

Chapter 4: Observations and Discussion

4.1 Survey

Total of 70 species belonging to 50 genera and 11 tribes were collected from South Gujarat.

Field survey was carried out at the five districts of south Gujarat which are Surat, Tapi, Navsari, Dang and Valsad. Total of 70 species belonging to 51 genera, 11 tribes and three sub-families were collected from South Gujarat. The number of plants reported in current study represents 7.78% of Indian Asteraceae members and 0.21% of global Asteraceae members. The list of the species is given in table 4.1.

Table 4.1 List of the Plants Collected from South Gujarat

Sr. No.	Plant Name	Tribes
1	<i>Echinops echinatus</i> Roxb.	Cardueae
2	<i>Goniocaulon indicum</i> (J.G.Klein ex Willd.) C.B.Clarke	
3	<i>Oligochaeta divaricata</i> (DC.) K.Koch	
4	<i>Tricholepis glaberrima</i> DC.	
5	<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal	Cichorieae
6	<i>Launaea sarmentosa</i> (Willd.) Kuntze	
7	<i>Sonchus asper</i> (L.) Hill	
8	<i>Sonchus oleraceus</i> L.	
9	<i>Acilepis divergens</i> (DC.) H.Rob. & Skvarla	Vernonieae
10	<i>Baccharoides anthelmintica</i> (L.) Moench	
11	<i>Centratherum punctatum</i> Cass.	
12	<i>Cyanthillium cinereum</i> (L.) H.Rob.	
13	<i>Elephantopus scaber</i> L.	
14	<i>Phyllocephalum microcephalum</i> (Dalzell) H.Rob.	
15	<i>Crassocephalum crepidioides</i> (Benth.) S.Moore	Senecioneae
16	<i>Emilia sonchifolia</i> (L.) DC.	
17	<i>Senecio bombayensis</i> N.P.Balakr.	
18	<i>Gamochaeta pensylvanica</i> (Willd.) Cabrera	Gnaphalieae

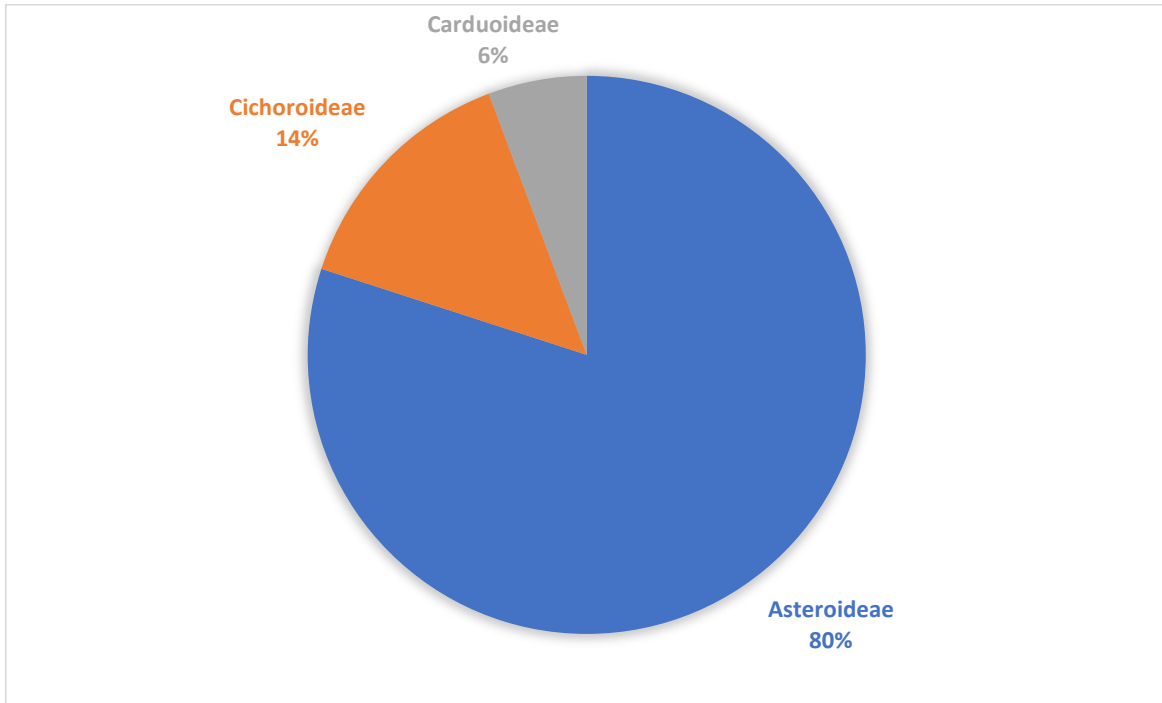
Sr. No.	Plant Name	Tribes
19	<i>Gamochaeta purpurea</i> (L.) Cabrera	Gnaphalieae
20	<i>Helichrysum indicum</i> (L.) Grierson	
21	<i>Cyathocline purpurea</i> (Buch.-Ham. ex D.Don) Kuntze	Astereae
22	<i>Erigeron bonariensis</i> L.	
23	<i>Eschenbachia stricta</i> (Willd.) Raizada	
24	<i>Grangea maderaspatana</i> (L.) Poir.	
25	<i>Thespis thakeri</i> J.J. Sharma & Nagar	
26	<i>Blumea axillaris</i> (Lam.) DC.	Inuleae
27	<i>Blumea belangeriana</i> DC.	
28	<i>Blumea bovei</i> (DC.) Vatke	
29	<i>Blumea eriantha</i> DC.	
30	<i>Blumea malcolmii</i> Hook.f.	
31	<i>Blumea membranacea</i> DC.	
32	<i>Blumea obliqua</i> (L.) Druce	
33	<i>Blumea oxyodonta</i> DC.	
34	<i>Blumea sinuata</i> (Lour.) Merr.	
35	<i>Blumea virens</i> DC.	
36	<i>Caesulia axillaris</i> Roxb.	
37	<i>Pluchea ovalis</i> (Pers.) DC.	
38	<i>Pluchea wallichiana</i> DC.	
39	<i>Pseudoconyza viscosa</i> (Mill.) D'Arcy	
40	<i>Pulicaria angustifolia</i> DC.	
41	<i>Sphaeranthus indicus</i> L.	
42	<i>Vicoa cernua</i> Dalzell	
43	<i>Vicoa indica</i> (L.) DC.	
44	<i>Bidens bipinnata</i> L.	Coreopsideae
45	<i>Bidens biternata</i> (Lour.) Merr. & Sherff	
46	<i>Cosmos caudatus</i> Kunth	
47	<i>Cosmos sulphureus</i> Cav.	
48	<i>Glossocardia bosvallia</i> (L.f.) DC.	
49	<i>Acmella ciliata</i> (Kunth) Cass.	Heliantheae

Sr. No.	Plant Name	Tribes
50	<i>Acmella oleracea</i> (L.) R.K.Jansen	Heliantheae
51	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen	
52	<i>Acmella radicans</i> (Jacq.) R.K.Jansen	
53	<i>Acmella uliginosa</i> (Sw.) Cass.	
54	<i>Blainvillea acmella</i> (L.) Philipson	
55	<i>Eclipta prostrata</i> (L.) L.	
56	<i>Lagascea mollis</i> Cav.	
57	<i>Lipoblepharis urticifolia</i> (Blume) Orchard	
58	<i>Lipochaeta lobata</i> (Gaudich.) DC.	
59	<i>Parthenium hysterophorus</i> L.	
60	<i>Sclerocarpus africanus</i> Jacq.	
61	<i>Sphagneticola trilobata</i> (L.) Pruski	
62	<i>Synedrella nodiflora</i> (L.) Gaertn.	
63	<i>Tithonia diversifolia</i> (Hemsl.) A.Gray	
64	<i>Xanthium strumarium</i> L.	
65	<i>Acanthospermum hispidum</i> DC.	Milleriaceae
66	<i>Guizotia abyssinica</i> (L.f.) Cass.	
67	<i>Tridax procumbens</i> L.	
68	<i>Adenostemma viscosum</i> J.R.Forst. & G.Forst.	Eupatorieae
69	<i>Ageratum conyzoides</i> L.	
70	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	

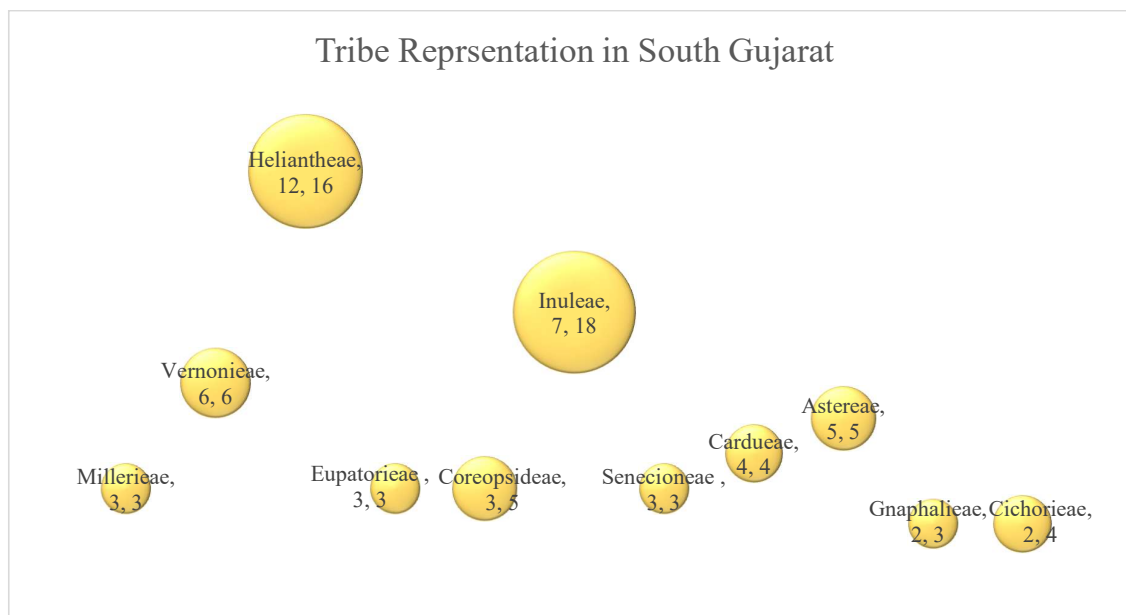
4.1.1 Representation of Taxa.

Largest subfamily is Asteroideae which is represented by 8 tribes, 38 genera and 56 species followed by Cichorioideae represented by two tribes (Cichorieae and Vernonieae), eight genera and 10 species. Smallest sub-family is Carduoideae represented by Cardueae tribe in which there are four genera and four species. This representation is given in figure 4.1.

Figure 4.1 Representation of Sub-families of Asteraceae in South Gujarat.



Tribe represented by majority of genera is Heliantheae which is has 12 genera but majority of species is represented by Inuleae tribe which has 18 species. Tribe which is less represented is Millerieae, Eupatorieae, Senecioneae and Gnaphalieae with three species each. Tribal representation is shown in bubble plot in figure 4.2.

Figure 4.2 Tribal Representation in South Gujarat (Tribe, Genera, Species)

The study shows the doubtful existence of *Blumea lacera* (Burm.f.) DC., *Phyllocephalum phyllolaenum* (DC.) Narayana, *Erigeron asteroides* Roxb., *Flaveria trinervia* (Spreng.) C.Mohr, *Gnaphalium luteoalbum* L., *Acmella calva* (DC.) R.K.Jansen and *Tricholepis amplexicaulis* C.B.Clarke probably owing the deficient data or wrong identification.

4.1.2 Distribution

After the survey, the distribution of the species was analysed. It was found that the highest genera are represented by Valsad with 45 genera (88.24 %) followed by Dang 44 genera (86.27 %). Lowest representation if of Surat district with 22 genera (43.14 %). Species is highly represented by Valsad and Dang districts each bearing 57 species (81.43 %) while lowest representation is of Surat district with 23 species (32.86 %). This representation is shown in Figure 4.3. Hence Dang and Valsad districts represented high diversity of Asteraceae family while Surat district have less diversity. The prime reasons for the above distribution can be the diversity in habitats and more ecotones. Hence the distribution of Asteraceae family through different habitats were also studied.

It was found that aquatic areas like river banks and lakes have the highest species diversity represented by 27 species (38.57 %) followed by hilly areas represented by 25 species

(35.71 %), roadsides with 24 species (34.29 %), wastelands with 19 species (27.14 %), grasslands and cultivated areas with 15 species (21.43 %). The lowest representation is of coastal areas with one species i.e. *Launaea sarmentosa*. This representation is shown in Figure 4.4.

Figure 4.3 Taxa Representation in Districts of South Gujarat.

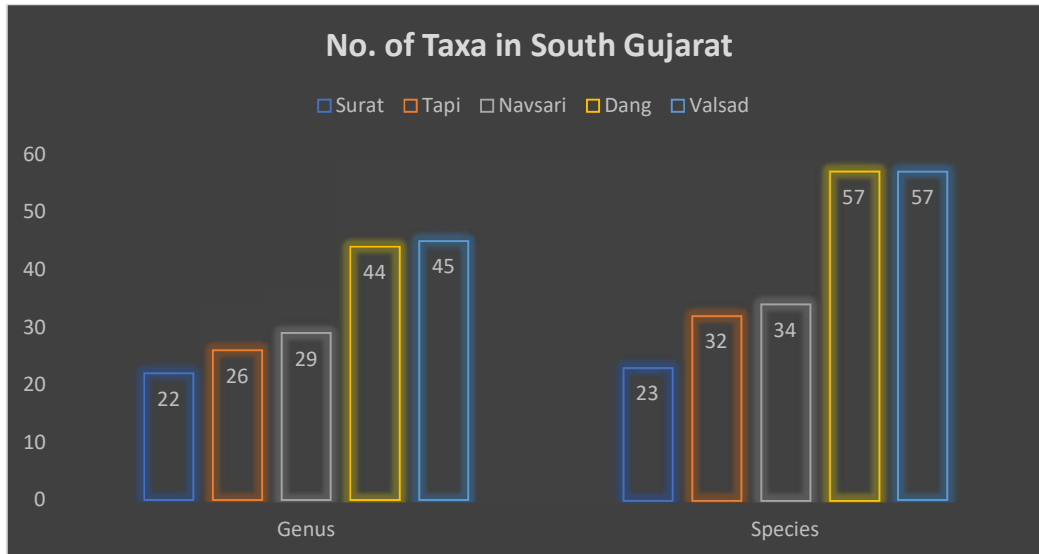
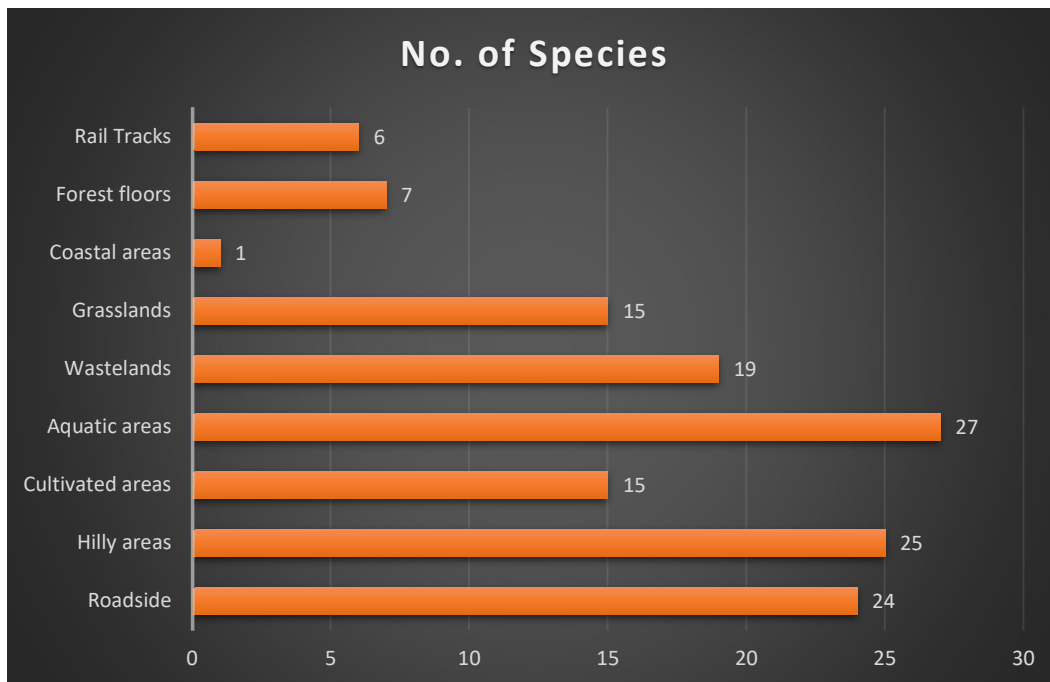


Figure 4.4 Distribution Representation in Different Habitats.



