kulkarni 121449 (BSI); Koyna Ghat, 1. 9. 1978, R. K. Kochar 152575 (BSI); Morgiri, Satara, 17. 10. 1984, S. D. Deshpande 167668 (BSI). **Karnataka:** Karwar, August 1883, W. A. Talbot 2499 (BSI); Castle rock, 2. 8. 1909, Bhide (BSI).

***Begonia crenata* Dryand.**

Goa: Kundai, 18. 7. 1997, Vaishali C. Joshi 780 (GU); St. Cruz, 21. 8. 1997, Vaishali C. Joshi 875 (GU). **Karnataka:** Kulshekar – Padam, Dakshin Kannada, 23. 8. 1980, C. J. Saldanha 12083 (JCB); Chandragiri (Bababudangiri range), Chikmagalur, 16. 10. 1978, C. J. Saldanha 3363 (JCB).

***Adelocaryum coelestinum* (Lindl.) Brand**

Goa: Codal, 5. 10. 1964, R. S. Raghavan 103270 (BSI); Molem, 15. 10. 1997 Vaishali C. Joshi 523 (GU). **Karnataka:** Uttar Kannada, 10. 11. 1908, W. A. Talbot 1734 (BSI); Agumbe, 27.10. 1960, R. S. Raghavan 67803 (BSI); Hulical, Shimoga 21. 8. 1963, R. S. Raghavan 93285 (BSI); Kavaledurga, Shimoga, R. S. Rao 82886 (BSI). **Kerala:** Dhoni, Palghat, 18. 7. 1963, J. Joseph 17203 (MH); Bonaccard estate, Travancore, 22. 8. 1975, J. Joseph 46471 (MH); Way to Ayyappan Temple, Idukki, 2. 9. 1977, N. C. Nair 105059 (MH); Travancore, 9. 10. 1982, Narayan Swami 830 (MH). **Tamil Nadu:** Santhi estate, Nilgiris, 30. 7. 1970, Ellis 35313 (MH); Lower Kodayar, Kanniyakumari, 6. 9. 1976, A. N. Henry 48239 (MH).

***Moullava spicata* (Dalz.) Nicolson**

Goa: Bambolim, 12. 11. 1997, Vaishali C. Joshi 654 (GU). **Karnataka:** Castle rock, 28. 12. 1966, C. J. Saldanha 10424 (JCB); Shiradi border, Hassan, 12. 12. 1970, C. J. Saldanha HFC 1246 (JCB); Belgaum – Khanapur, Belgaum, 16. 10. 1978, C. J. Saldanha 3655 (JCB); Dakshin Kannada, 10. 12. 1978, C. J. Saldanha & K. P. Sreenath 4963 (JCB); Shimoga, 12. 1. 1979, B. R. Ramesh, K. R. Keshava Murthy & P. Prakash 13789 (JCB); State forest, Chikmagalur, 13. 12. 1978, S. R. Ramesh & P. Prakash 5320 (JCB); Kodagu, 28. 12. 1978, C. J. Saldanha & P. Prakash 5551 (JCB); Kulagi, Uttar Kannada, 16. 2. 1979, S. B. Manohar & K. R. Keshava Muthy 6106 (JCB).

***Capparis rheedii* DC.**

Goa: Molem, 5. 4. 1998, Vaishali C. Joshi 1496 (GU); Molem, 15. 4. 1998, Vaishali C. Joshi 1525 (GU). **Kerala:** Mukali, Palghat, 11. 11. 1976, E. Vajravelu 48925 (MH); Nileshwar, Cannanore, 25. 12. 1980, Ansari 70013 (MH); Thenmala, Quilon, 10. 3. 1980, K. Vivekananthan 66185 (MH); Chalapudi - Mala road, Trichur, 10. 2. 1984, Ramamoorthy 80449 (MH). **Tamil Nadu:** Manchola, Tirunelveli, 25. 6. 1957, K.M. Sebastine 3640 (MH); Vallachithod, Kanniyakumari, 20. 3. 1984, A. N. Henry 70660 (MH).

***Calophyllum calaba* Linn.**

Goa: Colem, 23. 1. 1997, Vaishali C. Joshi 521 (GU); Colem, 11. 10. 1997, Vaishali C. Joshi 1079 (GU). **Maharashtra:** Ainode, 24 Km from Bhedshi, Ratnagiri, 28. 4. 1971, B. G. Kulkarni 129377 (BSI). **Karnataka:** Yellapur, December 1882, W. A. Talbot 245 (BSI); Castle rock, 13. 4. 1909, R. K. Bhide (BSI); Sirshi Kumta road, 9. 7. 1956, S. K. Jain 2166 (BSI); Mattikar forest, 26. 4. 1957, G. S. Puri 13131 (BSI); Barakana Agumbe, 4. 11. 1960, R. S. Raghavan 68118 (BSI); Varati stream near Hulical falls, 17. 2. 1963, R. S. Raghavan 86333 (BSI); Marnadhole Coorg, 27. 2. 1963, A. S. Rao 86783 (BSI); Devalli - Londa, 25. 10. 1978, C. J. Saldanha 3490 (JCB); Yermalu, Mangalore - Mulki road, 9. 12. 1978, C. J. Saldanha 4930 (JCB); Bisle Ghat boarder 11. 12. 1978, C. J. Saldanha 4985 (JCB); Dandeli, gund range, 14. 2. 1979, K. R. Keshava Murthy 6050 (JCB); Chikmagalur, Magundi - Balchole, 9. 3. 1979, S. R. Ramesh 6544 (JCB); Thandi nala, Uttar Kannada, 6. 11. 1981, B. R. Ramesh, Shivaprakash & Uday Kumar 14050 (JCB); Shiradi Ghat -Hassan, 25. 9. 1984, Satish kumar & Amarnath 14 (JCB).

***Garcinia indica* (Dupetite - Thouars) Choiss**

Goa: Chandranath, 4.12. 1996, Vaishali C. Joshi 445 (GU); St Cruz, 8. 1. 1998, Vaishali C. Joshi 1348 (GU). **Karnataka:** Anish, Uttar Kannada, 11. 2. 1980, K. P. Sreenath & S. R. Ramesh 10933 (JCB); Hulical Ghat, Dakshin Kannada, 24. 5. 1980, C. J. Saldanha 11570 (JCB).

***Garcinia talbotii* Raiz. ex Santapau**

Karnataka: Bisle Ghat, Hassan, 8. 1. 1970, C. J. Saldanha CJS 16027 (JCB); Hulical Ghat, Shimoga, 4. 5. 1978, C. J. Saldanha 7629 (JCB); Hulical Ghat, Shimoga, 4. 5. 1979, C. J. Saldanha 7629 (JCB).

***Murdannia versicolor* (Dalz.) Brueckner**

Goa: Varkin 6 miles from Sanguem, 27. 8. 1963, K. C. Kanodia 89559 (BSI); Koparde, 6. 10. 1964, R. S. Raghavan 103329 (BSI); Pednem Agarvado, 7. 9. 1965, P. J. Cherian 93097 (BSI); Taleigao, 24. 7. 1997, Vaishali C. Joshi 798 (GU). **Maharashtra:** Janavle village on the way to Malvan from Phonda, 25. 11. 1961, Ansari 78473 (BSI); Malvan, 25. 11. 1961, Ansari 78498 (BSI); Supa Ghat, 28. 11. 1961, Ansari 78620 (BSI); Top of Ram Khand, Khed Taluka, 30. 11. 1961, K. P. Janardhanan 76056 (BSI); Lonavala, 1. 12. 1963, B. Venkata Reddi 68359 (BSI); Sakarpathar hills, Lonavala, 27. 9. 1964, B. Venkata Reddi 98758 (BSI); Amboli, 12. 10. 1970, B. G. Kulkarni 121643 (BSI). **Karnataka:** Tala cauvery 4 Km from Bhagamandala, Coorg, 26.10.1963, A. S. Rao 95166 (JCB).