4.2 Morphological analysis

Key to the Sub-families

- 1a. Corolla deeply lobed, stigma present on the adaxial side of the style branches (2)
- 1b. Corolla shallowly lobed, stigma is marginal to the style branches Asteroideae
- 2a. Phyllaries spiny Carduoideae
- 2b. Phyllaries not spiny Cichorioideae

Sub-family: Carduoideae Cass. ex Sweet

Tribe: Cardueae Cass.

Key to the Genera

- 1a. Compound head *Echinops*
- 1b. Simple head (2)
- 2a. Branching dichotomous *Oligochaeta*
- 2b. Branching monopodial (3)
- 3a. Capitula solitary *Tricholepis*
- 3b. Capitula arranged in corymbose *Goniocaulon*

Genus: *Echinops* L., Sp. Pl. [Linnaeus] 2: 814 (1753).

***Echinops echinatus* Roxb.** in Fl. Ind. 3: 447 (1832); Fl. Brit. India 3: 358 (1883); Hajra *et al.*, Fl. of India 12: 178. (1995); Cooke, FBP 2: 54. (1904); Shah 378. (1978); Raghavan *et al.* 44 (1981); Bole & Pathak, FS 2: 14. (1988). *Sphaerocephalus echinatus* Kuntze, Revis. Gen. Pl. 1: 366 (1891).

Plate 4.1

Annuals herbs, 25-65 cm high. Stem woody, monopodial, terete, glabrous. Leaves simple, alternate, 6 - 25 cm, sessile, amplexicaul, lobes triangular, lyrate, spiny margin and apex, spines often ca 3-5 cm long. Capitulum compound with each unit (headlet) possess single

floret, 5-6 cm across. Involucre surrounded by white bristles; phyllaries, lanceolate, 5 -17 mm, glabrous. Flowers tubular, bisexual, white, 1.5 - 2.5 cm. Anther apex acute and base sagittate, 3.5-4 mm. Style arms obtuse, 1-1.5 mm. Cypsela obovoid, 3-5 mm long, villous. Pappus ciliated.

Common Name: Indian Globe Thistle

Vernacular Name: Utakanto, Shuliyo

Specimen: JJS 103 (Songardh).

Coordinates: 21°09'54.73" N, 73°32'19.41E.

Origin: India (Native).

Abundance: Common.

Associated Species: *Alternanthera bettzickiana* (Regel) G.Nicholson, *Tridax procumbens* L., *Oplismenus burmanni* (Retz.) P.Beauv., *Launaea procumbens* (Roxb.) Ramayya & Rajagopal, *Eragrostris* sp., *Sporobolus* sp.

Flw-Fru: November – June.

Habitat: Wasteland and cultivated fields.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: Although the head appears like simple but head is compound and each unit possess one flower hence floret term is not appropriate in case of *Echinpos*. This can be inferred by observing the phyllaries which surrounds each flower which is absent in the base of compound head.

Genus: *Goniocaulon* Cass., Bull. Sci. Soc. Philom. Paris 1817: 34 (1817).

***Goniocaulon indicum* (J.G.Klein ex Willd.) C.B.Clarke** Compos. Ind.: 236 (1876); Shah 383. (1978); Raghavan *et al.* 45. (1981); Bole & Pathak, FS 2: 20. (1988); *Serratula indica* J.G.Klein ex Willd. in Sp. Pl., ed. 4. 3: 1642 (1803); *Goniocaulon glabrum* Cass. in Bull. Sci. Soc. Philom. Paris 1818: 184 (1818); Hajra *et al.*, Fl. of India 12: 181. (1995); Cooke, FBP 2: 55. (1904). *Tricholepis indica* (J.G.Klein ex Willd.) S.M.Almeida in Fl. Savantwadi 1: 234 (1990).

Plate 4.2

Annual erect herb, 70-120 cm tall. Stem branched, polygonal, glabrous. Leaves simple, alternate, linear, 3-6 cm, margin and apex with cartilaginous toothed, auricled. Capitulescence corymbose or fascicled. Capitulum discoid, 1-3 cm across. Involucre many-seriate; phyllaries ovate, 1-14 mm margins hyaline, acute, not spinescent. Florets all bisexual, tubular, pink – lilac, 15-16 mm. Anther apex acute, bases sagittate, 5-6 mm. Style obtuse, 2-3 mm. Cypsela ovoid-oblong, 5-7 mm many-ribbed, glabrous. Pappus scaly, 4-6 mm.

Common Name: Indian Cornflower

Vernacular Name: Nani Brahmadandi

Specimen: JJS 74 (Abrama)

Coordinates: 21°16'02.34" N, 72°53'31.84" E.

Origin: India (Native)

Associated Species: *Alternanthera bettzickiana* (Regel) G.Nicholson, *Trianthema portulacastrum* L., *Desmodium triflorum* (L.) DC., *Oligochaeta divaricata* (DC.) K.Koch.

Abundance: Less frequent.

Flw-Fru: December - April.

Habitat: Cultivated lands.

Distribution: India: Surat and Valsad.

Taxonomic Note: Plant resembles to *Tricholepis* but differs in tip of phyllary where tip is small spinoluse in *Goniocaulon* while it is prominent spine in case of *Tricholepis*.

Genus: *Oligochaeta* (DC.) K.Koch, Linnaea 17(1): 42 (1843).

***Oligochaeta divaricata* (DC.) K.Koch** Linnaea 17: 43 (1843); *Amberboa ramosa* (Roxb.) Jafri in Scientist (Karachi), reimpr., 3: 29 (1959); Hajra *et al.*, Fl. of India 12: 153. (1995); Shah 367. (1978). *Oligochaeta ramosa* (Roxb.) Wagenitz in Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich 37: 323 (1962); Raghavan *et al.* 46. (1981); Bole & Pathak, FS 2: 28. (1988). *Microlonchus divaricatus* DC. in Prodr. 6: 562 (1838). *Amberboa divaricata* (DC.) Kuntze in Revis. Gen. Pl. 1: 305 (1891). *Volutarella divaricata* (DC.) Benth. & Hook.f. in Gen. Pl. 2:

476 (1873); Cooke, FBP 2: 57. (1904). *Volutarella ramosa* (Roxb.) Santapau in Pl. Saurashtra: 22 (1953).

Plate 4.3

Bushy herb, 45 - 70 cm long. Stem dichotomously branched, straggling, polygonal, glabrous. Leaves simple, alternate, linear-oblong, margin spiny, 2 – 5.5 cm; apex spiny. Capitulescence solitary. Capitulum discoid, 1-2.5 cm across. Involucre multiseriate; phyllaries, ovate, apex spiny, 6 - 8 mm long. Florets bisexual, tubular, 1.5-2.5 cm long, pink-purple. Anther apex acute and base sagittate, 6-7 mm. Style apex acute and possess collar of hairs at bifurcation, 1-2 mm. Cypsela obovoid 3-5 mm long, grooved. 18-20 mm. Pappus bristles, 5-7 mm.

Common Name: Branched Sweet-Sultan

Vernacular Name: Bhonyadandi, Badaward.

Specimen: JJS 72 (Subir), 73 (Tokarva).

Coordinates: 20°55'45.07" N, 73°46'50.06" E; 21°07'17.30" N, 73°34'02.53" E.

Origin: India (Native)

Associated Species: *Desmodium* sp., *Alternanthera* sp., *Tridax procumbens* L., *Launaea procumbens* (Roxb.) Ramayya & Rajagopal, *Goniocaulon indicum* (J.G.Klein ex Willd.) C.B.Clarke.

Abundance: Common.

Flw-Fru: October-May.

Habitat: Cultivated fields.

Distribution: India: Surat, Tapi, Navsari, Dang and Valsad

Taxonomic Note: In literatures, it is reported that outer florets are sterile and inner florets are fertile. This character was considered in key for differing *Oligochaeta* from *Tricholepis*. But in current investigation it was found that outer florets also produce cypsela. This confusion probably happened because the style is not coming out of the anther tube.

Genus: *Tricholepis* DC., Arch. Bot. (Paris) 2: 515 (1833).

***Tricholepis glaberrima* DC.** Prodr. 6: 564 (1838); Hook.f., Fl. Brit. India 3: 381. (1883); Hajra *et al.*, Fl. of India 12: 222. (1995); Cooke, FBP 2: 56. (1904); Shah 397. (1978); Raghavan *et al.* 47. (1981); Bole & Pathak, FS 2: 36. (1988).

Plate 4.4

Erect herbs, 0.8-1.5 m high. Stem polygonal, ribbed, glabrous. Leaves simple, alternate, linear-oblong/lanceolate, serrate margins, obtuse apex, auricled at base, scaberulous. Capitulescence solitary. Capitulum discoid, 7-9 mm across. Involucre phyllaries multiseriate; phyllaries ovate, 2.5-11.5 mm apex spiny. Florets tubular, bisexual, pink-purple, 12-15 mm. Anther apex acute and base sagittate 4-6 mm. Style apex obtuse 1-2 mm. Cypsela obovoid, glabrous twice as long as pappus, ribbed, 4-6 mm. Pappus scaly 2-3 mm.

Common Name: Smooth Camel Thistle

Vernacular Name: Brahmadandi.

Specimen: JJS 16 (Mahal).

Coordinates: 20°56'44.04" N, 73°38'56.99" E.

Origin: India (Native).

Associated Species: *Lavandula bipinnata* (Roth) Kuntze, *Oplismenus burmanni* (Retz.) P.Beauv., *Impatiens balsamina* L., *Sporobolus* sp., *Celosia argentea* L., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult.

Abundance: Occasional.

Flw-Fru: September - January

Habitat: Grasslands.

Distribution: Dang.

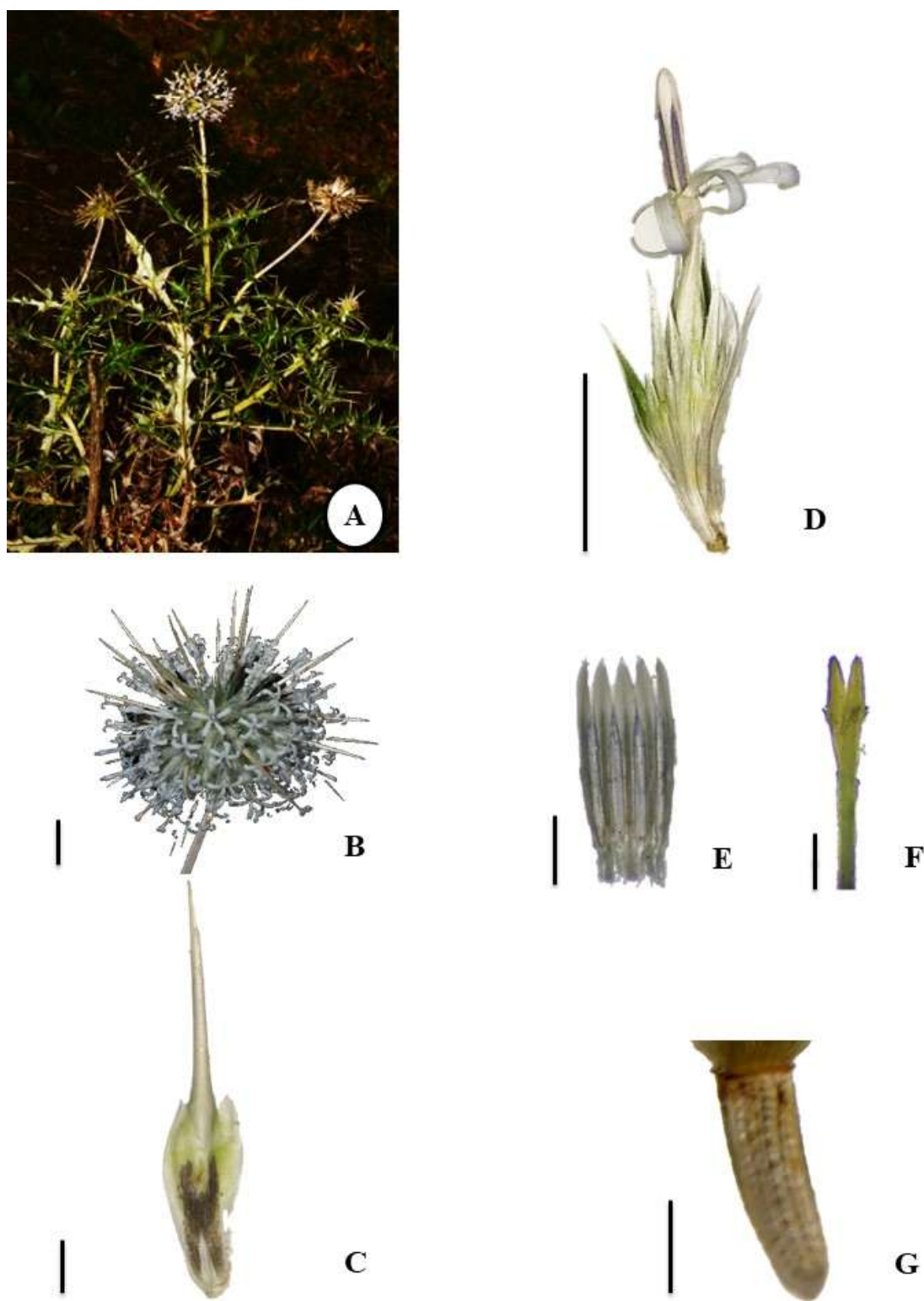


Plate 4.1 *Echinops echinatus* Roxb. **A**- Habit; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 3 mm); **D**-Floret (bar = 7 mm); **E**-Anthers (bar = 2 mm); **F**- Style (bar = 2 mm); **G**-Cypsela (bar = 7 mm).

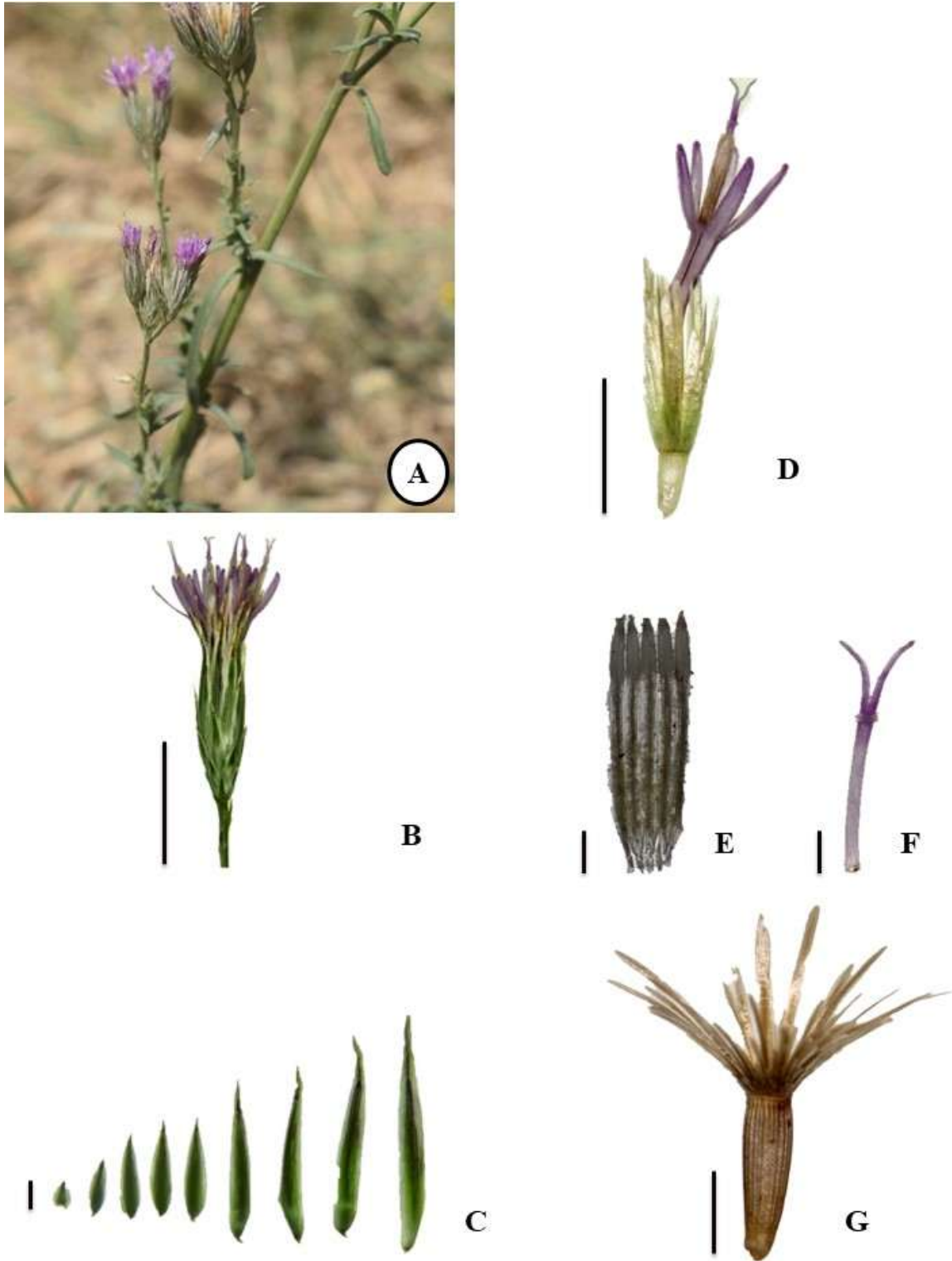


Plate 4.2 *Goniocaulon indicum* (J.G.Klein ex Willd.) C.B.Clarke A- Flowering twig; B- Capitulum (bar = 1 cm); C- Phyllary (bar = 2 mm); D- Floret (bar = 5 mm); E- Anthers (bar = 1 mm); F- Style (bar = 1 mm); G- Cypsela (bar = 3 mm).