***Fimbristylis dauciformis* Govind.**

Goa: Taleigao, Goa University Campus, 25. 7. 1997, Vaishali C. Joshi 813 (GU); Pernem, 3. 9. 1997, Vaishali C. Joshi 933 (GU); Colem, 11. 10. 1997, Vaishali C. Joshi 1078 (GU).

***Fimbristylis lawiana* (Boeck.) Kern.**

Goa: Verna, 17. 8. 1996, Vaishali C. Joshi 41 (GU); Taleigao, 23. 6. 1997, Vaishali C. Joshi 686 (GU). **Maharashtra:** Belgaum, 15. 6. 1885, W. A. Talbot 1270; Lonavala, 24. 6. 1903, L. D. Garade 2700 (BSI); Khandala – Meroli, 15. 6. 1956, S. K. Jain 2271 (BSI); Bhimashankar, 13. 6. 1961, K. P. Janardhanan 72253 (BSI); 6th mile West to Junnar, 29. 6. 1965, Hemadri 99256 (BSI); Mohili – Bhiwandi range (Thane), 20. 7. 1968, K. M. Billore I16223 (BSI).

***Hopea ponga* (Dennst.) Mabblerley**

Goa: Querim, 16. 3. 1997, Vaishali C. Joshi 620 (GU); **Karnataka:** Karkala, Dakshin Kannada, 16. 3. 1950, 1968 (MH); Castle Rock, 19. 12. 1953, C. J. Saldanha CS 986 (JCB); Bisle Ghat, Hassan, 4. 5. 1971, C. S. Ramamoorthy HFP 1655 (JCB); Barkur – Halady, Dakshin Kannada, 20. 4. 1979, C. S. Prakesh 7072 (MH); Belgaum, 22. 5. 1979, C. J. Saldanha 7836 (JCB); Hulical – Agumbe, 1. 5. 1980, C. J. Saldanha & Gurudev Singh 11335 (JCB); Uttar Kannada, 23. 3. 1981, C. J. Saldanha, S. R. Ramesh & Ramesh 12737 (JCB). **Kerala:** Kattakada, Trivandrum, 21. 4. 1973, J. Joseph 44224 (MH); Adirapalli, Thrissur 13. 9. 1976, Ramamoorthy 48500 (MH); Kannothe R. F, Cannanore, 17. 2. 1978, Ramachandran 54030 (MH); Periyaram, Kasaragod, 14. 5. 1982, V. J. Nair 73874 (MH); Idukki, 27. 12. 1983, Pandurang 62554 (MH); Kottayam, 20. 8. 1984, Anthony 657 (MH); Thekkuthode, Pathnamthitta, 19. 4. 1988, Anil Kumar 554 (MH); Paripally, Quilon, 18. 7. 1979, C. N. Mohanan 63164 (MH).

***Diospyros angustifolia* (Miq.) Kosterman.**

Goa: Molem – Anmod, 2. 4. 1998, Vaishali C. Joshi 1483 (GU); Kodal – Ambachagol, 18. 4. 1998, Vaishali C. Joshi 1546; Molem – Anmod, 31. 5. 1998, Vaishali C. Joshi 1569 (GU). **Maharashtra:** Koyana, 26. 4. 1979, R. K. Kochhar, 154755 (BSI).

***Diospyros paniculata* Dalz.**

Goa: Molem – Anmod, 10. 3. 1998, Vaishali C. Joshi 1400 (GU). **Karnataka:** Castle rock 16. 4. 1909, Bhide (BSI); Cattle shed road, Agumbe, 5. 2. 1961, R. S. Raghavan 69354 (BSI); Kodachadri, 7. 4. 1979, C. J. Saldanha, K. R. Keshava Murthy & S. R. Ramesh 6874 (JCB); Anshi Ghat, Uttar Kannada, 11. 2. 1980, K. P. Sreenath & S. R. Ramesh 10928 (JCB); Malemane Ghat, Uttar Kannada, 13. 2. 1980, S. R. Ramesh & K. P. Sreenath 10992 (JCB).

***Diospyros pruriens* Dalz.**

Goa: Tamdi surla, 5. 4. 1998, Vaishali C. Joshi 1492 (GU). **Karnataka:** Kempuhole, 20. 5. 1970, D. H. Nicolson, C. J. Saldanha & T. P. Ramamoorthy HFP 129 (JCB); Kempuhole, Shiradi Ghat, Hassan, 13. 4. 1971, T. P. Ramamoorthy HFP 1535 (JCB).

Diospyros saldanhae Kosterm.

Goa: Molem – Anmod, 2. 4. 1998, Vaishali C. Joshi 1483 (GU); Kodal, 18. 4. 1998, Vaishali C. Joshi 1546 (GU). **Karnataka:** Devarunde, Hassan, Mysore, 13. 5. 1969, C. J. Saldanha CJS 13012, (JCB); Kodachadri, Shimoga, 7. 4. 1979, C. J. Saldanha, S. R. Ramesh & K. R. Keshava Murthy 6864 (JCB).

Eriocaulon cuspidatum Dalz.

Goa: Verna, 17. 8. 1996, Vaishali C. Joshi 54 (GU); Cortalim, 14. 11. 1996, Vaishali C. Joshi 394 (GU).

Eriocaulon dalzellii Koern.

Goa: Amberem near Pednem, 6. 9. 1965, John Cherian 93087 (BSI); Molem – Sanguem, 21. 9. 1970, N. P. Singh 124460 (BSI); Bicholim, 31. 8. 1997, Vaishali C. Joshi 905 (GU); Molem – Anmod, 27. 9. 1998, Vaishali C. Joshi 1671 (GU). **Maharashtra:** Mangaon forest towards Akari, Ratnagiri, 29. 9. 1964, R. D. Pataskar 102229 (BSI); Amboli plateau, 8. 11. 1965, B. G. Kulkarni 107910 (BSI); Chukal road, Amboli, Ratnagiri, 12. 8. 1991, B. G. Kulkarni 131610 (BSI). **Karnataka:** Agumbe, Vanake Abbi, 18.6. 1961, R. S. Raghavan 74157A (BSI); Gubbiga near Yedur, Shimoga, 22. 8. 1963, R. S. Raghavan C 90157 (BSI); Begar, near Agumbe, Shimoga, 2. 9. 1963, R. S. Raghavan 90382 (BSI).

Eriocaulon eurypeplon Koern.

Goa: Loliem, 24. 8. 1996, Vaishali C. Joshi 69 (GU).

Eriocaulon fysonii Ansari & Balakr.

Goa: On the way to Margao, 8. 11. 1962, R. S. Rao 84480 (BSI); Nuvem hills - Verna Plateau, 21. 8. 1963, K. C. Kanodia 89430 (BSI); Tudal, 24. 8. 1963, K. C. Kanodia 89505 (BSI); Chimal Reservoir, 9. 11. 1963, R. S. Rao 92905 (BSI); Querim, 16. 10. 1996, Vaishali C. Joshi 232 (GU); Loliem, 10. 9. 1997, Vaishali C. Joshi 950 (GU). **Maharashtra:** Kupri Ghat top of Malvan, Ratnagiri, 7. 8. 1971, R. S. Rao 131544 (BSI).

Eriocaulon lanceolatum Miq. ex Koern.

Goa: Gotmode, Ponda - Usgao, 9.8.1997, Vaishali C. Joshi 860 (GU).

Eriocaulon redactum Rhuland.

Goa: Taleigao, Goa University Campus, 15. 9. 1997, Vaishali C. Joshi 958 (GU); Cotigao, 23. 8. 1998, Vaishali C. Joshi 1633 (GU).

Eriocaulon stellulatum Koern.

Goa: Molem, 12.11.1997, Vaishali C. Joshi 860 (GU).

***Bruxanellia indica* Dennst. ex Kostel**

Goa: Molem, Avelde jungle, 22. 11. 1962, S. R. Rao 85002 (BSI); Chorla, 7. 3. 1997, Vaishali C. Joshi 590 (GU). **Maharashtra:** Amboli Ghat, Ratnagiri, 31. 10. 1969, B. G. Kulkarni 119240 (BSI); Kumborli Ghat, Koyna 17. 2. 1979, R. K. Kochar 154315 (BSI). **Karnataka:** Uttar Kannada, W. A. Talbot 8596, 8600, 8595 (BSI); Mysore, 21. 3. 1964, R. S. Raghavan 97061 (BSI); Arabail Ghat, Uttar Kannada, 2. 10. 1981, S. R. Ramesh, S. Uday Kumar 13767 (JCB).

***Dimorphocalyx glabellus* Thw., var. *lawianus* (Hook. f.) T. Chakrab. & Balakr.**

Goa: Molem – Anmod, 12. 1. 1998, Vaishali C. Joshi 1368 (GU); Molem – Anmod, 31. 5. 1998, Vaishali C. Joshi 1574 (GU); Molem – Anmod, 29. 10. 1998, Vaishali C. Joshi 1675 (GU). **Maharashtra:** Lonavala, 26. 5. 1909, R. K. Bhide (BSI); Bhimashankar (Khed Taluka), 25. 2. 1961, K.P. Janardhanan 69280 (BSI); Amboli Ghat – Ratnagiri, 27.10. 1969, B.G. Kulkarni 119104 (BSI); Koyna, 23. 11. 1978, R. K. Kochhar 157808 (BSI). **Karnataka:** Agumbe, 12. 10. 1962, R. S. Raghavan 83157 A (BSI); Ainshi, 10.11. 1893, W. A. Talbot 3169 (BSI). **Tamil Nadu:** Cunbummedu, Ramnad, 23. 9. 1971, E. Vajravelu 38690 (MH); Karian Shola, Coimbatore, 2. 7. 1976, Chandrabose 47251 (MH); Sivagiri hills, Tirunelveli, 22. 4. 1989, Sreenivasan 89543 (MH).

***Drypetes venusta* (Wight) Pax & Hoffm.**

Goa: Molem – Anmod, 12. 1. 1997, Vaishali C. Joshi 1355 (GU); Vageri hills, 19. 12. 1997, Vaishali C. Joshi 1289 (GU); Gaodongrem, 4. 1. 1998, Vaishali C. Joshi 1324 (GU).

***Euphorbia notoptera* Boiss.**

Goa: Verna, 21. 8. 1963, Betlae 89428 (BSI); Ordofond forest on way to Tudal, 24. 8. 1963, K. C. Kanodia 89478 (BSI); Patiem forest, 28. 8. 1963, K. C. Kanodia 89590; 3 miles from Darbandora, 29. 8. 1963, K. C. Kanodia 89647 (BSI); Porvorim rocky plateau, 7. 11. 1963, R. S. Rao 69885 (BSI); Chimal, 9. 11. 1963, R. S. Rao 92889; Honda, 6. 10. 1964, R. S. Raghavan 103314 (BSI); Agonda, 5. 9. 1965, P. J. Cherian 85091 (BSI); Curchorim, 10. 9. 1965, John Cherian 106076 (BSI); Verna 17. 8. 1996, Vaishali C. Joshi 39 (GU). **Karnataka:** Uttar Kannada, Talbot 1920 (BSI).

***Phyllanthus talbotii* Sedgwick**

Goa: Sanguem, 22. 9. 1997, Vaishali C. Joshi 1022 (GU); Sanguem, 11. 10. 1997, Vaishali C. Joshi 1070 (GU). **Karnataka:** Jog falls along river, 6. 5. 1956, G. S. Puri 2065 (BSI); Barakana, Agumbe, 16. 10. 1967, R. S. Raghavan 83287 (BSI).

***Crotalaria filipes* Benth.**

Goa: Taleigao, 23. 10. 1996, Vaishali C. Joshi 358 (GU). **Maharashtra:** Bhorgiri, 23. 12. 1960, K. P. Janardhanan 70062 (BSI); Top of Bhima hills, Khandala, 25. 10. 1962, R. S. Rao 83460 (BSI); Lonavla, 25. 12. 1962, R. S. Rao 85223 (BSI); Ratanwadi river bed, 1. 10. 1970, B. M. Wadhwa 127921 (BSI). **Karnataka:** Pedubidri Belmannu road, Dakshin Kannada, 12. 11. 1978, C. J. Saldanha & P. Prakash 10935 (JCB); Nittur Hasangara road, Shimoga, 29. 12. 1978, K. R. Keshava Murthy, K. P. Sreenath & B. R. Ramesh 5196 (JCB); Gulbarga, 27. 10. 1979, S. R. Ramesh 10058 (JCB); Uttar Kannada, 11. 2. 1980, K. P. Sreenath & S. R. Ramesh 10934 (JCB).

***Crotalaria lutescens* Dalz.**

Goa: Margao, 15. 10. 1909, W. A. Talbot 2601 (BSI); Butpal - Kanpas hill top, 10. 11. 1962, R. S. Rao 84614 (BSI); Ordofond, 11. 10. 1964, R. S. Raghavan 103486 (BSI); Bastor, 17. 9. 1966, J. Pallithanam G 553 (BSI); Goa University Campus, 23. 10. 1996, Vaishali C. Joshi 359 (GU); Mapusa, 31. 8. 1997, Vaishali C. Joshi 899 (GU). **Maharashtra:** Adari road, Malvan, 28. 9. 1970, B. G. Kulkarni 121247 (BSI); Kalsubai hills, 8. 10. 1970, B. M. Wadhwa 128283 (BSI).

***Derris heyneana* (Wight & Arn.) Benth.**

Goa: Molem – Anmod, 10. 3. 1998, Vaishali C. Joshi 1410 (GU). **Karnataka:** Kulhutti R. F, Chikamagalur, 2. 3. 1984, E. Vajravelu 77896 (MH). **Kerala:** Vallakkadavu, Idukki, 11. 3. 1973, Sharma 43811 (MH); Mukkali, Palghat, 7. 3. 1975, E. Vajravelu 46241 (MH); Quilon, 22. 12. 1979, C. N. Mohanan, 65015 (MH); Merchiston- Kallar, Trivandrum, 6. 3. 1980, K. Vivekanandan 66128 (MH).

***Geissaspis tenella* Benth.**

Goa: Ordofond Butpal, 25. 8. 1963, K. C. Kanodia 89515 (BSI); Porvorim, 4. 9. 1963, K. C. Kanodia 89806 (BSI); Netravali, 15. 10. 1970, N. P. Singh 125486 (BSI); Taleigao, 14. 8. 1996, Vaishali C. Joshi 12 (GU); Bambolim, 24. 7. 1997, Vaishali C. Joshi 807 (GU). **Maharashtra:** Khandala, G. A. Gammie (BSI). **Karnataka:** Kumta, Uttar Kannada, 28. 9. 1978, K. R. Keshava Murthy & K. P. Sreenath 2996 (JCB); Suratkal, Dakshin Kannada, 18. 10. 1978, C. J. Saldanha & K. R. Keshava Muthy 3390 (JCB); Siddapur, 16. 11. 1884, W. A. Talbot (BSI).

***Indigofera dalzellii* Cooke**

Goa: Margao, 15. 10. 1891, W. A. Talbot 2590 (BSI); Verna plateau, 21. 8. 1963, K. C. Kanodia 89425 (BSI); Usgao – Honda, 31. 8. 1963, K. C. Kanodia 89681 (BSI); Taleigao, 23. 10. 1996, Vaishali C. Joshi 1 (GU). **Maharashtra:** Panchgani tabel top, 8. 5. 1961, R. S. Rao 71691(BSI); Ramghat, 30. 5. 1970, B. G. Kulkarni 120970 (BSI); Ajgaon near Bando, 14. 8. 1971, B. G. Kulkarni 131671 (BSI); Koyna, 26. 4. 1979, R. K Kochar 154752 (BSI). **Karnataka:** Shimoga, 16. 7. 1981, B. R. Ramesh & Shivaprakash 13191 (JCB).