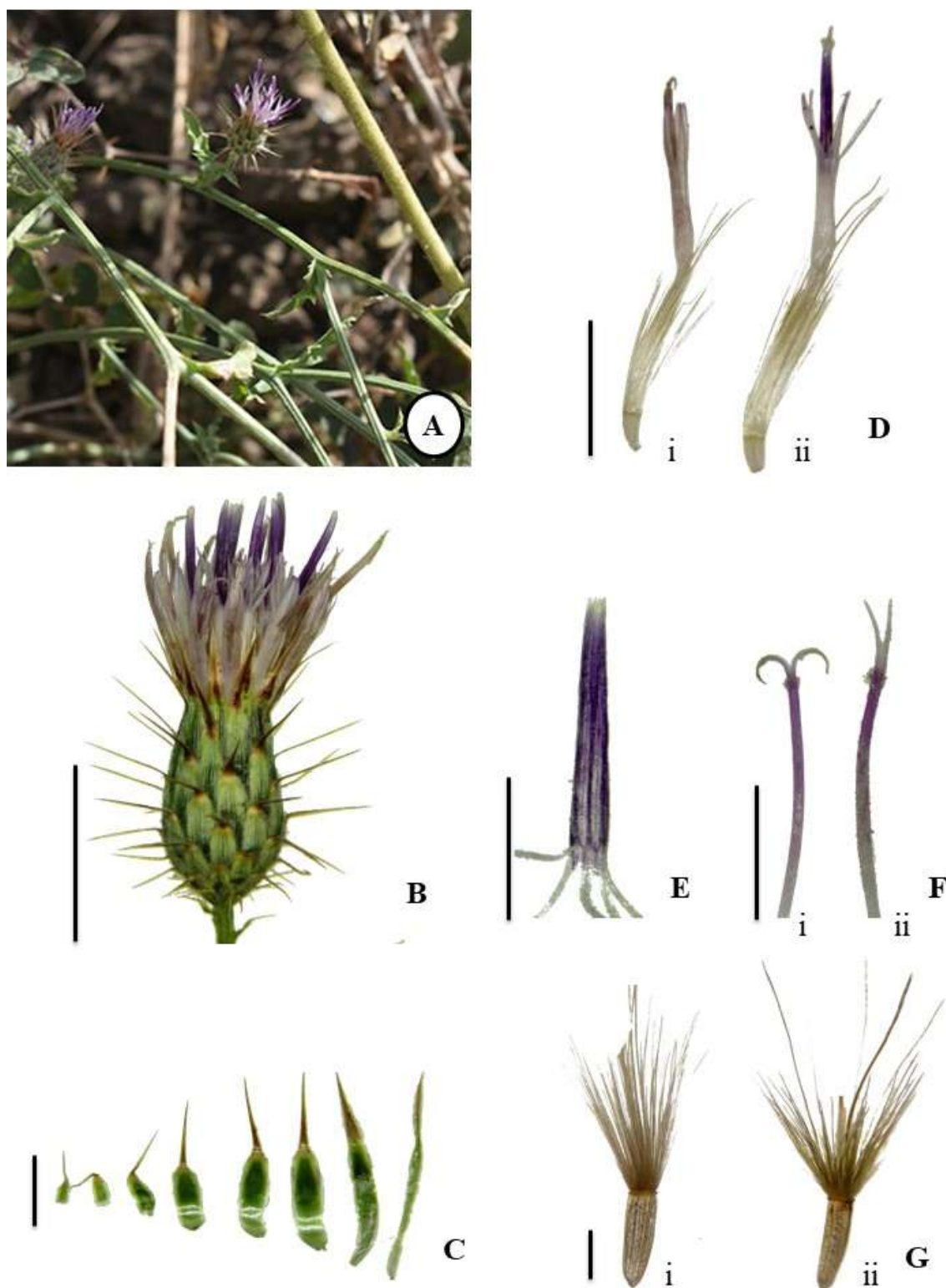


Plate 4.3 *Oligochaeta divaricata* (DC.) K. Koch **A**- Flowering twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 5 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 3 mm); **F**- Style (bar = 2 mm); **G**- Cypsela (bar = 2 mm) (i= RF, ii= DF).

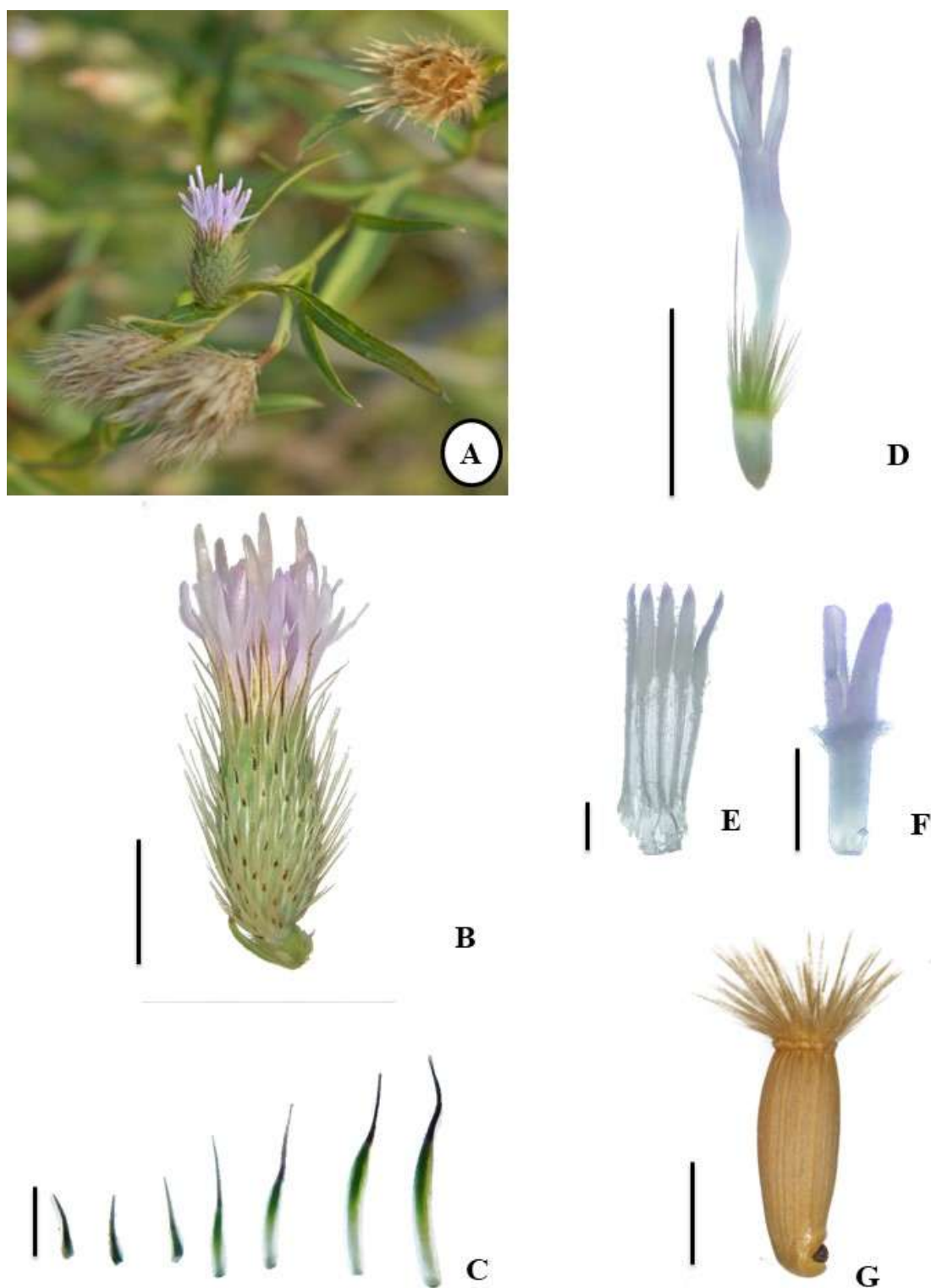


Plate 4.4 *Tricholepis glaberrima* DC. **A**- Flowering twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 3 mm); **D**- Floret (bar = 6 mm); **E**- Anthers (bar = 2 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 3 mm).

Sub-family: Cichorioideae Chevall.

Key to the tribes

- 1a. Capitula ligulate, laticifers present Cichorieae
- 1b. Capitula discoid, laticifers absent Vernoniae

Tribe: Cichorieae Lam. & DC.

Key to the Genera

- 1a. Leaf amplexicaul, florets arranged in more than one series, cypsela flat *Sonchus*
- 1b. Leaf not amplexicaul, florets arranged in one series, cypsela columnar *Launaea*

Genus: *Launaea* Cass., Dict. Sci. Nat., ed. 2. [F. Cuvier] 25: 321 (1822).

Key to the Species

- 1a. Stems not rooting from nodes *L. procumbens*
- 1b. Stems rooting from nodes *L. sarmentosa*

***Launaea procumbens* (Roxb.) Ramayya & Rajagopal** Kew Bull. 23: 465 (1969); Hajra *et al.*, Fl. of India 12: 309. (1995); Shah 387. (1978); Raghavan *et al.* 45. (1981); Bole & Pathak, FS 2: 28. (1988). *Prenanthes procumbens* Roxb. in Fl. Ind., ed. 1832. 3: 404 (1832). *Launaea fallax* (Jaub. & Spach) Kuntze in Revis. Gen. Pl. 1: 351 (1891).

Plate 4.5

Creeping decumbent herb, 20 - 55 cm height. Stems unbranched or profusely branched, glabrous. Leaves simple, mostly radical or cauline, 7 - 20 cm, sessile, lyrate or sinuate-runcinate with irregular lobes; margin dentate with white cartilaginous teeth, obtuse, glabrous. Capitulescence raceme. Capitula ligulate. Florets ligulate, bisexual, corolla lobes five, yellow. Involucre phyllaries multiseriate; phyllaries ovate-linear, 1.5 - 6 mm, apex acute. Anther apex obtuse and base tailed, 1.5-2 mm. Style apex obtuse, 0.5-1 mm. Cypsela columnar, glabrous, 1-1.5 mm. Pappus bristles, 4-6 mm.

Common Name: Creeping Launaea

Vernacular Name: Pathari, Moti Bhonpatri

Specimen: JJS 120 (Kosamba).

Coordinates: 21°28'48.71" N, 72°56'12.14" E.

Origin: India (Native).

Associated Species: *Desmodium triflorum* (L.) DC., *Trianthema portulacastrum* L., *Dichanthium annulatum* (Forssk.) Stapf, *Tridax procumbens* L., *Rungia repens* (L.) Nees.

Abundance: Common.

Flw-Fru: Throughout the year

Habitat: Wastelands and cultivated fields.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: *L. procumbens* can be confused with other species of *Launaea* like *L. resedifolia* but this species can be distinguished by the presence of dentate margin with cartilaginous teeth.

***Launaea sarmentosa* (Willd.) Kuntze** Revis. Gen. Pl. 1: 350 (1891); (Willd.) Alston in Trimen, Hand-Book Fl. Ceylon vi. Suppl., 173 (1931); Hajra *et al.*, Fl. of India 12: 310. (1995); Shah 388. (1978); Raghavan *et al.* 46. (1981); Bole & Pathak, FS 2: 27. (1988). *Prenanthes sarmentosa* Willd. in Phytographia 1: 10 (1794). *Lactuca sarmentosa* (Willd.) Wight ex DC. in R.Wight, Contr. Bot. India: 27 (1834). *Launaea pinnatifida* Cass. in Ann. Sci. Nat. (Paris) 23: 85 (1831); Cooke, FBP 2: 64. (1904).

Plate 4.6

Acualescent herbs, 25-70 cm height. Stems unbranched, producing new plant from the node, glabrous. Leaves simple, arranged in rosette lyrate or sinuate-runcinate, 10 - 30 cm, margine dentate with cartilaginous teeth, apex obtuse, glabrous. Capitulescence clustered or paniced. Capitulum ligulate, 14-16 mm. Florets ligulate, bisexual, 5-7 mm corolla lobes five, yellow. Involucre phyllaries multiseriate; phyllaries ovate-linear, 1.5 - 5 mm, apex acute.

Anther apex obtuse and base tailed, 2-3 mm. Style apex obtuse 1-2 mm. Cypsela columnar, glabrous, 2.5-3.5 mm. Pappus bristles, 4-6 mm.

Common Name: Beach Launaea

Vernacular Name: Sagar Pathari, Nani Bhonpatri

Specimen: JJS 125 (Dandi)

Coordinates: 20°53'15.38" N, 72°47'49.06" E.

Origin: India (Native).

Associated Species: *Ipomoea pes-caprae* (L.) R.Br.

Abundance: Occasional.

Flw-Fru: Throughout the year.

Habitat: Coastal areas.

Distribution: India: Navsari (Dandi beach).

Taxonomic Note: In many literatures, this plant has been described as small in size as compare to *L. procumbens* but it cannot be distinguished on the basis of size.

Genus: *Sonchus* L., Sp. Pl. [Linnaeus] 2: 793 (1753).

Key to the Species

1a. Plant armed *S. asper*

1b. Plant not armed *S. oleraceus*

***Sonchus asper* (L.) Hill** Herb. Brit. 1: 47 (1769); Hajra *et al.*, Fl. of India 12: 318. (1995); Cooke, FBP 2: 62. (1904); Shah 394. (1978); Raghavan *et al.* 46. (1981). *Sonchus oleraceus* var. *asper* L. in Sp. Pl.: 794 (1753). *Sonchus oleraceus* subsp. *asper* (L.) Ehrh. in Hannover. Mag. 14: 230 (1780).

Plate 4.7

Erect herbs, 14 - 70 cm high. Stem terete, sparsely glandular hair. Leaves simple, alternate, amplexicaul, sinuate-lyrate, 8 - 55 cm, margin spinous, apex spinous. Capitulescence solitary. Capitulum ligulate, 2 - 5 cm across, peduncle with glandular hairs. Involucre multiseriate; phyllaries lanceolate-linear, 2.5-5.5 mm. Florets ligulate, 7-9 mm, bisexual, corolla lobes five, yellow. Anther apex obtuse and base tailed, 1-2 mm. Style apex obtuse 0.5-1 mm. Cypsela obovoid, compressed, ribbed, glabrous, 2.5-3 mm. Pappus bristles, 2-3 mm.

Common Name: Prickly Sow-Thistle

Vernacular Name: Dudhi, Kadi

Specimen: JJS 78 (Vyara).

Coordinates: 21°06'25.16" N, 73°19'10.98" E.

Origin: Europe.

Associated Species: *Vigna vexillata* (L.) A.Rich., *Chromolaena odorata* (L.) R.M.King & H.Rob., *Merremia* sp., *Laggera aurita* Benth. ex C.B.Clarke, *Dactyloctenium aegyptium* (L.) Willd..

Abundance: Occasional.

Flw-Fru: March - June

Habitat: Road sides, wastelands and cultivated fields.

Distribution: Tapi.

Taxonomic Note: This plant can easily distinguish by prominent spines on the margin of leaves.

***Sonchus oleraceus* L.** Sp. Pl.: 794 (1753); Hajra *et al.*, Fl. of India 12: 321. (1995); Cooke, FBP 2: 61. (1904); Shah 394. (1978); Raghavan *et al.* 46. (1981); Bole & Pathak, FS 2: 33. (1988). *Carduus amplexicaulis* Noronha in Verh. Batav. Genootsch. Kunsten 5(4): 11 (1790), nom. nud.

Plate 4.8

Erect herbs, 30 - 180 cm tall. Stem polygonal, glabrous, finely grooved. Leaves simple, alternate, amplexicaul, ovate-runcinate, 10 - 45 cm, margin dentate, apex acute. Capitulescence biparous. Capitulum ligulate, 3 - 5.5 cm, often glandular hispid. Involucre multiseriate,

imbricate; lanceolate-linear, 1.5-5.5 mm. Florets ligulate, 7-9 mm bisexual, corolla lobes five, yellow. Anther apex obtuse and base sagittate 1-2 mm. Style obtuse 0.5-1 mm. Cypsela obovoid, compressed, ribbed, glabrous, 2-3 mm. Pappus bristles 1-2 mm.

Common Name: Hare's-lettuce

Vernacular Name: Dudhali Sonki.

Specimen: JJS 126 (Don).

Coordinates: 20°43'51.72" N, 73°51'09.07" E.

Origin: Europe.

Associated Species: *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult., *Acmella radicans* (Jacq.) R.K.Jansen, *Apluda mutica* L., *Alternanthera sessilis* (L.) DC., *Celosia argentea* L., *Colebrookea oppositifolia* Sm.

Abundance: Common.

Flw-Fru: Throughout the year.

Habitat: Wasteland and cultivated fields.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

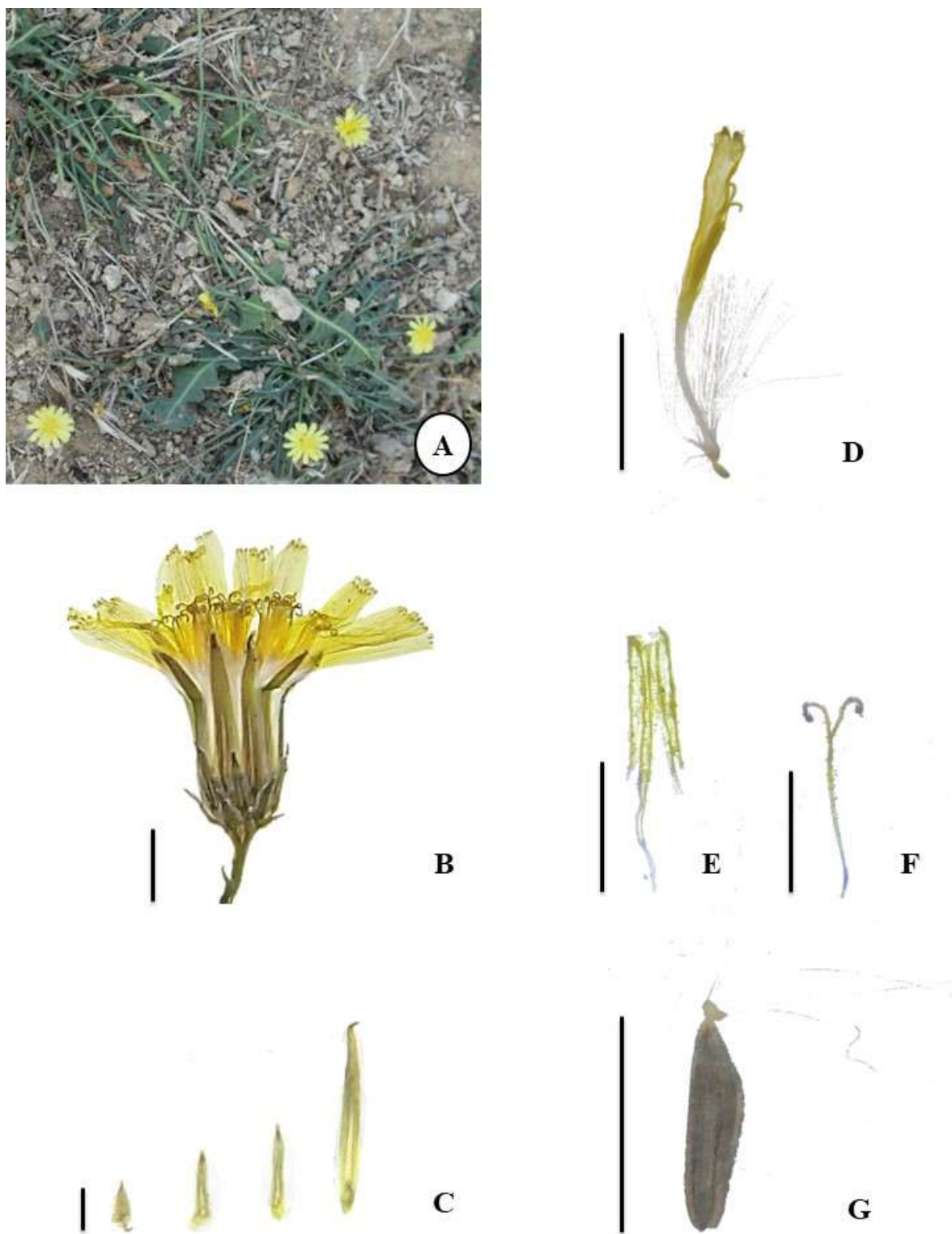


Plate 4.5 *Launaea procumbens* (Roxb.) Ramayya & Rajagopal A- Habit; B- Capitulum (bar = 1 cm); C- Phyllary (bar = 2 mm); D- Floret (bar = 5 mm); E- Anthers (bar = 2 mm); F- Style (bar = 2 mm); G-Cypsela (bar = 1 mm).

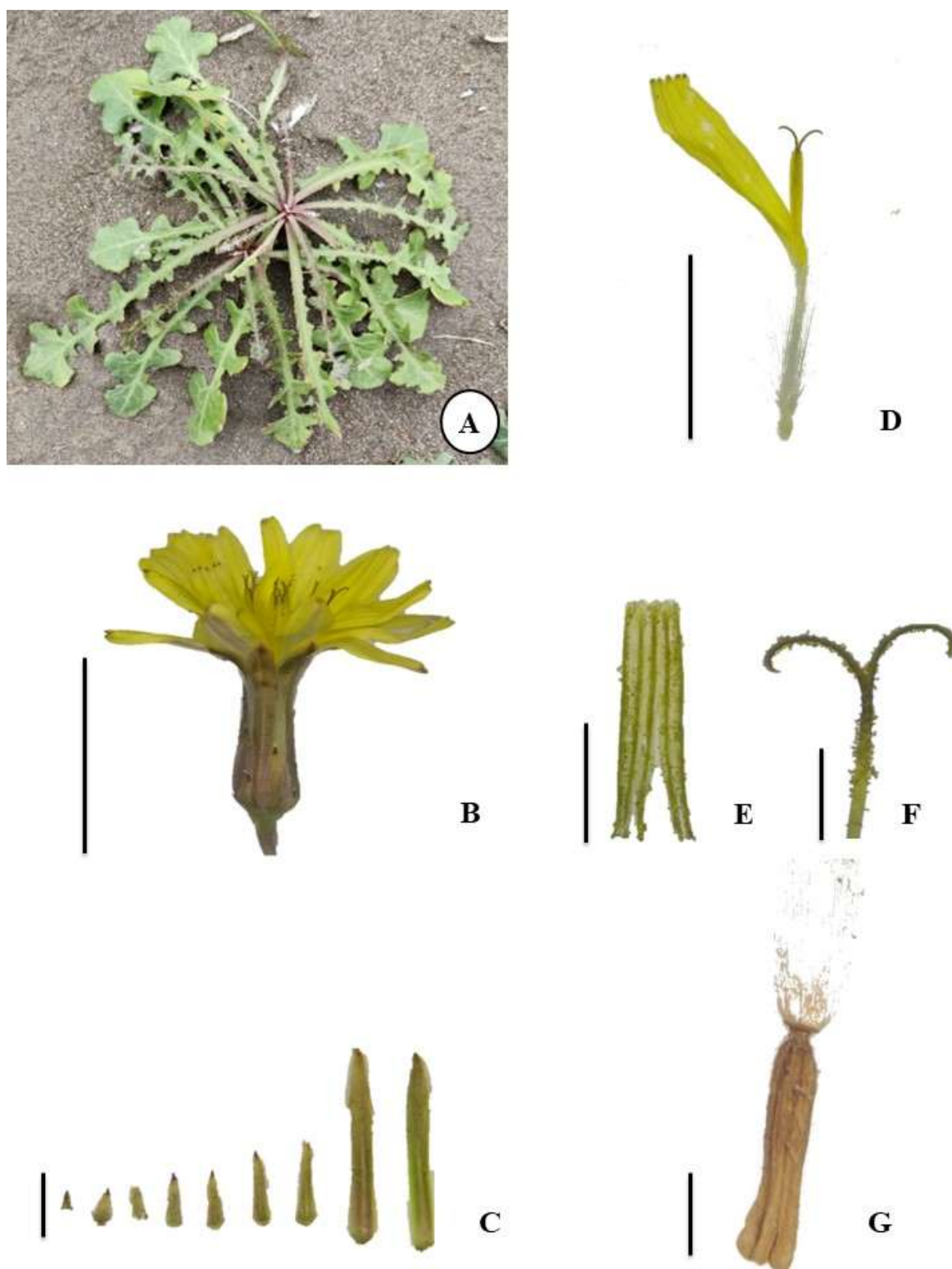


Plate 4.6 *Launaea sarmentosa* (Willd.) Kuntze A- Habit; B- Capitulum (bar = 1 cm); C- Phyllary (bar = 5 mm); D- Floret (bar = 5 mm); E- Anthers (bar = 2 mm); F- Style (bar = 1 mm); G-Cypsela (bar = 1 mm).

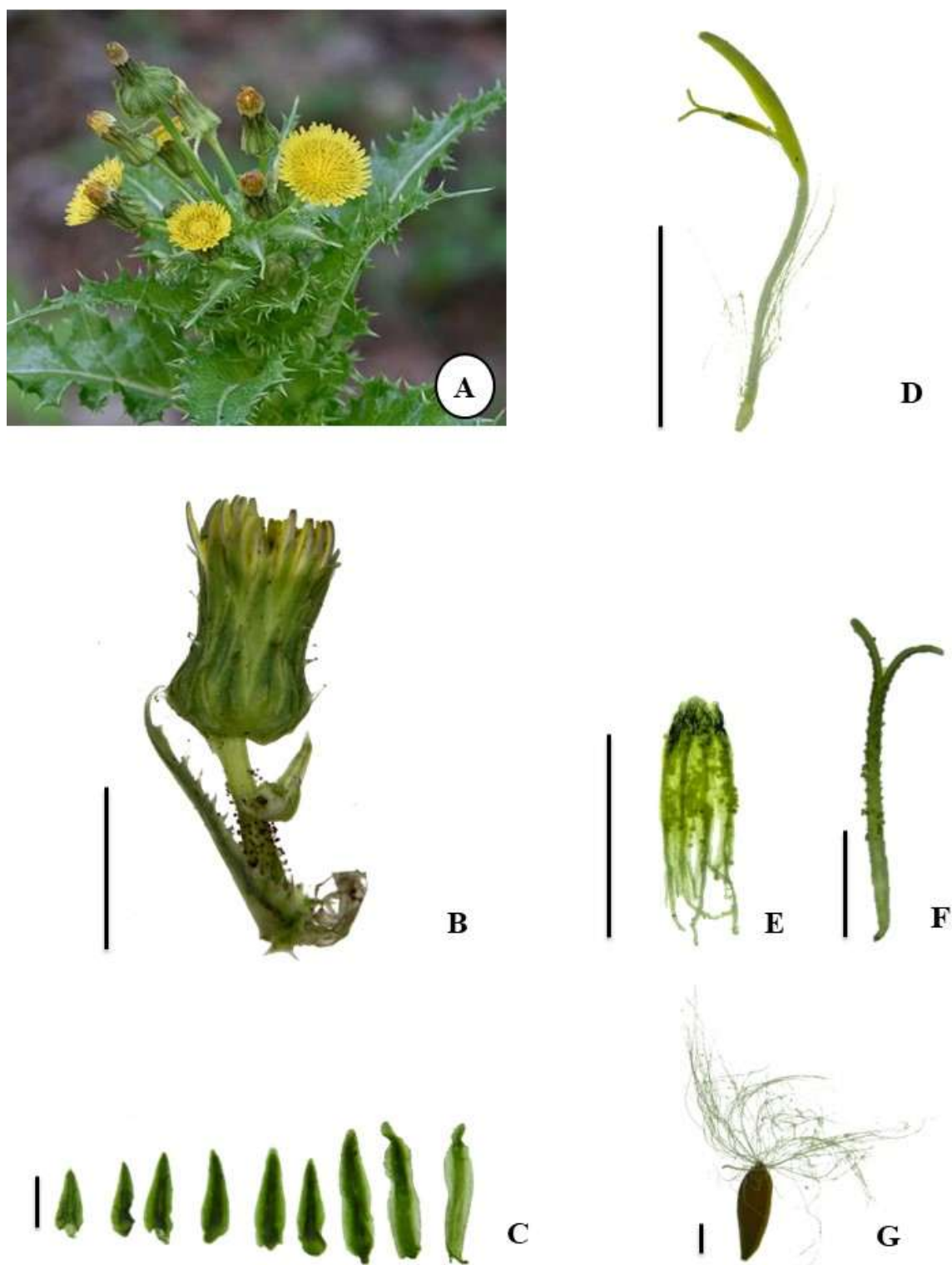


Plate 4.7 *Sonchus asper* (L.) Hill A- Flowering Twig; B- Capitulum (bar = 1 cm); C- Phyllary (bar = 2 mm); D- Floret (bar = 5 mm); E- Anthers (bar = 1 mm); F- Style (bar = 1 mm); G- Cypsela (bar = 1 mm).

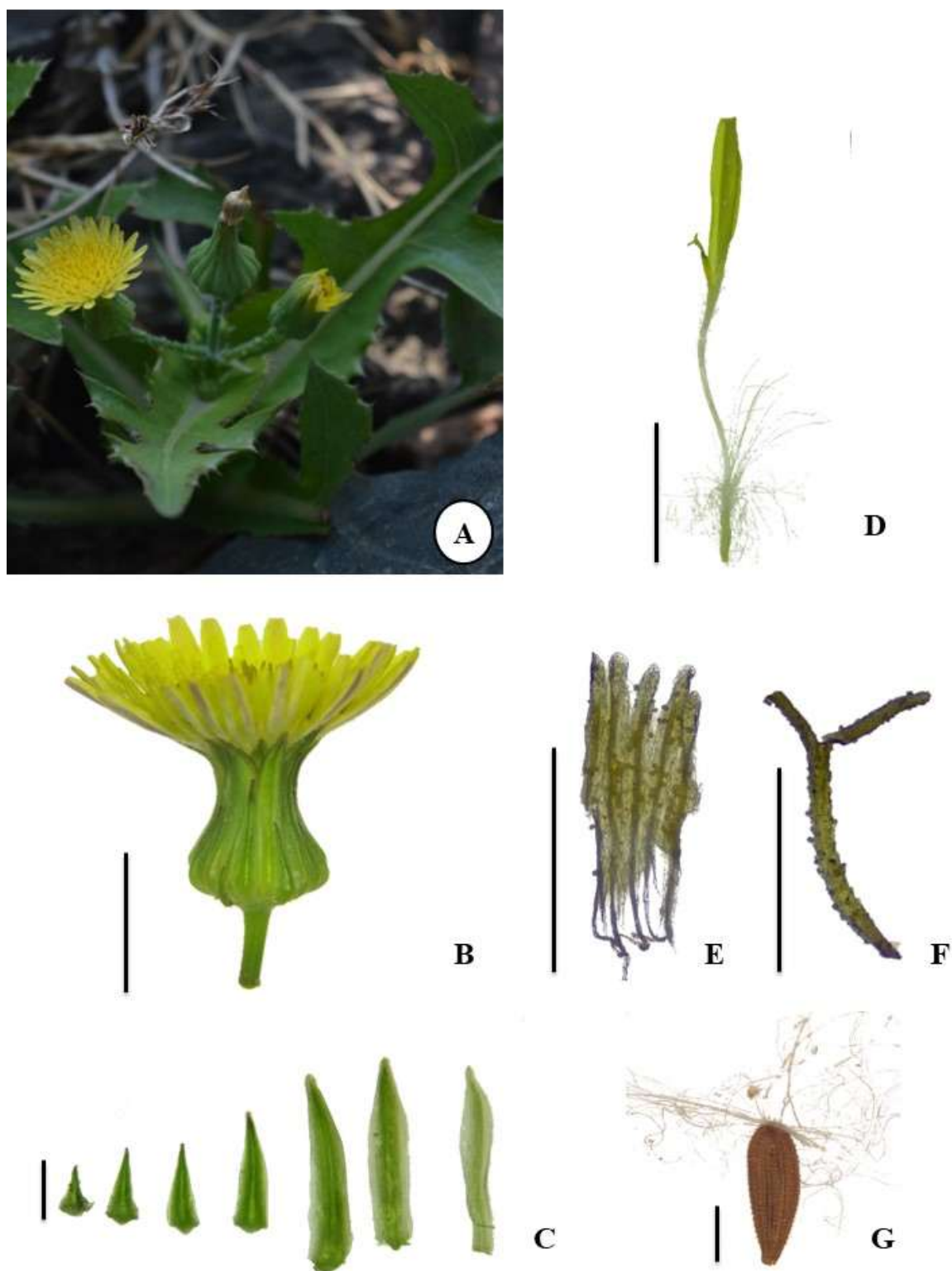


Plate 4.8 *Sonchus oleraceus* L. **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 3 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**- Cypsela (bar = 2 mm).