***Spatholobus purpureus* Benth. ex Baker**

Goa: Molem – Anmod, 4. 12. 1997, Vaishali C. Joshi 1260 (GU); Molem – Anmod, 11. 12. 1998, Vaishali C. Joshi 1708 (GU); Molem - Anmod, 12. 1. 1998, Vaishali C. Joshi 1363 (GU). **Karnataka:** Uttar Kannada, 1. 5. 1888, W. A Talbot 3831; Agumbe, 6. 2. 1961, R. S. Raghavan C 69406. **Kerala:** Chandanthode, 18. 4. 1966, J. E. Ellis 27134 (MH); Palarure, Quilon, 18. 12. 1978, C. N. Mohanan 134155 (MH); Mandampatty forest, Palghat, 2. 2. 1979, E. Vajravelu 60624 (MH); Karapava estate, Palghat, 20. 12. 1980, N. C. Nair 69682 (MH); Panumkutty, Idukki, 19. 12. 1982, C. N. Mohanan 151340 (MH). **Tamil Nadu:** Karian Shola, Anamalai, 19. 3. 1931, V. Narayan Swami 5460 (MH).

***Hydnocarpus pentandra* (Buch. - Ham.) Oken.**

Goa: Querim 16. 3. 1997, Vaishali C. Joshi 623 (GU); Gaodongri, 12. 7. 1997, Vaishali C. Joshi 746 (GU). **Karnataka:** Shiradi Ghat, Hassan, 30. 1. 1969, C. J. Saldanha 12618 (JCB); Agumbe – Belgaum road, Shimoga, 15. 12. 1978, S. R. Ramesh, P. Prakash 5400 (JCB); Dandeli, Uttar Kannada, 14. 2.

1979, Manohar, Keshav Murthy 6036 (JCB); Coorg, 21. 7. 1979, R. Ramesh & Manohar 8439 (JCB); Karadikhan estate, Chikmagalur, 29. 6. 1980, C. J. Saldanha (JCB). **Kerala:** Tambratcheri, Wyanad, 21. 1. 1903, Berber 5666 (MH); Atteri, Palghat, 17. 4. 1962, Sree Madhavan 14050 (MH); Kottayam, 25. 5. 1965, K. Vivekananthan 24382 (MH); Ernakulam, 16. 2. 1970, B.V. Shetty 335202 (MH); Podakkapara, Mallapuram, 25. 2. 1970, Ellis 33568 (MH); Trivandrum, 14. 4. 1973, J. Joseph 44160 (MH); Cannanore, 26. 4. 1979, V. S. Ramachandran 61609 (MH); Idukki, 26. 1. 1982, Ramamoorthy 72998 (MH); Kasaragod, 15. 5. 1982, V. J. Nair 73906 (MH); Chavakad, Thrissur, 20. 1. 1987, Ramamoorthy 84700 (MH); Pathnamhitta, 9. 5. 1988, Chandrasakaran 84922 (MH). **Tamil Nadu:** Tirunelveli, 1. 10. 1971, E. Vajravelu 38831 (MH); Nelli Thorai, Nilgiri, 28. 6. 1974, E. Vajravelu 45016 (MH).

Trithuria konkanensis S. R. Yadav & M. K. Janarthanam

Goa: Verna, 4. 9. 1998, Vaishali C. Joshi 1649 (GU).

Eusteralis tomentosa (Dalz.) Panig

Goa: Gaodongri, 4. 1. 1998, Vaishali C. Joshi 1321 (GU). **Maharashtra:** Ratnagiri, 17. 2. 1970, B. G. Kulkarni 120160 (BSI); Amboli, M. Y. Ansari 78544 (BSI). **Karnataka:** Charnadi Village, 27. 10. 1960, C. J. Saldanha CS 6174 (JCB); Bannuhalla, Hassan, 23. 2. 1970, C. J. Saldanha 16396 (JCB); Londha, Belgaum, 25. 10. 1978, C. J. Saldanha & P. Prakash 3459 (JCB); Surathkal, Dakshin Kannada, 27. 12. 1979, C. J. Saldanha 10558 (JCB); Somvarpeth, Coorg, 17. 1. 1984, E. Vajravelu 77787 (MH). **Kerala:** Arunapparai, Cannanore, 9. 2. 1978, V. S. Ramachandran 53821 (MH).

Cryptocarya lawsonii Gamble

Goa: Molem – Anmod, 10. 3. 1998, Vaishali C. Joshi 1411 (GU). **Karnataka:** Kodachadri range, Shimoga, 8. 3. 1979, K. R. Keshava Murthy & B. R. Ramesh 6175 (JCB).

Litsea coriacea (Heyne ex Meisner) Hook. f.

Goa: Molem – Anmod, 22. 3. 1997, Vaishali C. Joshi 1733 (GU); Colem – Sonali, 11. 10. 1997, Vaishali C. Joshi 1092 (GU). **Karnataka:** Sampagi, Dakshin Kannada, 1900, Barber 2243 (MH); Bisale Ghat, Dakshin Kannada, 1. 12. 1972, Raj 18246 (MH); Yellapur, 9. 11. 1953, R. P. Patil 2592 (BSI); Arienkaur reserve, opposite Thenmalai station, 6. 2. 1961, K. N. Subramaniam 63388 (BSI); Way to Malandur, Agumbe, 8. 2. 1961, R. S. Raghavan 69470 (BSI); Swarnampillai reserve forest, 26. 3. 1962, K. N. Subramaniam 71578 (BSI); Yedur – Hulical route, 12. 2. 1963, R. S. Raghavan 86079 (BSI); Vanakeabbi, Agumbe, 27. 3. 1964, R. S. Raghavan 97223 (BSI). **Kerala:** Peruvanthanam, Kottayam, 24. 9. 1964, K. Vivekananthan 21358 (MH); Sultan Batteri, Calicut, 29. 10. 1965, Ellis 25796 (MH); Thekkady, Idukki, 16. 3. 1973, Sharma 43892 (MH); Tirunelli, Cannanore, 7. 3. 1979, V. S. Ramachandran 62296 (MH). **Tamil Nadu:** Cumbum, Madurai, 24. 9. 1925, Jacob 17768 (MH); Siruvani, Coimbatore, 9. 10. 1960, A. N. Henry 68921 (MH); Gusalur – Deva Shola, Nilgiri, 18. 11. 1972, E. Vajravelu 42809 (MH); Keeriparai, Kanniyakumari, 5. 10. 1980, A. N. Henry 68921 (MH); Kannikatty, Tirunelveli, 17. 7. 1989, Gopalan 90578 (MH).

***Litsea ghatica* Saldanha**

Goa: Netravali, 4.1. 1998, Vaishali C. Joshi 1339 (GU); Molem – Anmod, 29. 10. 1998, Vaishali C. Joshi 1673 (GU). **Maharashtra:** Along Mahad road Ghat, 28 th mile stone, Mahabaleshwar, 12. 10. 1960, M. Y. Ansari 47388 (BSI); Shindoli hills near Bhovargini Khed Taluka, 26. 12. 1960, K. P. Janardhanan 70193 (BSI); Ravine above Busi Lake, Lonavala, 20. 8. 1964, B. Venkata Reddi 98669 (BSI); Phonda Ghat, Ratnagiri, 23. 10. 1970, B. G. Kulkarni 121830 (BSI). **Karnataka:** Hauhalli, 9. 9. 1964, C. J. Saldanha CS 9037 (JCB); Huhalli, 9. 9. 1964, C. J. Saldanha CS 9036 (JCB); Sakleshpur, Hassan, 12. 3. 1969, C. J. Saldanha 12936 (JCB); Vanagur, 17. 10. 1975, K. P. Mary 38 (JCB); Hassan, 17. 10. 1976, Jane William 9 (JCB); Kodagu Mercara, Abbe falls, 11. 10. 1978, S. R. Ramesh & P. Prakash 3279 (JCB); Charmadi Ghat, Chikmagalur, 13. 11. 1978, C. J. Saldanha 4175 (JCB); Kotegehar – Javali, Chikmagalur, 7. 9. 1979, C. J. Saldanha 9660 (JCB).