Tribe: Vernonieae Cass.

Key to the Genera

- 1a. Capitula are compound *Elephantopus*
- 1b. Capitula are simple (2)
- 2a. Leaves are present below the head (3)
- 2b. Leaves are absent below the head (4)
- 3a. Leaves white tomentose beneath *Phyllocephalum*
- 3b. Leaves not white tomentose beneath *Centratherum*
- 4a. Pappus in two rows (5)
- 4b. Pappus in one row *Cyanthillium*
- 5a. Involucre phyllaries are hairy *Acilepis*
- 5b. Involucre phyllaries are glabrous *Baccharoides*

Genus: *Acilepis* D.Don, Prodr. Fl. Nepal. 169 (1825).

Acilepis divergens (DC.) H.Rob. & Skvarla. Proc. Biol. Soc. Washington 122: 140 (2009). *Decaneurum divergens* DC. in R. Wight, Contr. Bot. India: 8 (1834). *Vernonia divergens* (DC.) Edgew. in J. Asiat. Soc. Bengal 21(2): 172 (1852); Hook.f., Fl. Brit. India 3: 234 (1883); Hajra *et al.*, Fl. of India 13: 370. (1995); Cooke, FBP 2: 11. (1904); Shah 399. (1978); Raghavan *et al.* 47. (1981).

Plate 4.9

Shrubs, 1 - 2.5 m tall. Stems less branched, stout, pubescent. Leaves simple, alternate, 5-12 cm, elliptic - lanceolate, margin serrate, apex acute. Capitulescence corymb. Capitulum discoid, 5-7 mm. Involucre multiseriate, ovate - oblong; apex acute, woolly, 1-3 mm. Florets bisexual, tubular, lilac – lavender, 7-9 mm. Anther apex acute and base sagittate 2.5-3.5 mm. Style apex acute 1-2 mm. Cypsela obovoid, ribbed, glabrous, 2.5-3.5 mm. Pappus bristles 3-4 mm.

Common Name: Diverge Vernonia.

Vernacular Name: Bandar

Specimen: JJS 71 (Saputara).

Coordinates: 20°35'09.84" N, 73°44'59.93" E.

Origin: India (Native).

Associated Species: *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult., *Alternanthera sessilis* (L.) DC., *Chromolaena odorata* (L.) R.M.King & H.Rob., *Celosia argentea* L., *Eranthemum roseum* (Vahl) R.Br. ex Roem. & Schult., *Colebrookea oppositifolia* Sm.

Abundance: Restricted.

Flw-Fru: January-March.

Habitat: Hilly areas.

Distribution: Dang.

Taxonomic Note: It resembles to *Chromolaena odorata* but can be differentiate on the basis of leaf shape where it is elliptical-lanceolate in *A. divergens* and deltoid in *C. odorata*. Another character is less branching in *A. divergens*. Involucre is hairy.

Genus: *Baccharoides* L. ex Moench, Methodus (Moench) 578 (1794).

***Baccharoides anthelmintica* (L.) Moench**. Methodus: 578 (1794); *Conyza anthelmintica* L. Sp. Pl., ed. 2.: 1207 (1763); *Vernonia anthelmintica* (L.) Willd., Sp. Pl. 3: 1634 (1803); Hook.f., Fl. Brit. Ind. 3: 236 (1883); Hajra *et al.*, Fl. of India 13: 357. (1995); Cooke, FBP 2: 10. (1904); Shah 398. (1978); Raghavan *et al.* 47. (1981); Bole & Pathak, FS 2: 38. (1988).

Plate 4.10

Long erect herb, 0.8 - 1.2 m tall. Stem striate, pubescent. Leaves simple, alternate, ovate - lanceolate, 6 – 10 cm, margin serrate, apex acute, pubescent. Capitulescence solitary or corymb. Capitulum discoid, 12-14 mm; subtended to one foliaceous bract. Involucre multiseriate; 6-8 mm, linear-oblong, purple tipped, apex obtuse. Florets tubular, 8-10 mm, bisexual, pink - magenta. Anther apex acute and base sagittate, 1-2.5 mm. Style apex obtuse 1.5-2 mm. Cypsela obovoid, ca 4.5 mm long, ribbed, pubescent on the ribs. Pappus scaly or paleaceous, biseriate, dimorphic 3-4 mm.

Common Name: Ironweed.

Vernacular Name: Kali-jiri.

Specimen: JJS 80 (Jam Gabhan).

Coordinates: 20°19'35.37" N, 73°09'44.83" E.

Origin: India (Native).

Associated Species: *Boerhavia diffusa* L., *Commelina benghalensis* L., *Oplismenus burmanni* (Retz.) P.Beauv., *Trianthema portulacastrum* L.

Abundance: Occasional.

Flw-Fru: October-March.

Habitat: Cultivated fields and hilly areas.

Distribution: Dang and Valsad.

Taxonomic Note: The phyllaries is recurving along with purple tip.

Genus: *Centratherum* Cass., Bull. Sci. Soc. Philom. Paris 1817: 31 (1817).

***Centratherum punctatum* Cass.** G.-F.Cuvier, Dict. Sci. Nat., ed. 2. 7: 384 (1817).
Baccharoides punctata (Cass.) Kuntze in Revis. Gen. Pl. 1: 320 (1891).

Plate 4.11

Decumbent herbs, 60 - 80 cm. Stem terete, glabrous. Leaves 3.5 - 5.5 cm, elliptic, veins prominent, serrate margins. Capitulescence solitary. Capitula discoid, calyculate by foliaceous phyllaries. Involucre in multi-seriate; phyllaries ovate, 2-12 mm apex attenuate. Florets tubular, 10-12 mm bisexual, 1-1.5 mm, pink. Anther apex acute and base sagittate 2.5-3.5 mm. Style acute 1.5-2.5 mm. Cypsela oblong, striated 2-2.5 mm. Pappus scaly 1.5-2 mm.

Common Name: Brazilian Bachelor's Button.

Vernacular Name: Kesavardhini.

Specimen: JJS 30 (Ahwa), 31 (Wilson Hills).

Coordinates: 20°29'35.10" N, 73°20'03.86" E.

Origin: Brazil.

Associated Species: *Boerhavia diffusa* L., *Datura innoxia* Mill., *Euphorbia hirta* L., *Digitaria adscendens* (Kunth) Henrard.

Abundance: Occasional.

Flw-Fru: September-June.

Habitat: Roads side and wastelands.

Distribution: Dang and Valsad.

Taxonomic Note: This species was misidentified as *C. phyllolaenum* in which leaves not prominently reticulately veined beneath but the specimen found have prominently veined beneath.

Genus: *Cyanthillium* Blume, Bijdr. Fl. Ned. Ind. 15: 889 (1826).

***Cyanthillium cinereum* (L.) H.Rob.** Proc. Biol. Soc. Washington 103: 252 (1990); *Conyza cinerea* L. in Sp. Pl.: 862 (1753); *Vernonia cinerea* (L.) Less. in Linnaea 4: 291 (1829); Hook.f., Fl. Brit. India 3: 233 (1883); Hajra *et al.*, Fl. of India 13: 367. (1995); Cooke, FBP 2: 10. (1904); Shah 398. (1978); Raghavan *et al.* 47. (1981); Bole & Pathak, FS 2: 39. (1988).

Plate 4.12

Erect herbs, polymorphic, 10 - 80 tall. Stems terete, ribbed, pubescent. Leaves simple, alternate, variously shaped, 3 – 8 cm, serrate or entire, apex obtuse or acute, attenuate, glabrous. Capitulescence solitary or corymb. Capitulum discoid, 4 - 8 mm across. Involucre multiseriate, ovate - lanceolate, apex acuminate, 1.5 - 4.5 mm long. Florets tubular, 2-3 mm bisexual, pink - purple. Anther apex obtuse and base sagittate 0.5-1 mm. Style apex acute 1-2 mm. Cypsela obovoid, hairy, faintly ribbed, disc present 1-2 mm. Pappus dimorphic, bristles, biseriate.

Common Name: Little ironweed.

Vernacular Name: Sahadevi, Sadedi.

Specimen: JJS 113 (Vesma), 114 (Khambhala).

Coordinates: 21°01'51.27" N, 72°57'49.37" E; 21°07'52.19" N, 73°28'22.61" E.

Origin: Asia and Africa.

Associated Species: *Acalypha indica* L., *Corchorus aestuans* L., *Boerhavia diffusa* L., *Tridax procumbens* L.

Abundance: Common.

Flw-Fru: Throughout the year.

Habitat: Wasteland, cultivated fields, hilly areas and aquatic areas.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: The habit is polymorphic where it can be prostrate or erect with variable size.

Genus: *Elephantopus* L., Sp. Pl. 2: 814 (1753).

***Elephantopus scaber* L.** Sp. Pl.: 814 (1753); Hook.f., Fl. Brit. India 3: 242 (1883); Hajra *et al.*, Fl. of India 13: 333. (1995); Cooke, FBP 2: 12. (1904); Shah 379. (1978); Raghavan *et al.* 44. (1981); Bole & Pathak, FS 2: 16. (1988).

Plate 4.13

Acaulescent herbs, 20 - 50 cm tall. Stems condensed, terete. Leaves simple, rosette, spatulate - obovate, 20 - 45 cm, crenate, obtuse, sparsely hairy on nerves beneath. Capitulescence corymb - biparous. Capitulum compound, receptacle branched with each branch possess each unit, discoid, compound head possess 3 phyllaries at the top of peduncle, foliaceous, prominently nerved. Involucre of each unit biseriate, 3-7 mm, enclosing 3 - 5 florets; ovate - linear, apex acute. Florets tubular, 6-10 mm, bisexual white - lilac. Anther apex appendiculate and base sagittate, 2-3 mm. Style apex obtuse, 1.5- 2.5 mm. Cypsela obovate, hispid, finely 10-ribbed, 3-5 mm. Pappus bristles, 2-4 mm long.

Common Name: Elephant Foot.

Vernacular Name: Hastipad and Kharsat.

Specimen: JJS 62 (Wilson Hills).

Coordinates: 20°30'00.38" N, 73°19'51.25" E.

Origin: India (Native).

Associated Species: *Oplismenus burmanni* (Retz.) P.Beauv., *Commelina benghalensis* L., *Synedrella nodiflora* (L.) Gaertn., *Eranthemum roseum* (Vahl) R.Br. ex Roem. & Schult., *Ageratum conyzoides* L.

Abundance: Occasional.

Flw-Fru: September-March.

Habitat: Hilly areas and Forest.

Distribution: Dang and Valsad.

Taxonomic Note: Capitula are compound. Both compound head and headlet possess involucre of phyllaries.

Genus: *Phyllocephalum* Blume, Bijdr. Fl. Ned. Ind. 15: 888 (1826).

***Phyllocephalum microcephalum* (Dalzell) H.Rob.** Proc. Biol. Soc. Washington 112: 235 (1999); *Decaneurum microcephalum* Dalzell in Hooker's J. Bot. Kew Gard. Misc. 3: 231 (1851); *Lamprachaenium microcephalum* (Dalz.) Benth. in C.B. Clarke, Comp. Ind. 5 (1876); Hook.f. Fl. Brit. India 3: 229 (1883); Hajra *et al.*, Fl. of India 13: 337. (1995); Cooke, FBP 2: 8. (1904).

Plate 4.14

Erect herbs, 0.6-1 m tall. Stems terete, ridged, pubescent. Leaves simple, alternate, elliptic - lanceolate, 5-20 cm, serrate, acute to acuminate, white tomentose beneath. Capitulescence solitary or corymb. Capitulum discoid, calyculate with foliaceous bract. Involucre multiseriate; phyllaries ovate-lanceolate, 3-7 mm, apex acute. Florets tubular, bisexual, pink – magenta. Anther apex attenuate and base sagittate, 1-2 mm. Style apex obtuse, 1-1.5 mm. Cypsela obovate, 3 - 5 mm long, glabrous, 10-ribbed. Pappus bristles, 1-2 mm.

Common Name: Indian Bachelor's Button.

Vernacular Name: Parnagumphi.

Specimen: JJS 60 (Saputara), 61 (Wilson Hills).

Coordinates: 20°35'28.86" N, 73°45'24.71" E; 20°30'23.40" N, 73°21'04.41" E.

Origin: India (Native).

Associated Species: *Impatiens balsamina* L., *Elephantopus scaber* L., *Anisomeles indica* (L.) Kuntze, *Chromolaena odorata* (L.) R.M.King & H.Rob., *Colebrookea oppositifolia* Sm.

Abundance: Occasional.

Flw-Fru: October- December.

Habitat: Hilly areas

Distribution: Dang and Valsad.

Taxonomic Note: Leaves are white Tomentose beneath and involucre is calyculate.

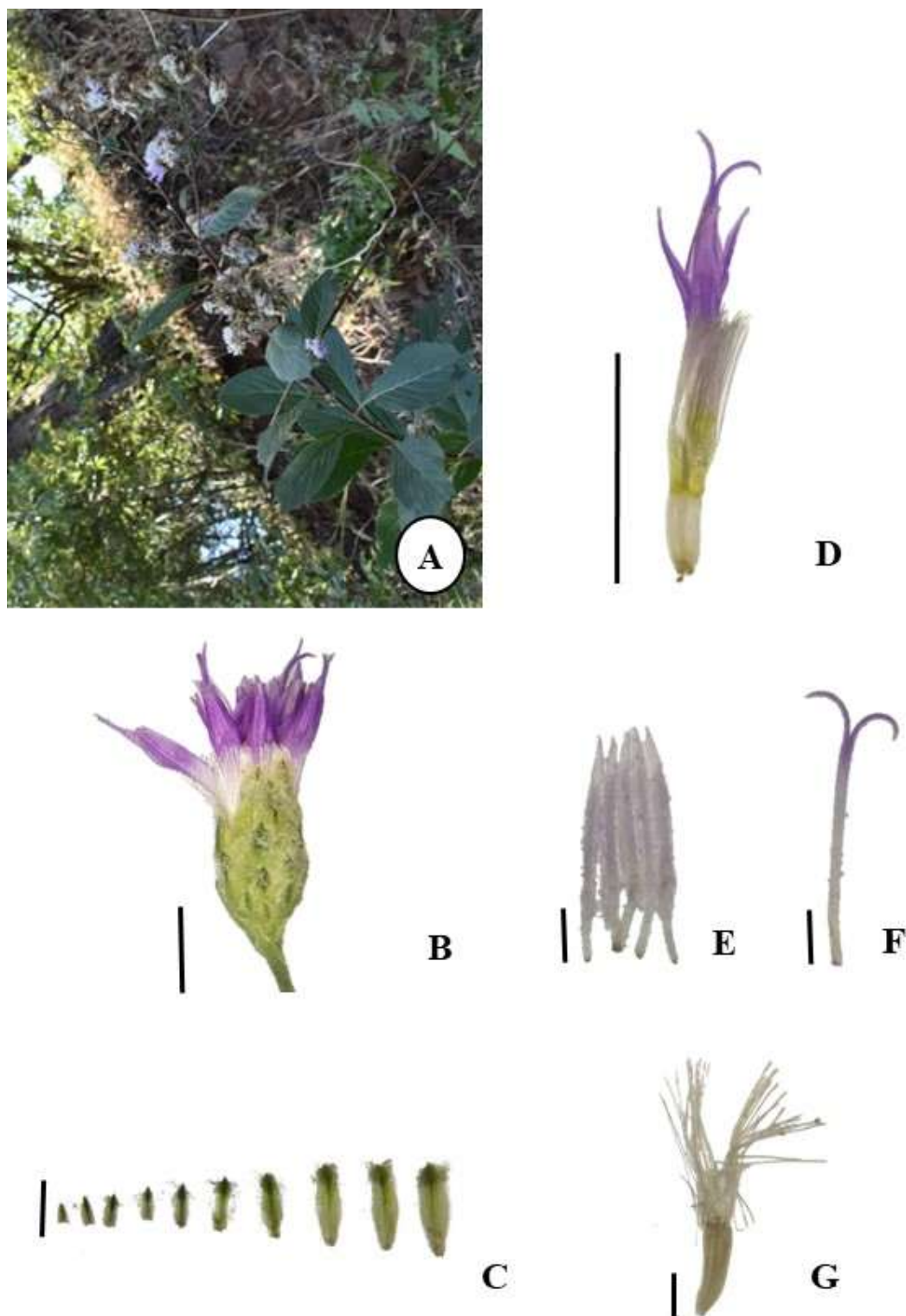


Plate 4.9 *Acilepis divergens* (DC.) H. Rob. & Skvarla **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 5 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 2 mm).