***Utricularia lazulina* Taylor**

Goa: Ordofond – Tudal, 24. 8. 1963, K. C. Kanodia 89507 (BSI). **Karnataka:** Dakshin Kannada, Kulshekar, 19. 8. 1985, M. K. Janarthanam 82914 (MH). **Kerala:** Kasaragod, Vidyannagar, 18. 8. 1985, M. K. Janarthanam 82912 (MH); Kanjankad, Ramnagar, 20. 8. 1985, M. K. Janarthanam 829116, 82918 (MH); Mulleriya, 21. 8. 1985, M. K. Janarthanam 82922 (MH); Beemanadi, 22. 8. 1985, M. K. Janarthanam 82927 (MH); Palghat, Malampuzha, 15. 9. 1985, M. K. Janarthanam 82940 (MH).

***Utricularia malabarica* Janarthanam & Henry**

Goa: Verna, 8. 8. 1997, Vaishali C. Joshi 831 (GU), Kalem, 1.9. 1998, Vaishali C. Joshi 1647 (GU). **Kerala:** Mulleriya, Kasaragod, 21. 8. 1985, M. K. Janarthanam, 82924 (MH).

***Utricularia praeterita* Taylor**

Goa: Vasco – Navy office plateau, 20. 8. 1963, K. C. Kanodia 89401 (BSI); Verna, 8. 8. 1997, Vaishali C. Joshi 832 (GU). **Maharashtra:** Satara, Mahabaleshwar, Ludwig point, 11. 10. 1960, M. Y. Ansari 67638 (BSI); Khed Taluka, 9. 10. 1962, K. P. Janardhanan 70193 (BSI); Mahabaleshwar near Venna lake, 5. 10. 1985, M. K. Janarthanam 82943 (MH); Lingmalla falls, 8. 10. 1985, M. K. Janarthanam 82947, 82950 (MH); Venna lake, 9. 10. 1985, M. K. Janarthanam 82952 (MH); Lonavala hills slopes, 11. 10. 1985, M. K. Janarthanam 82954 (MH); Ambavene road, INS Shivaji, 12. 10. 1985, M. K. Janarthanam 82957 (MH); Bushy hills, 13. 10. 1985, M. K. Janarthanam 82960 (MH).

***Lagerstroemia microcarpa* Wight**

Goa: Charan, 24. 10. 1996, Vaishali C. Joshi 268 (GU); Chorla, 7. 3. 1997, Vaishali C. Joshi 593 (GU). **Karnataka:** Mysore, 17. 12. 1903, Berber (MH). **Kerala:** Pavagad, Calicut, 12. 5. 1965, Ellis 24068 (MH); Chandanthode, Cannanore, 3. 11. 1965, Ellis 26379 (MH); Chindak forest, Palghat, 1. 6. 1966, E. Vajravelu 27754 (MH); Pamba – Vandiperiyar, Kottayam, 28. 6. 1968, Deb 30466 (MH); Thenkanchi, Idukki, 24. 9. 1972, Neyyar Dam, Trivandrum, 17. 4. 1973, J. Joseph 44185 (MH); Plapally – Nilakkar, Quilon, 3. 9. 1977, N. C. Nair 50863 (MH); Machad – Mala Reserve, Thrissur, 6. 4. 1977, Ramamoorthy 49244 (MH). **Tamil Nadu:** Gudalur Ghat, Nilgiris, May 1889, Gamble 20540 (MH); Sulakharai, Coimbatore, 19. 7. 1963, C. P. Sreemadhavan 767 (MH); Mavilai, Odai Kadu, Kanniyakumari, 9. 9. 1969, B. V. Shetty 32308 (MH).

***Rotala macrandra* Koehne**

Goa: Carambolim, 2. 12. 1996, Vaishali C. Joshi 431 (GU); Rivona – Tilamol, 4. 1. 1998, Vaishali C. Joshi 1309 (GU). **Kerala:** Calicut, 11. 12. 1931, Narayan 62915 (MH); Arunapparai, Cannanore, 9. 2. 1978, Ramachandran 53813 (MH); Nileshwar, Kasaragod, 7. 12. 1990, 16309 (MH).

***Rotala malampuzhensis* R.V.Nair**

Goa: Dodamarg, 13. 9. 1996, Vaishali C. Joshi 148 (GU); Querim, 16. 10. 1996, Vaishali C. Joshi 234 (GU); Taleigao, 11.7. 1997, Vaishali C. Joshi 737 (GU).

***Decaschistia trilobata* Wight**

Goa: Surla, 27. 9. 1970, N. P. Singh 124699 (BSI); Verlem, 12. 10. 1970, N. P. Singh 125355 (BSI); Ravanacho Donger, Verlem, 13. 10. 1970, N. P. Singh 125379 (BSI); Charan – Chorla, 24. 10. 1996, Vaishali C. Joshi 361 (GU). **Maharashtra:** Charekeel road, 9.11. 1965, B. G. Kulkarni 107965 (BSI). **Karnataka:** Castle rock, October 1909, Bhide (BSI); Jog falls, 7. 5. 1956, G. S. Puri 2131 (BSI); Castle rock 28. 12. 1966, C. J. Saldanha 11022 (JCB); Anmod – Castle rock, 7. 11. 1969, B. M. Wadhrwa 119516 (BSI); Castle rock, 19. 9. 1970, M. Y. Ansari 124138 (BSI); After Londa, Belgaum, 25. 10. 1978, C. J. Saldanha & P. Prakash 3455 (JCB); Kumbarvada, 10. 2. 1980, K. P. Shreenath & S. R. Ramesh 10894 (JCB).

***Memecylon talbotianum* Brandis**

Goa: Sidha forest Sanguem, 22. 4. 1966, John Cherian 109035 (BSI); Tamdi Surla, 5. 4. 1998, Vaishali C. Joshi 1492 (GU). **Karnataka:** Uttar Kannada, 22. 3. 1896, Talbot 3568 (BSI); Asloli, Uttar Kannada, 20. 5. 1897, Talbot 3829 (BSI); Near Venagu, Hassan, 29. 1. 1969, C. J. Saldanha (JCB); Shiradi Ghat, Hassan, 22. 6. 1969, C. J. Saldanha 13885 (JCB); Someshwar, Dakshin Kannada, 14. 12. 1978, S. R. Ramesh & P. Prakash 5389 (JCB); Kodachadri, Shimoga, 7. 4. 1979, C. J. Saldanha, K. R. Keshava Murthy & S. R. Ramesh 6858 (JCB); Anshi Ghat, Uttar Kannada, 24. 5. 1979, C. J. Saldanha 7910 (JCB); Mularnagiri, Matha road, Chikmagalur, 27. 4. 1980, C. J. Saldanha & S. R. Ramesh 11303 (JCB); Anshi Ghat, Uttar Kannada, 10. 6. 1982, S. Udaya Kumar & B. Gurudev 14655 (JCB).

***Sonerila rheedii* Wight & Arn.**

Goa: Chandranath, 16. 9. 1997, Vaishali C. Joshi 962 (GU). **Karnataka:** Yellapur, 1883, W. A. Talbot; Hulical – Nilskal route, 25. 8. 1962, R. S. Raghavan 90213 (BSI); Jittekoppa near Tirthahalli, 28. 9. 1962, R. S. Raghavan 82713 (BSI); Agumbe Ghat, 13.10. 1962, R. S. Raghavan 83166 (BSI); **Kerala:** Ponnudi, Trivandrum, 14. 9. 1977, N. C. Nair 51085 (MH); Idukki – Meenmutti, 27. 9. 1981, Pallode 72129 (MH). **Tamil Nadu:** Gudalur, Nilgiris, 20. 9. 1928, Narayanan & Raj 18485 (MH).