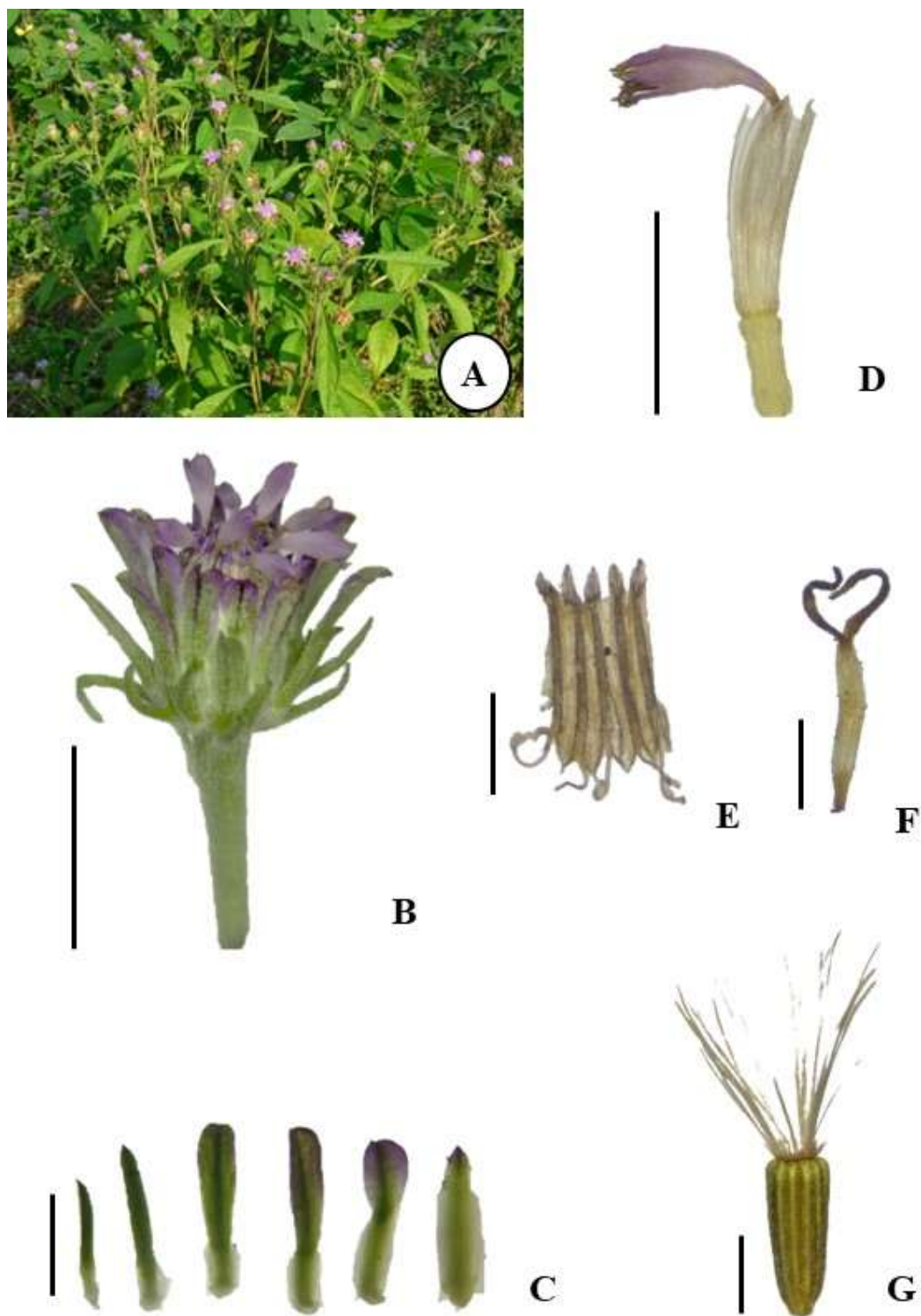


Plate 4.10 *Baccharoides anthelmintica* (L.) Moench **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 5 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 3 mm); **G**-Cypsela (bar = 2 mm).

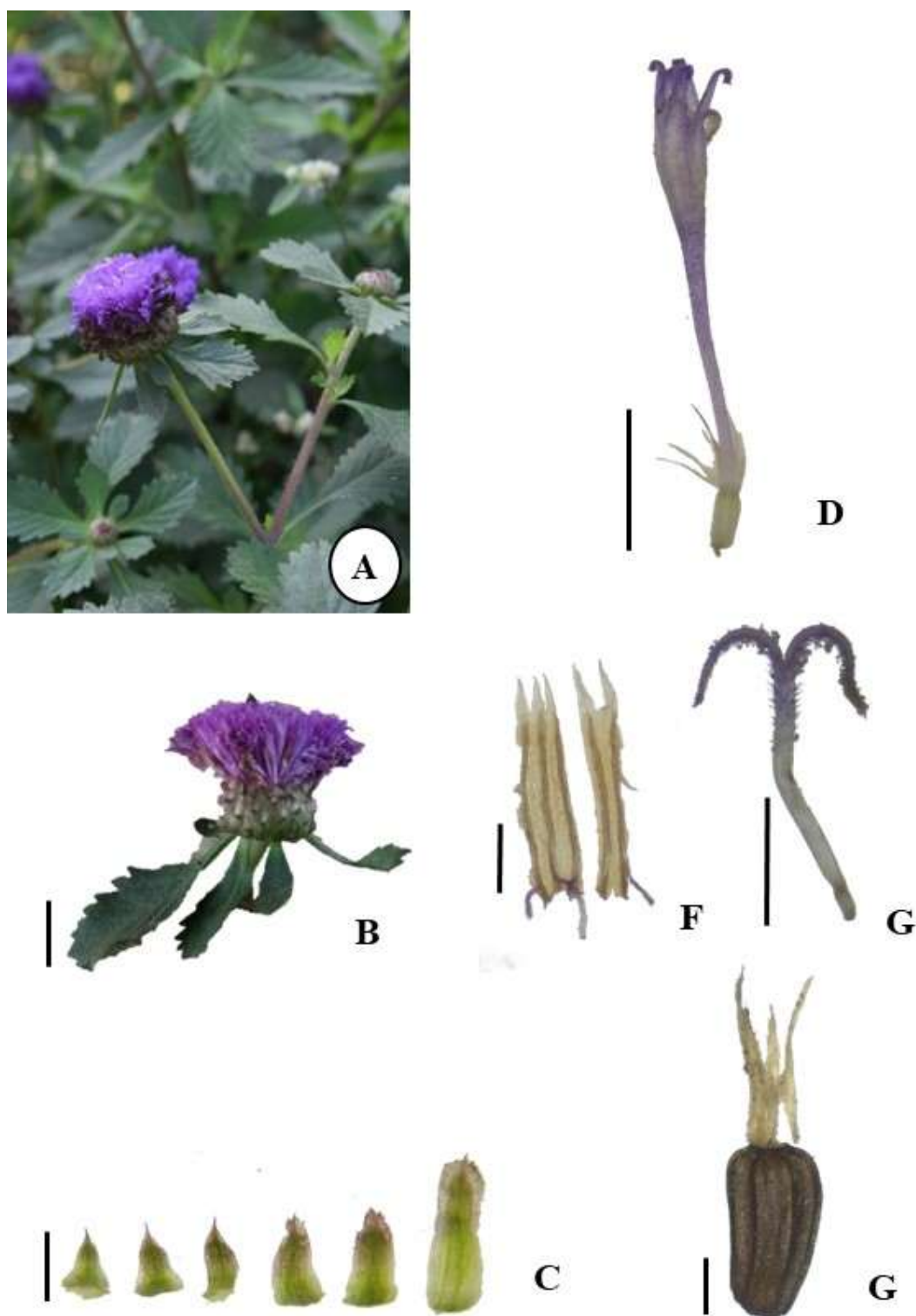


Plate 4.11 *Centratherum punctatum* Cass. **A**- Flowering Twig; **B**- Capitulum (bar =1 cm); **C**- Phyllary (bar = 5 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 2 mm); **G**-Cypsela (bar = 1 mm).



Plate 4.12 *Cyanthillium cinereum* (L.) H. Rob. **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 1 mm); **D**- Floret (bar = 2 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm).

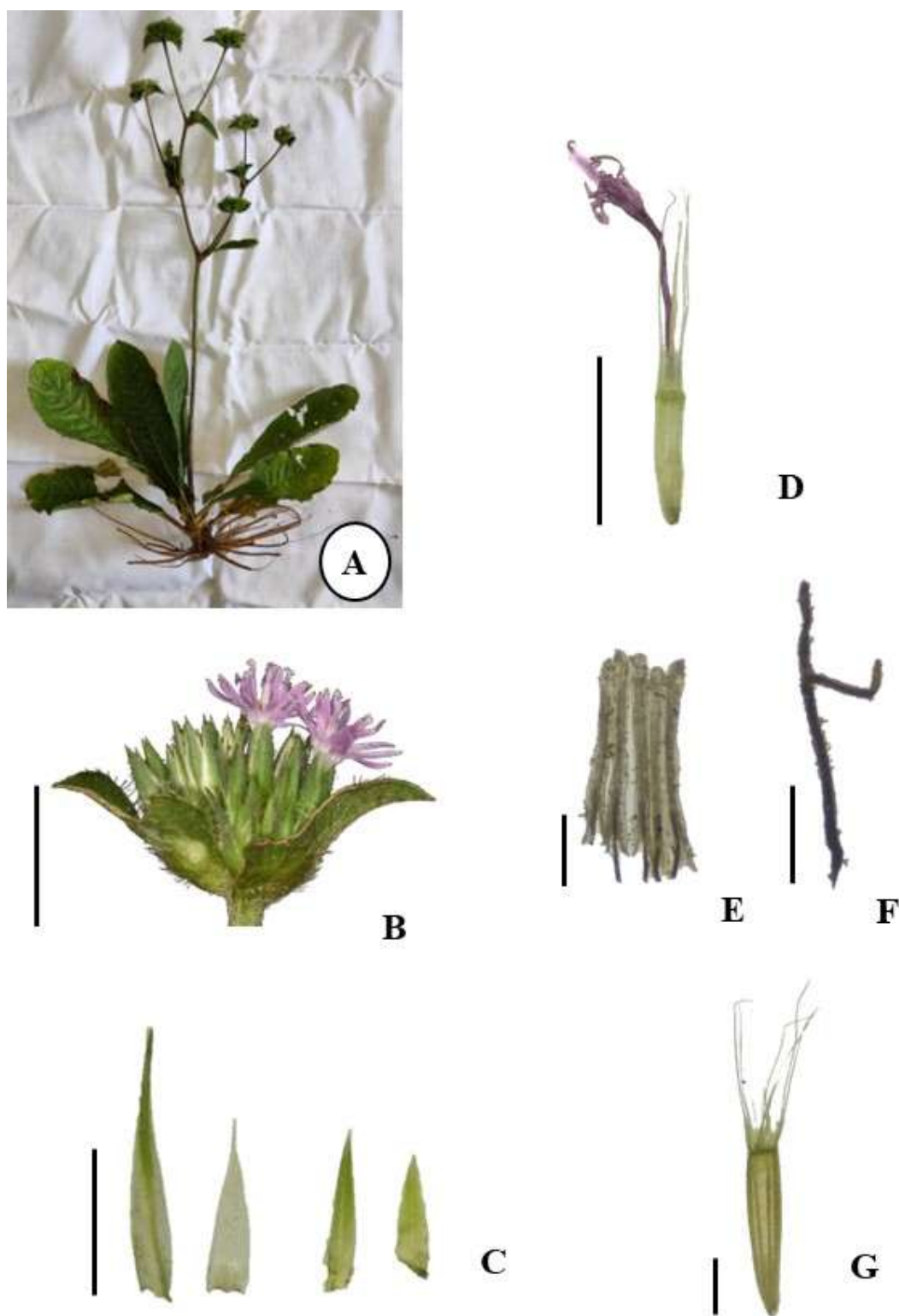


Plate 4.13 *Elephantopus scaber* L. **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 5 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**- Cypsela (bar = 2 mm).

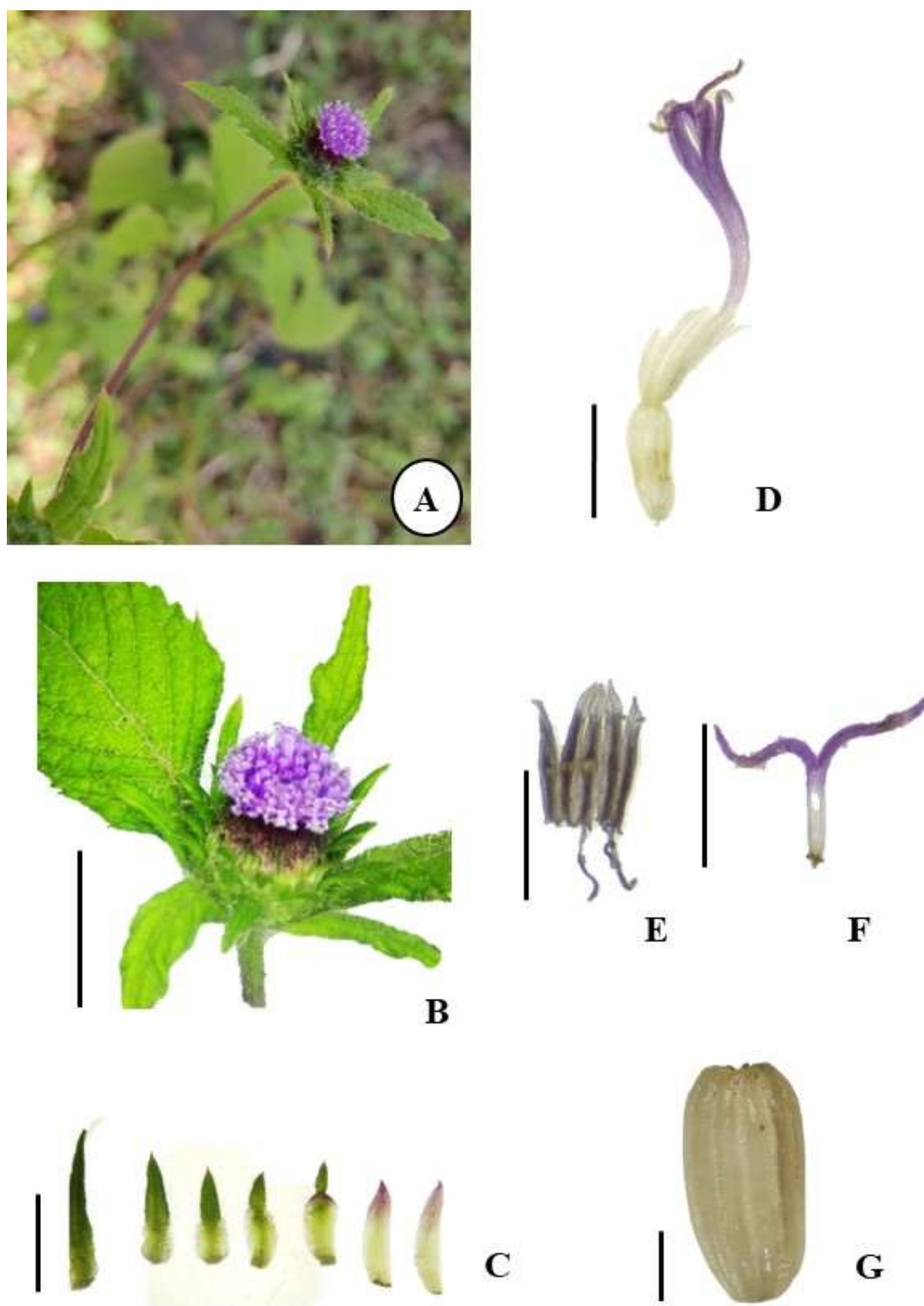


Plate 4.14 *Phyllocephalum microcephalum* (Dalzell) H.Rob. **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 10 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsel (bar = 1 mm).

Sub-family: Asteroideae (Cass.) Lindl.

Key to the tribes

- 1a. Cypsela with a layer of phytomelanin (blackened) (2)
- 1b. Cypsela without a layer of phytomelanin (not blackened) (5)
- 2a. Involucre dimorphic, inner involucre and paleae with orange-brown striation (presence of resin ducts) Coreopsideae
- 2b. Involucre not dimorphic, inner involucre and paleae without orange-brown striation (resin ducts absent) (3)
- 3a. Capitula strictly discoid, style arms distinctly extrose and terete to clavate Eupatorieae
- 3b. Capitula homogamous or heterogamous, style arms not distinctly extrose (4)
- 4a. Cypsela mostly flattened with conduplicate paleae Heliantheae
- 4b. Cypsela mostly terete without conduplicate paleae Millerieae
- 5a. Anther tailed (6)
- 5b. Anther not tailed (7)
- 6a. Plant densely woolly, involucre scarious Gnaphalieae
- 6b. Plant not densely woolly, involucre not scarious Inuleae
- 7a. Style branches truncate or appendiculate Senecioneae
- 8a. Style branches not truncate or appendiculate Astereae

Tribe: Senecioneae Cass.

Key to the Genera

- 1a. Involucre free, style of disc floret truncate *Senecio*
1b. Involucre fused, style not truncate (2)
2a. Involucre calyculate *Crassocephalum*
2b. Involucre not calyculate *Emilia*

Genus: *Crassocephalum* Moench, Methodus (Moench) 516 (1794).

***Crassocephalum crepidioides* (Benth.) S.Moore** J. Bot. 50: 211 (1912); Hajra *et al.*, Fl. of India 13: 201. (1995). *Gynura crepidioides* Benth. in Hook.f., Fl. Niger. 438 (1849).

Plate 4.15

Erect herbs, 70–110 cm high. Stems greenish-pale brown, terete, faintly ribbed, pubescent, branched distally. Leaves simple, alternate, lanceolate-lyrate, 3.5–15 cm, serrate, acute, pubescent, prominently veined abaxially, sessile, amplexicaul. Capilulescence corymb-paniculate. Capitula discoid; 2.5–3.5 cm long. Involucre uniseriate, fused; phyllary linear, 2 – 3 cm, acute, pubescent. Florets tubular, bisexual, slender, 2 – 3.5 cm, scarlet red. Anthers apex acuminate and base entire. Style apex acute. Cypsela columnar, 2–3 mm long, deeply ribbed, pubescent between the ribs white. Pappus of capillary bristles, 6-8 mm.

Common Name: Fireweed

Vernacular Name: Agniva.

Specimen: JJS 83 (Saputara).

Coordinates: 20°34'51.22" N, 73°44'48.71" E.

Origin: Madagascar.

Associated Species: *Alternanthera bettzickiana* (Regel) G.Nicholson, *Apluda mutica* L., *Vigna vexillata* (L.) A.Rich., *Asclepias curassavica* L., *Blumea belangeriana* DC.

Abundance: Occasional.

Flw-Fru: October-April.

Habitat: Forests and hilly areas.

Distribution: India: Dang.

Taxonomic Note: This plant can be confused with *Emilia javanica* but can be distinguished on the basis of calyculate involucre.

Genus: *Emilia* Cass., Bull. Sci. Soc. Philom. Paris 1817: 68 (1817).

***Emilia sonchifolia* (L.) DC.** R.Wight, Contr. Bot. India: 24 (1834); Hajra *et al.*, Fl. of India 13: 212. (1995); Cooke, FBP 2: 49. (1904); Shah 380. (1978); Bole & Pathak, FS 2: 17. (1988). *Cacalia sonchifolia* L. in Sp. Pl.: 835 (1753); Hook.f., Fl. Brit. India 3: 336 (1883).

Plate 4.16

Decumbent herbs, 20 - 40 cm high. Stem branched, faintly ribbed, sparsely pubescent or glabrous. Leaves simple, alternate, amplexicaul, lyrate pinnatifid, 5 - 12 cm, margins irregularly toothed, apex obtuse, membranous, glabrous to sparsely pubescent. Capitulescence corymbose. Capitula discoid, 1 – 2.5 cm long. Involucre uniseriate, cylindrical; phyllaries fused 1 – 2 cm, linear, acute, glabrous. Florets tubular, bisexual, slender, 1 – 2.5 cm long, pink - purple. Anthers apex obtuse and base subentire. Style apex subulate. Cypsela fusiform, brown, 2.5 - 3 mm long, 5-ribbed, scabrid. Pappus capillary bristles, 5-7 mm.

Common Name: Lilac tassel-flower

Vernacular Name: Hirankhuri.

Specimen: JJS 6 (Ahwa).

Coordinates: 20°46'14.45" N, 73°38'21.77" E.

Origin: Southeast Asia.

Associated Species: *Dregea volubilis* (L.f.) Benth. ex Hook.f., *Lavandula latifolia* Medik., *Trichodesma zeylanicum* (Burm.f.) R.Br., *Peristrophe bicalyculata* (Retz.) Nees, *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult.

Abundance: Common.

Flw-Fru: June - December.

Habitat: Roadsides and hilly areas.

Distribution: Tapi, Navsari, Dang and Valsad.

Genus: *Senecio* L., Sp. Pl. 2: 866 (1753).

***Senecio bombayensis* N.P.Balakr.** J. Bombay Nat. Hist. Soc. 67: 61 (1970); Hajra *et al.*, Fl. of India 13: 244. (1995). *Doronicum reticulatum* Wight in Cal. J. Nat. Hist. 7: 156 (1847). *Senecio grahami* Hook.f., Fl. Brit. India 3: 347 (1883); Cooke, FBP 2: 52. (1904); Shah 393. (1978); Raghavan *et al.* 46. (1981); Bole & Pathak, FS 2: 32. (1988).

Plate 4.17

Erect or decumbent herbs 20 - 90 cm high. Stems branched, angular, pubescent. Leaves simple, alternate, ovate-deltate, 1 - 5 cm, margins serrate, acute, sparingly pubescent on the upper surface, lower surface with white tomentum. Capitulescence corymbose. Capitula radiate, 2 - 4 cm in diameter, bracteolate. Involucre uniseriate; phyllaries obovate-oblong, 5 - 7 mm long. Ray florets ligulate, neuter, yellow, 1 - 2 cm long. Disc florets tubular, bisexual, 1 - 1.5 cm long. Anther apex obtuse and base sagittate, 1.5-2 mm. Style apex truncate, 0.5-1 mm. Cypsela obovoid, 3.5 - 4.5 mm long, ribbed, strigose. Pappus absent in ray florets; paleaceous and short setaceous hairs in disc florets, 1.5-2 mm.

Common Name: Graham's groundsel

Vernacular Name: Sonki

Specimen: JJS 20 (Malegaon).

Coordinates: 20°35'29.04" N 73°45'20.03" E.

Origin: India (Native).

Associated Species: *Oplismenus burmanni* (Retz.) P.Beauv., *Tridax procumbens* L., *Paspalum* sp., *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult., *Celosia argentea* L.

Abundance: Occasional.

Flw-Fru: August - December.

Habitat: Hilly areas.

Distribution: Dang (Malegaon-Saputara).

Taxonomic Note: Pappus may be confused with awns but it is the extension of the scaly pappus.

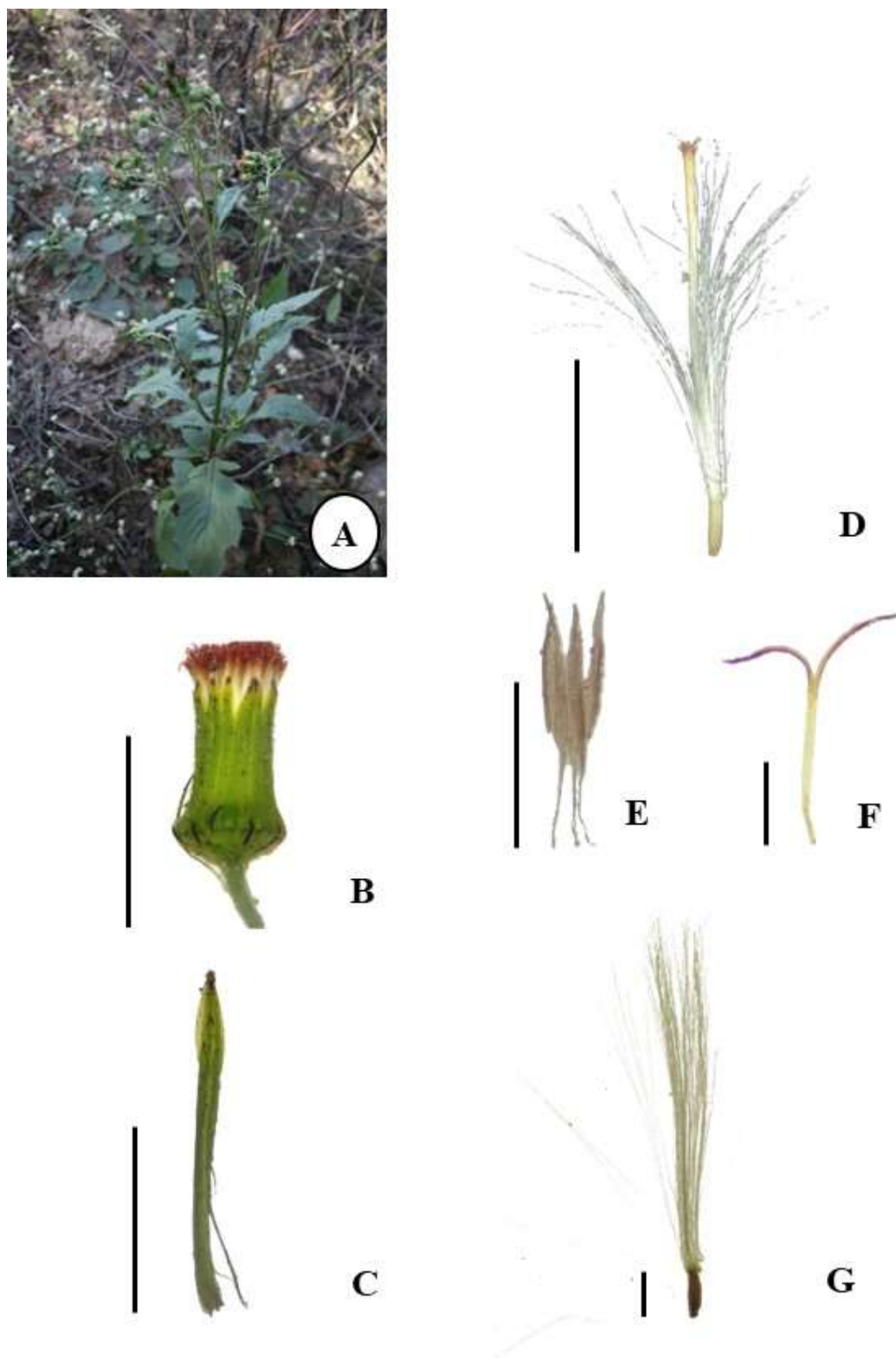


Plate 4.15 *Crassocephalum crepidioides* (Benth.) S. Moore **A-** Habit; **B-** Capitulum (bar= 1 cm); **C-** Phyllary (bar= 2 mm); **D-** Floret (bar= 5 mm); **E-** Anthers (bar= 1 mm); **F-** Style (bar= 1 mm); **G-** Cypsela (bar= 2 mm).

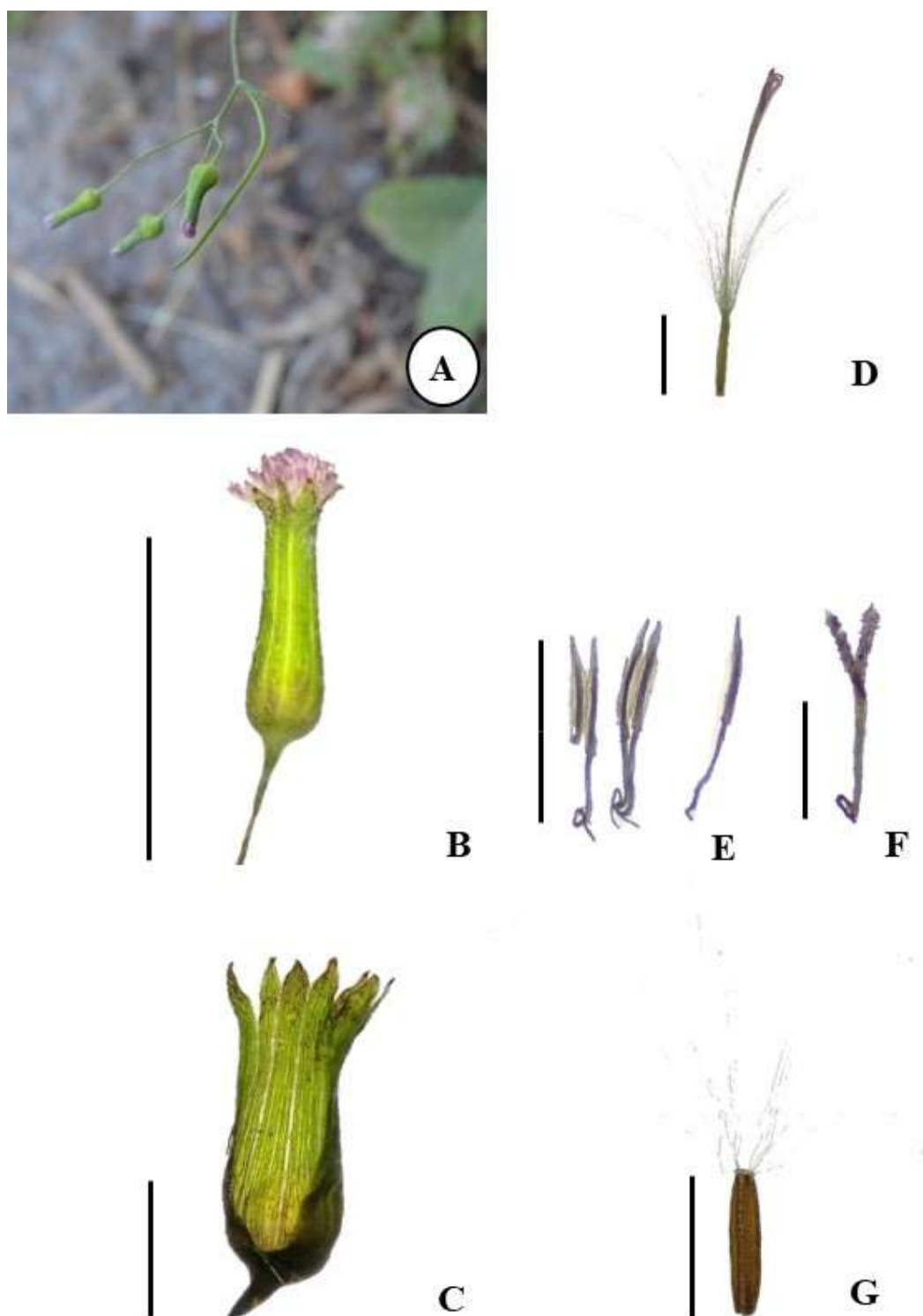


Plate 4.16 *Emilia sonchifolia* (L.) DC. **A**- Flowering twig; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 3 mm); **D**- Floret (bar= 2 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 2 mm).