***Artocarpus hirsutus* Lam.**

Goa: Chandranath, 30. 1. 1997, Vaishali C. Joshi 557 (GU). **Karnataka:** Streams of Devarunde, Hassan, 29. 5. 1969, C. J. Saldanha 13735 (JCB); Belmannu – Karkala road, Dakshina Kannada, 19. 4. 1979, C. J. Saldanha & P. Prakash 7048 (JCB); Malagaon, Uttar Kannada, 12. 5. 1981, B. R. Ramesh, S. R. Ramesh, Shivaprakash & S. Udaya Kumar 12861 (JCB).

***Gymnacantha farquhariana* (Hook. & Thom.) Warburg**

Goa: Nirankarichi rai, Valpoi, 18. 4. 1998, Vaishali C. Joshi 1529 (GU). **Kerala:** Valazal, Thrissur, 20. 3. 1966, Ramamoorthy 207030 (MH); Edapalayam swamp, Quilon, Kerala, 1980, K. Vivekananthan 126201 (MH); Adimali R. F, Idukki, 1982, Ramamoorthy 122270 (MH); Palghat, Mukkali forest, 2. 4. 1983, Bhargavan 77268 (MH).

***Knema attenuata* (Wall. ex Hook. f., & Thoms.) Warb.**

Goa: Gaodongrem – Netravali, 16. 11. 1997, Vaishali C. Joshi 1186 (GU); Molem – Anmod, 4. 12. 1997, Vaishali C. Joshi 1268 (GU). **Karnataka:** Yellapur, 2. 2. 1954, R. P. Patil 2751 (MH); Uttar Kannada, Yellapur, 16. 11. 1959, S. K. Jain 3476 A (MH); Someshwar Ghat, Agumbe, 17. 5. 1962, R. Raghavan 80724 (MH); Shiradi – Hassan, 26. 4. 1965, C. J. Saldanha CS 9665 (JCB); Before Kempuhole camp, Hassan, 28. 5. 1969, C. J. Saldanha 13567 (JCB); Kulkunda, Dakshin Kannada, 13. 4. 1978, C. J. Saldanha, Sayed Maqsood Ahamed & S. R. Ramesh 562 (JCB); Nittur, Shimoga, 8. 5. 1979, C. J. Saldanha, S. R. Ramesh & K. R. Keshava Murthy 6936 (JCB); Magod near Dam Site, Uttar Kannada, 23. 4. 1981, C. J. Saldanha, B. R. Ramesh & S. R. Ramesh 12732 (JCB); Yellapur – Sirshi road, Uttar Kannada, 13. 5. 1981, S. R. Ramesh, B. R. Ramesh, Shivaprasad & S. Udaya Kumar 12883 (JCB); Stream near Birkole, Uttar Kannada, 22. 5. 1982, B. Gurudev Singh & S. Udaya Kumar 14509 (JCB).

***Eugenia macrosepala* Duthie**

Goa: Panchi near Nandore - Valpoi, 22. 3. 1964, K. C. Kanodia 96431 (BSI); Vanguri forest, Valpoi, 23. 3. 1964, K. C. Kanodia 96447 (BSI); Nadquem, 27. 4. 1966, John Cherian 109077 (BSI); Molem – Anmod, 10. 3. 1998, Vaishali C. Joshi 1404 (GU). **Karnataka:** Minhol, Agumbe, 10. 2. 1961, R. S. Raghavan 69534 (BSI); Varahi forest Hulical, Shimoga, 20. 5. 1962, R. S. Raghavan 80791 (BSI); Someshwar Ghat, Mysore, 22. 2. 1963, R. S. Raghavan 86452 (BSI); Near Nittur, Shimoga, 8. 4. 1979, C. J. Saldanha, K. R. Keshava Murthy & S. R. Ramesh 6931 (JCB); Hulical, Shimoga, 25. 1. 1981, C. J. Saldanha, B. Gurudev Singh & B. Ajay Kumar 12585 (JCB).

***Aerides viridifolia* (Dalz.) comb. nov**

Goa: Molem – Anmod, 31. 5. 1998, Vaishali C. Joshi 1579 (GU).

***Dendrobium ovatum* (Willd.) Kranzl.**

Goa: Karmal Ghat, 19. 12. 1997, Vaishali C. Joshi 1303 (GU); Karmal Ghat, 30. 4. 1998, Vaishali C. Joshi 1561 (GU). **Maharashtra:** Malagaon, Nasik, 15. 3. 1907, G. B. Gardner (BSI); Ratnagiri, 15. 2. 1966, M. Y. Ansari 107794 (BSI); Khardi range, Thane, 2. 6. 1968, K. Milliore 116119 (BSI); **Karnataka:** Shiradi Ghat, Hassan, 20. 11. 1969, C. J. Saldanha 15697 (JCB); Puttur – Subramanya road, Dakshin Kannada, 11. 12. 1978, C. J. Saldanha & K. P. Sreenath 4971 (JCB).

***Eria datzellii* (Hook. ex Dalz.) Lindl.**

Goa: Ordofond, 23. 8. 1998, Vaishali C. Joshi 1631 (GU).

Oberonia brachyphylla Blatt. & McCann.

Goa: Molem – Anmod, 15. 4. 1998, Vaishali C. Joshi 1525 (GU). **Karnataka:** Kempuhole, Shiradi Ghat, 13. 4. 1971, T. P. Ramamoorthy 1537 (JCB); Agumbe, Shimoga, 14.3.1998, M. K. Janarthanam, Vaishali C. Joshi and S. Rajkumar s.n., (GU). **Kerala:** Mandampatty, Palghat, 12. 4.1978. N. C. Nair 56781 (MH).

Porpax jerdoniana (Wight) Rolfe

Goa: Netravali, 12. 7. 1997, Vaishali C. Joshi 750 (GU). **Karnataka:** Someshwar, Dakshin Kannada, 14. 10. 1942, R. S. Raghavan 83239 A (BSI); Bisle Ghat, Hassan, 30. 10. 1969, C. J. Saldanha 15538 (JCB); Kumta – Sirsi road, Uttar Kannada, 31. 7. 1978, C. J. Saldanha, S. R. Ramesh & N. S. Ravindra 2119 (JCB); Londa – Anmod road, Belgaum, 25. 10. 1978, C. J. Saldanha & P. Prakash 3499 (JCB); Kokkada road, Dakshin Kannada, 14. 7. 1979, C. J. Saldanha & B. R. Ramesh 8343 (JCB).

Arthraxon lanceolatus (Roxb.) Hochst var. **meeboldii** (Stapf.) Welzen.

Goa: Surla, 2. 11. 1996, Vaishali C. Joshi 309 (GU); **Maharashtra:** Brahmagiri top, Nasik, 13. 9. 1984, P. L. Narasimhan 166876 (BSI).

Arundinella metzii Hochst. ex Miq.

Goa: Panjim on way to Margao, 8. 11. 1962, R. S. Rao 84475 (BSI); Amona ferry cross; 15. 11. 1962, R. S. Rao 84799 (BSI); Valpoi, 16. 11. 1962, R. S. Rao 84840 (BSI); Molem, 21. 11. 1962, R. S. Rao 84996 (BSI); Porvorim, 7.11. 1963, R. S. Rao 92847 (BSI); Chimal reservoir to Brahmipuri temple, 9. 11. 1963, R. S. Rao (BSI); Goodiar way to Quepem, 9. 11. 1963, S. R. Rao 84486 (BSI); Foot of the hills of Potim, 14. 11. 1963, R. S. Rao 84758 (BSI); Molem – Anmod, 4. 12. 1997, Vaishali C. Joshi 1263 (GU); Vageri, 19. 12. 1997, Vaishali C. Joshi 1295 (GU). **Maharashtra:** Matheran, 1. 12. 1903, G. A. Gammie 16652 (BSI); Wadgaon State, 30. 12. 1956, G. S. Puri 8395 (BSI); Top of Kondeshwar hill, 26. 1. 1961, K. P. Janarthanan 70243 (BSI); Bewada, Poona, 16. 8. 1970, B. M. Wadhwa 128504 (BSI); Kankauli – Achra, Ratnagiri, 19. 10. 1970, B. G. Kulkarni 121762 (BSI). **Karnataka:** Castle rock, 24. 10. 1902, G. A. Gammie 15555 (BSI); Aralavi forest, Katgal, Uttar Kannada, 19. 1. 1959, S. K. Jain 3891 (BSI); Agumbe, Shimoga, 12. 12. 1978, S. R. Ramesh & P. Prakash 5248 (JCB); Farangipet road, Dakshin Kannada, 29. 11. 1981, C. J. Saldanha, P. W. Michael & S. R. Ramesh 14238 (JCB).

Dimeria woodrowii Stapf

Goa: Vasco da Gama, September 1890, R. K. Bhide, 3030 (BSI); Taleigao, 3. 10. 1996, Vaishali C. Joshi 357 (GU); Loliem, 10. 9. 1997, Vaishali C. Joshi 944 (GU). **Maharashtra:** Near Deogad rest house, Ratnagiri, 28. 2. 1970, B. G. Kulkarni 120364 (BSI); Adari – Nandruk, Malwan, 29. 9. 1970, B. G. Kulkarni 121287 (BSI).

***Glyphochloa acuminata* (Hack.) Clayton var. *woodrowii* (Bor) Clayton**

Goa: Goa University Campus, 17.9.1996, Vaishali C. Joshi 354 (GU); Padi, 11. 11. 1998, Vaishali C. Joshi 1691 (GU).

***Glyphochloa goaensis* (Rao & Hemadri) Clayton**

Goa: Tiska – Usgao, 15. 10. 1998, Vaishali c. Joshi 355 (GU); Loliem, 19. 9. 1997, Vaishali C. Joshi 942 (GU); Thivem, 13. 9. 1998, Vaishali C. Joshi 1657 (GU); Molem, 27. 9. 1998, Vaishali C. Joshi 1660 (GU).

***Glyphochloa talbotii* (Hook. f.) Clayton**

Goa: Goa University Campus, 3. 10. 1996, Vaishali C. Joshi 353 (GU); Dabal–Panchavadi, 6. 10. 1997, Vaishali C. Joshi 1061 (GU)

***Ischaemum dalzellii* Stapf ex Bor**

Goa: Goa University campus, 18. 10. 1997, Vaishali C. Joshi 1124 (GU); Molem– Anmod, 19. 10. 1997, Vaishali C. Joshi 1149 (GU); Molem - Anmod, 4. 12. 1997, Vaishali C. Joshi 1250 (GU).
Karnataka: Kodachadri, Shimoga, 12. 1. 1979, B. R. Ramesh, K.R. Keshava Murthy & P. Prakash 5630 (JCB); Dandeli, Uttar Kannada, 11. 11. 1982, S. Udaya Kumar, B. Gurudev Singh 14723 (JCB).

Ischaemum jaychandrani

Goa: Tiska - Molem 28. 9. 1998, Vaishali C. Joshi 1659 (GU).

***Ischaemum travancorense* Stapf ex C. E. C. Fischer**

Goa: Cuncolim, 11. 11. 1998, Vaishali C. Joshi 1688 (GU).

***Ophiuros bombaiensis* Bor**

Goa : Sanguem, 22. 9. 1997, Vaishali C. Joshi 1028 (GU).

***Panicum painium* Nair & Patankar**

Goa: Goa University campus, 24. 4. 1997, Vaishali C. Joshi 786 (GU).

Paspalum canarae* (Steud.) Veldk. var. *fimbriatum

Goa: Surla, 8. 11. 1996, Vaishali C. Joshi 306 (GU).

***Griffithella hookeriana* (Tulasne) Warming**

Goa: Canacona, 12. 6. 1997 Vaishali C. Joshi 671 (GU). **Karnataka:** Ujire, Dakshin Kannada, 10. 12. 1978, C. J. Saldanha & K. P. Sreenath 4992 (JCB); Bedthi river near Dam site, Magod, Uttar Kannada, 23. 4. 1981, C. J. Saldanha, B. R. Ramesh & S. R. Ramesh 12781 (JCB). **Kerala:** Chikle river, Thrissur, 9. 12. 1965, K.M. Sebastine 26670 (MH); Kasaragod, 22. 12. 1992, Satish 0164 (MH).

***Ventilago bombaiensis* Dalz.**

Goa: Molem – Anmod, 11. 12. 1997, Vaishali C. Joshi 1280 (GU). **Maharashtra:** Matheran, 30. 1. 1957, G. S. Puri 140265 (BSI); Chowa hills, Bhimasankar, 6. 4. 1962, K. P. Janardhanan 76583 (BSI); Devi Ghat, Wasbala Range, 30. 5. 1968, K. M. Billore 116053 (BSI); Sadrya Ghat, Tokavada range,

11. 6. 1968, K. M. Billore 115460 (BSI). **Karnataka:** Bisle Ghat, Hassan, 5. 2. 1970, C. J. Saldanha, (JCB); Kollur Ghat, Dakshin Kannada, 8. 4. 1979, C. J. Saldanha, S. R. Ramesh & K. R. Keshava Murthy 6922 (JCB). **Kerala:** Arunapara, Palghat, 19. 1. 1980, Bhargavan 129138 (MH); Idukki, 18. 2. 1983, C. N. Mohanan 76227 (MH).

Hedyotis maheswarii (Sant. & Merch.) Rao & Hamadri

Karnataka: Shimoga, 1998, M.K. Janarthanam s.n. (GU).

Ixora brachiata Roxb.

Goa: Poshi forest near Pengeral village, 7. 5. 1963, K. C. Kanodia 88466 (BSI); Potim forest, 28. 8. 1963, K. C. Kanodia 89587 (BSI); Nadquem, 14. 3. 1964, K. C. Kanodia 96259 (BSI); Butpal – Nadquem, 10. 10. 1964, R. S. Raghavan 103474 (BSI); Verem, 13. 9. 1965, John Cherian 106130 (BSI); Codal – Sateram road, 14. 4. 1966, John Cherian 106771 (BSI); Butpal, 25. 4. 1968, John Cherian 109060 (BSI); Modka Bungalow, 20. 9. 1970, G. H. Khisti 124415 (BSI); Ambechagol, 24. 9. 1970, N. P. Singh 124501 (BSI); Satrem, 25. 9. 1970, N. P. Singh 124570 (BSI); Talaulim, 5. 10. 1970, N. P. Singh 125024 (BSI); Dudhsagar, 15. 1. 1997, Vaishali C. Joshi 503 (GU). **Karnataka:** Yellapur, 19. 3. 1884, W. A. Talbot 1011 (BSI); Someshwar, Dakshin Kannada, 14. 2. 1940, S. R. Raj 6556 (MH); Yellapur, 11. 3. 1957, S. K. Jain 16298 (BSI); Jog, 23. 5. 1957, G. S. Puri 18181 (BSI); Sagar – Shimoga road, 13. 6. 1961, R. S. Raghavan 74016 (BSI); Sampaje (Coorg) 1. 10. 1961, A. S. Rao 74860 (BSI); Bisle, Hassan, 30. 10. 1969, C. J. Saldanha 15531 (JCB); Castle rock on way to Anmod, 19. 9. 1970, M. Y. Ansari 124113 (BSI); Kagenari, Hassan, 6. 6. 1971, T. P. Ramamoorthy 1793 (JCB); Akungi, Uttar Kannada, 24. 5. 1978, Syed Maqsood Ahamed 1065 (JCB); Devalli - Londa, Belgaum, 25. 10. 1978, C. J. Saldanha 3491 (JCB); Sampana Katte, Shimoga, 13.1. 1979, B. R. Ramesh, K. R. Keshava Murthy & P. Prakash 5672 (JCB); Udani – Ichlampadi, Dakshin Kannada, 14. 7. 1979, C. J. Saldanha & B. R. Ramesh 8333 (JCB); Abbey falls, Coorg, 21. 2. 1984, E. Vajravelu 77824 (MH); **Kerala:** Kannothe, Cannanore, 21. 9. 1979, Ramachandran 58800 (MH); Chikandamala, Kasaragod, 2. 10. 1982, Ansari 74443 (MH).

Mussaenda laxa Hutchin.

Goa: Cotigao, 10. 1. 1997, Vaishali C. Joshi 488 (GU); Taleigao, 24. 7. 1997, Vaishali C. Joshi 809 (GU). **Kerala:** Thrissur, 18. 5. 1966, K.M. Sebastine 278819 (MH); Vazhamoola island, Trivandrum, 30. 8. 1975, J. Joseph 46540 (MH); Plapally, Quilon, 3. 9. 1977, N. C. Nair 50839 (MH); Mukkali forest, Palghat, 3. 5. 1980, V. J. Nair 67494 (MH).

Neanotis rheedei (Wall. ex Wight & Arn.) W. H. Lewis

Goa: Verem, 13. 9. 1965, John Cherian 106131 (BSI); Molem –Belgaum road, 17. 9. 1970, N. P. Singh 124256 (BSI); Castle rock on way to Anmod, 19. 9. 1970, M. Y. Ansari 124121 (BSI); Bati Sidha, 9. 10. 1970, N. P. Singh 125195 (BSI); Taleigao, 31. 8. 1996, Vaishali C. Joshi 117 (GU); Molem – Anmod, 28. 9. 1996, Vaishali C. Joshi 183 (GU); Tiska, 9. 8. 1997, Vaishali C. Joshi 845 (GU); St Cruz, 21. 8. 1997, Vaishali C. Joshi (GU); Honda – Valpoi, 1. 9. 1997, Vaishali C. Joshi 994 (GU). **Gujarat:** Daman \ Nagarhaveli: Dolara forest, Ansari, 94147 (BSI). **Maharashtra:** Vageri forest

Vengurla, 15. 9. 1964, P. D. Pataskar 102004 (BSI); Sarni, R. F. Kasa Range, 28. 7. 1968, K. M. Billore 116435 (BSI); Adari – Nandruk, Malvan – Ratnagiri road, 29. 9. 1970, B. G. Kulkarni 121286 (BSI); Ratnagiri, 2. 10. 1970, B. M. Wadhwa 128002 (BSI). **Karnataka:** Hulical Ghat, Agumbe, 24. 8. 1963, R. S. Raghavan 90174 (BSI); Someshwar Agumbe, 30. 8. 1963, R. Sundar Raghavan 90316 (BSI). **Kerala:** Thekkadi, 8. 5. 1958, G. S. Puri 36553 (BSI); Chandkhel, 28. 8. 1958, S. K. Jain 43242 (BSI).

Psychotria dalzellii Hook. f.

Goa: Dudhsagar, 15. 3. 1997, Vaishali C. Joshi 503 (GU).

Tricalysia sphaerocarpa (Dalz.) Gamble

Goa: Molem - Anmod, 4. 12. 1997, Vaishali C. Joshi 1255 (GU); Molem, 24. 12. 1997, Vaishali C. Joshi 1276 (GU). **Tamil Nadu:** Beddome 1873, 25427; Wight 1871, 25427 (MH); Kannikatty, Tirunelveli, 16. 9. 1921, K. C. Jacob 349 (MH); Way to Eluthuparai, Ramanad, 21. 9. 1971, E. Vajravelu 38641 (MH); South Arcot, 12. 9. 1977, K. Ramamurthy 99429 (MH).

Lindernia estaminodosa (Blatt. & Hallb.) Mukherjee

Goa: St. Cruz, 12. 19. 1999, Vaishali C. Joshi 1614 (GU).

Lindernia manilaliana Sivarajan,

Goa: Verna, 17. 8. 1996, Vaishali C. Joshi 34 (GU); Taleigao, 11. 7. 1997, Vaishali C. Joshi 735 (GU). **Kerala:** Brahmagiri, Cannanore, 18. 8. 1980, V. S. Ramachandran 68222 (MH); Kallai River bank, Sivarajan & Suresh 21629 (CALI).

Rhamphicarpa longiflora (Arn.) Benth.

Goa: Taleigao, 12. 10. 1996, Vaishali C. Joshi 362 (GU). **Karnataka:** Suratkal, Dakshin Kannada, 29. 7. 1978, C. J. Saldanha, S. R. Ramesh & N. S. Ravindra 1994 (JCB); Kadra – Kadasali, Uttar Kannada, 7. 7. 1982, S. Udaya Kumar & B. Gurudev Singh 14627 (JCB).

Torenia bicolor Dalz.

Goa: Codal forest area, 1. 9. 1963, B. Venkata Reddi 89708 (BSI); Sukur Village, 5. 9. 1963, B. Venkata Reddi 89792 (BSI); Ordofond Village, 22. 9. 1965, John Cherian 106608 (BSI); Colem – Dudhsagar, 11. 10. 1997, Vaishali C. Joshi 127 (GU); Dodamarg, 31.8.1996, Vaishali C. Joshi 117 (GU); Nirankarichi rai, Valpoi, 21. 9. 1997, Vaishali C. Joshi 1000 (GU). **Maharashtra:** Davoli – Amboli Ghat, 17. 9. 1964, R. D. Palaskar 102074 (BSI); Jungle near Savantwadi, Ratnagiri, 14. 10. 1970, B. G. Kulkarni 121666 (BSI). **Karnataka:** Agumbe, 29. 10. 1960, R. S. Raghavan 67813 (BSI); Shimoga, 26. 10. 1963, R. S. Raghavan 90250 (BSI); Bhagamandala, Kodagu, 22. 8. 1978, S. R. Ramesh 2326 (JCB); Jog, Shimoga, 27. 9. 1978, K. R. Keshava Murthy & K. P. Sreenath 2988 (JCB); Kumta - Sirshi road, Uttar Kannada, 28. 9. 1978, K. R. Keshava Murthy & K. P. Sreenath 3046 (JCB); Anmod, Belgaum, 25. 10. 1978, C. J. Saldanha & P. Prakash 3509 (JCB); Way to Shiradi, Hassan, 19. 9. 1979, C. J. Saldanha & K. P. Sreenath 9144 (JCB); Top of Charamadi Ghat, Chikmagalur, 23. 5. 1980, C. J. Saldanha 11519 (JCB); Kodagu, 30. 10. 1981, C. J. Saldanha, B. Gurudev Singh & Shivaprakash 13965 (JCB). **Kerala:** Thnakadarre, Thrissur, 28. 10. 1964, K.M.

Sebastine 22364 (MH); Kannothe, Calicut, 8. 12. 1967, Ellis 29542 (MH); Panthanthode, Palghat, 21. 9. 1977, J. Joseph 51424 (MH); Nilamel, Quilon, 24. 5. 1978, C. N. Mohanan 55773 (MH); Meenmutty, Idukki, 14. 2. 1982, C. N. Mohanan 73242 (MH); Changdankubari, Kasaragod, 15. 5. 1982, V. J. Nair 73892 (MH); Chandanacherry, Kottayam, 11. 1. 1984, Antony 150 (MH); Rajampara, Pathanamthitta, 20. 9. 1988, Anilkumar 902 (MH). **Tamil Nadu:** Cumbum, Madurai, 25. 9. 1925, Jacob 17775 (MH); Subra, Tirunelveli, 16. 12. 1957, Subramanayam 49510 (MH); Cherankode forest, Nilgiris, 22. 6. 1974, E. Vajravelu 44907 (MH).

Zingiber neesatum (Graham) Ramamoorthy

Goa: Molem - Anmod, 28. 9. 1996, Vaishali C. Joshi 192 (GU). **Karnataka:** Hulical Ghat, Shimoga, 9. 10. 1962, R. S. Raghavan 83103 (BSI); Barakana, near Agumbe, 16. 10. 1962, R. S. Raghavan 83269 (BSI); Banaganahalli, 26. 10. 1970, F. M. Jarrett & T. P. Ramamurthy HFP 1049 (JCB); Bababudhangiri range, Chikmagalur, 16. 10. 1978, C. J. Saldanha & K. R. Keshava Murthy 3345 (JCB).