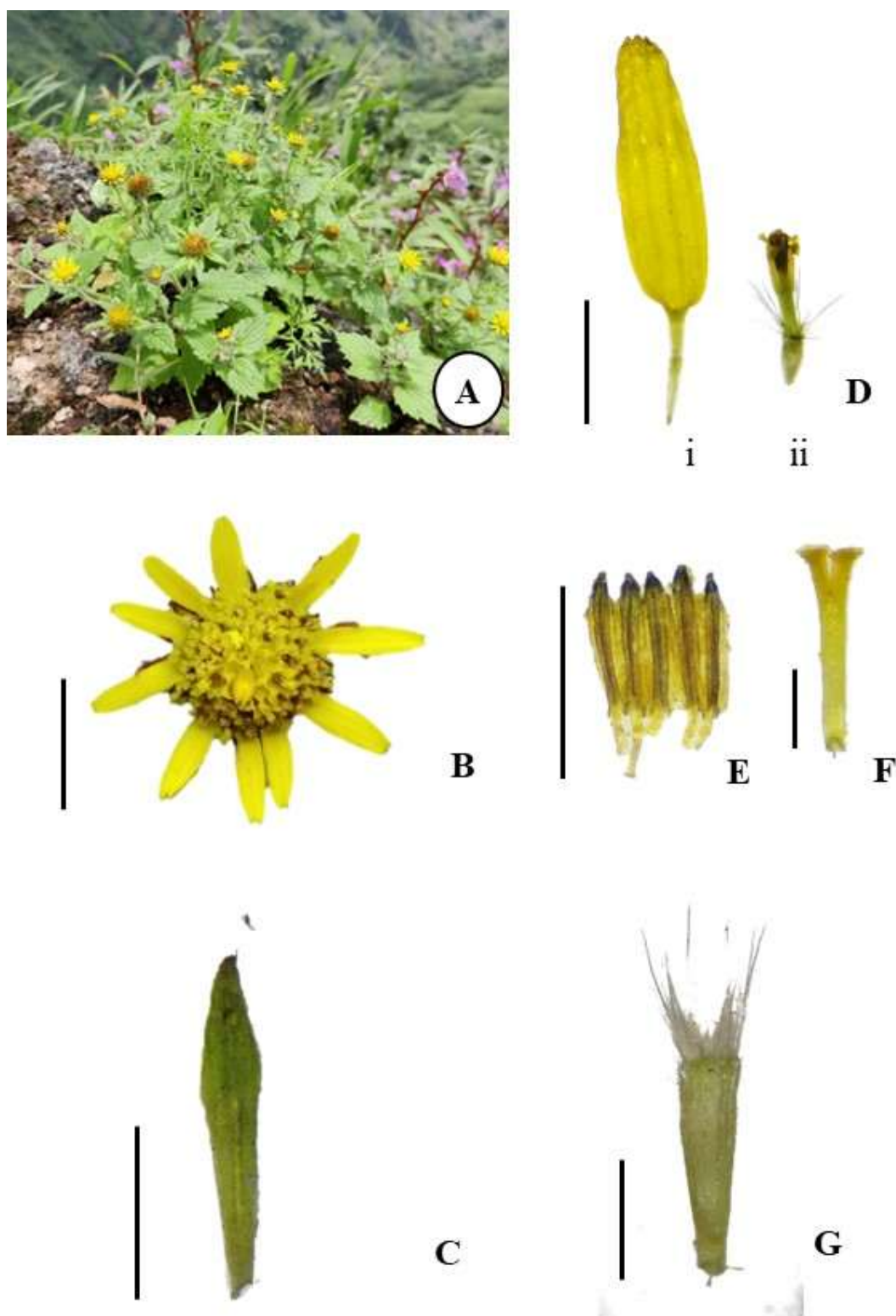


Plate 4.17 *Senecio bombayenesis* N.P. Balakr. **A-** Habit; **B-** Capitulum (bar= 2 cm); **C-** Phyllary (bar= 3 mm); **D-** Floret (bar= 5 mm); **E-** Anthers (bar= 1 mm); **F-** Style (bar= 1 mm); **G-** Cypsela (bar= 2 mm) (i= RF, ii= DF).

Tribe: Gnaphalieae Cass. ex Lecoq & Juill.

Key to the Genera

- 1a. Pappus connate from base forming ring *Gamochaeta*
1b. Pappus free, does not form ring *Helichrysum*

Genus: *Gamochaeta* Wedd., Chlor. Andina 1: 151 (1856).

Key to the Species

- 1a. Capitula in terminal and axillary clusters *G. pensylvanica*
1b. Capitula in short spikes *G. purpurea*

***Gamochaeta pensylvanica* (Willd.) Cabrera** Bol. Soc. Argent. Bot. 9: 375 (1961).
Gnaphalium pensylvanicum Willd., Enum. Hort. Berol. 867 (1809); Hajra *et al.*, Fl. of India
13: 89. (1995). *Gnaphalium peregrinum* Fernald in Rhodora 45: 479. t. 795 (1943).
Gnaphalium purpureum auct. non L.; Hook.f., Fl. Brit. India 3: 289 (1883).

Plate 4.18

Erect or decumbent herbs, 10 - 50 cm high. Stem unbranched or branched, terete, white cottony tomentose. Leaves simple, alternate, spatulate-obovate, 1 - 5 cm, margin entire, obtuse apex, lax villous on upper surface, white woolly tomentose beneath. Capitulescence axillary and terminal clusters or glomerulus, densely white woolly tomentose. Capitula disciform, sessile, 3-5 mm. Involucre biseriate; phyllaries ovate-oblong, acute. Ray florets filiform, female, 2 mm long. Disc florets tubular, 2-3 mm, bisexual. Anther apex obtuse and base tailed. Style apex obtuse in ray floret and truncate in disc florets, 0.5-1 mm. Cypsela brown, fusiform, 3 - 4 mm long. Pappus bristles connate from base, 1-2 mm.

Common Name: Pennsylvania Cudweed.

Vernacular Name: Pardesi Gulephuli.

Specimen: JJS 10 (Waghai).

Coordinates: 20°45'11.76" N, 73°29'58.23" E.

Origin: Central and South America.

Associated Species: *Phyllanthus niruri* L., *Cynodon dactylon* (L.) Pers., *Euphorbia hirta* L., *Desmodium triflorum* (L.) DC., *Alternanthera bettzickiana* (Regel) G.Nicholson, *Dichanthium annulatum* (Forssk.) Stapf.

Abundance: Occasional.

Flw-Fru: January - May.

Habitat: Wastelands.

Distribution: Surat and Navsari.

***Gamochaeta purpurea* (L.) Cabrera** Bol. Soc. Argent. Bot. 9: 377 (1961). *Gnapbalium purpureum* L., Sp. Pl. 854 (1753); Hook.f., Fl. Brit. India 3: 289 (1883); Hajra *et al.*, Fl. of India 13: 92. (1995).

Plate 4.19

Erect or decumbent herbs, 20 - 70 cm high. Stem unbranched or branched, terete, white cottony tomentose. Leaves simple, alternate, spatulate, 1 - 7 cm, margin entire, apex obtuse, pubescent on upper surface, white tomentose on lower surface. Capitulescence spike, tomentose. Involucre multiseriate; phyllaries ovate, 2-3 mm acute, with white woolly tomentum at base. Ray florets filiform, female, ca 1 mm long, pink at mouth. Disc florets tubular, bisexual, ca 2 mm long, 5-toothed. Anther apex obtuse and base tailed, 0.5-1 mm. Style of both ray floret and disc floret truncate, 0.5-1 mm. Cypsela fusiform, ca 0.5 mm, pubescent. Pappus bristles, connate at base.

Common Name: Purple Cudweed

Vernacular Name: Gulephuli

Specimen: JJS 53 (Kilad).

Coordinates: 20°45'10.97" N, 73°29'19.41" E.

Origin: Central and South America.

Associated Species: *Persicaria glabra* (Willd.) M.Gómez, *Rotala* sp., *Brassica nigra* (L.) W.D.J.Koch, *Cyperus rotundus* L., *Typha angustifolia* L.

Abundance: Occasional.

Flw-Fru: December-April.

Habitat: Aquatic areas.

Distribution: Dang and Valsad.

Genus: *Helichrysum* Mill., Gard. Dict. Abr., ed. 4. [462] (1754).

***Helichrysum indicum* (L.) Grierson** Notes Roy. Bot. Gard. Edinburgh 31: 138 (1971). *Gnaphalium polycaulon* Pers. Syn. Pl. 2: 421 (1807); Hajra *et al.*, Fl. of India 13: 91. (1995); Raghavan *et al.* 45. (1981); Bole & Pathak, FS 2: 20. (1988). *Gnaphalium indicum* L. in Sp. Pl.: 852 (1753); Cooke, FBP 2: 30. (1904); Shah 382. (1978).

Plate 4.20

Erect, decumbent or diffuse herb, 5-15 cm in height. Stem unbranched or branched, terete, weak, tomentose. Leaves simple, alternate, spatulate, 2-6 cm long, entire margin, obtuse apex. Capitulescence spike. Capitulum disciform, 0.5-0.7 mm across. Involucre multiseriate, phyllaries obovate, 2.5-3 mm, acute. Ray floret filiform, 1.5-2.5 mm, female, white. Disc floret tubular, 2.5-3 mm, bisexual, white. Anthers apex obtuse and base tailed, 0.5-1 mm. Style truncate, 0.25-0.5 mm. Cypsela columnar, pubescent, 0.5-0.75 mm. Pappus bristles, 0.3-0.5 mm.

Common Name: Indian Strawflower

Vernacular Name: Phulvo.

Specimen: JJS 35 (Raybor).

Coordinates: 20°42'29.46" N, 73°22'52.10" E.

Origin: North Africa.

Associated Species: *Cyperus rotundus* L., *Typha angustifolia* L., *Persicaria glabra* (Willd.) M.Gómez, *Spigelia anthelmia* L., *Alternanthera* sp.

Abundance: Occasional.

Flw-Fru: October to March.

Habitat: Aquatic areas.

Distribution: Navsari and Valsad.

Taxonomic Note: Plant is highly polymorphic in habit. This plant has been also treated as *Gnaphalium polycaulon* by Hajra *et al.* (1995); Raghavan *et al.* (1981); Bole & Pathak (1988) which is more appropriate because in *Helichrysum* the sternome in phyllaries is divided which is not in the case of above plant.

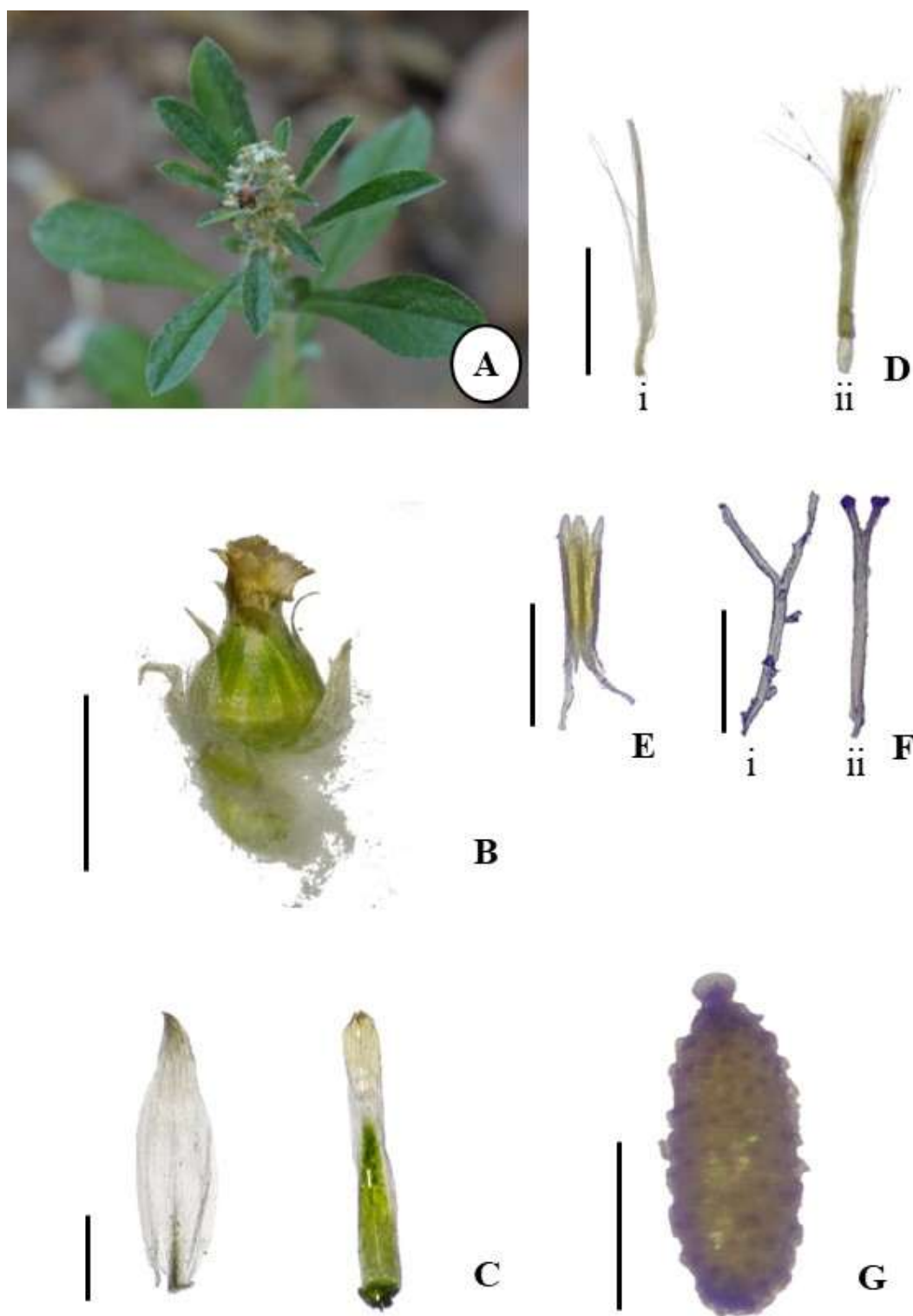


Plate 4.18 *Gamochaeta pensylvanica* (Willd.) Cabrera **A**-Flowering twig ; **B**- Capitulum (bar= 0.2 cm); **C**- Phyllary (bar= 1 mm); **D**- Floret (bar= 1 mm); **E**- Anthers (bar= 0.3 mm); **F**- Style (bar= 0.3 mm); **G**- Cypsela (bar= 0.3 mm) (i= RF, ii= DF).

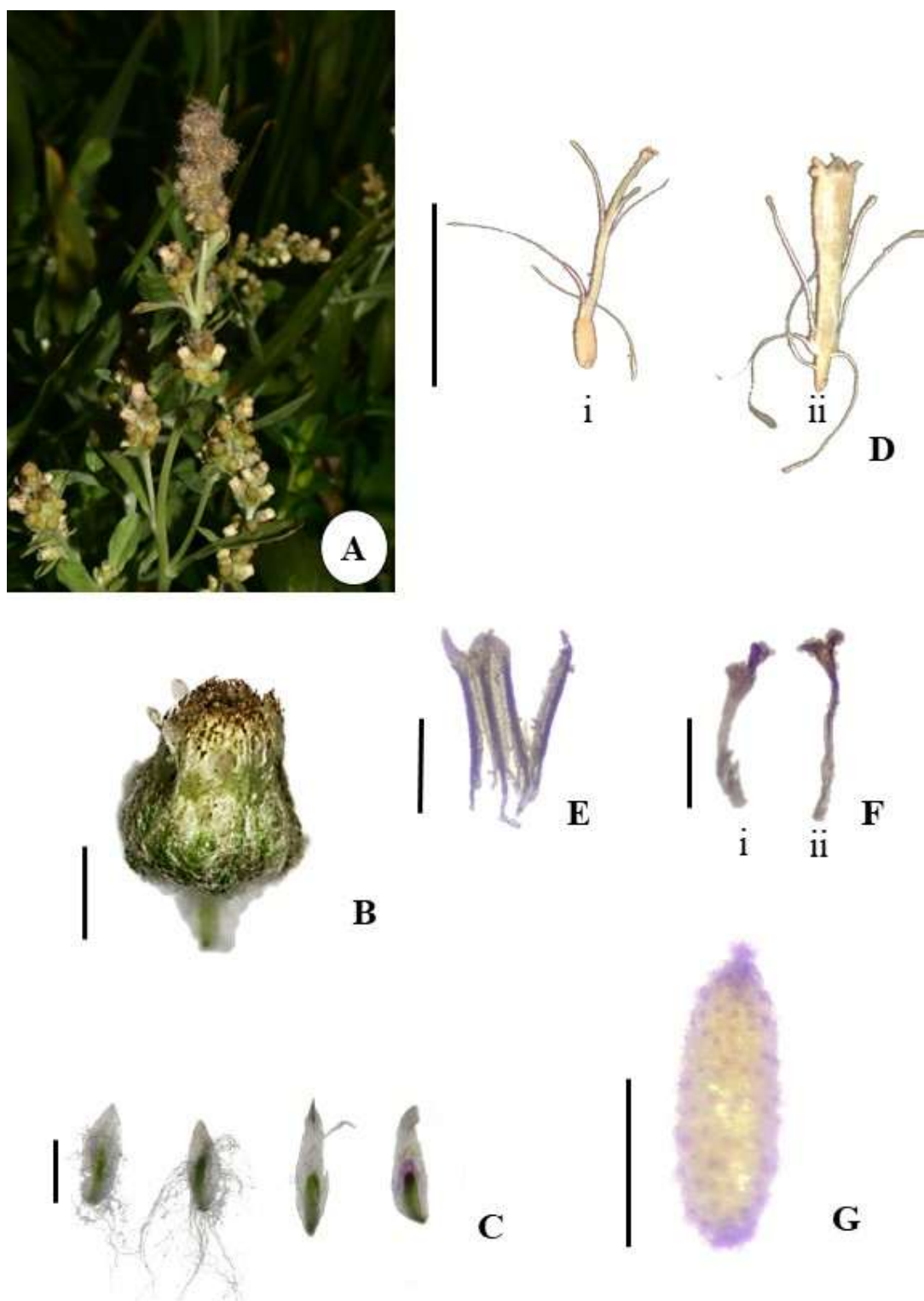


Plate 4.19 *Gamochaeta purpurea* (L.) Cabrera **A**-Flowering twig; **B**- Capitulum (bar= 0.2 cm); **C**- Phyllary (bar= 1 mm); **D**- Floret (bar= 2 mm); **E**- Anthers (bar= 0.3 mm); **F**- Style (bar= 0.3 mm); **G**- Cypsela (bar= 0.3 mm) (i= RF, ii= DF).

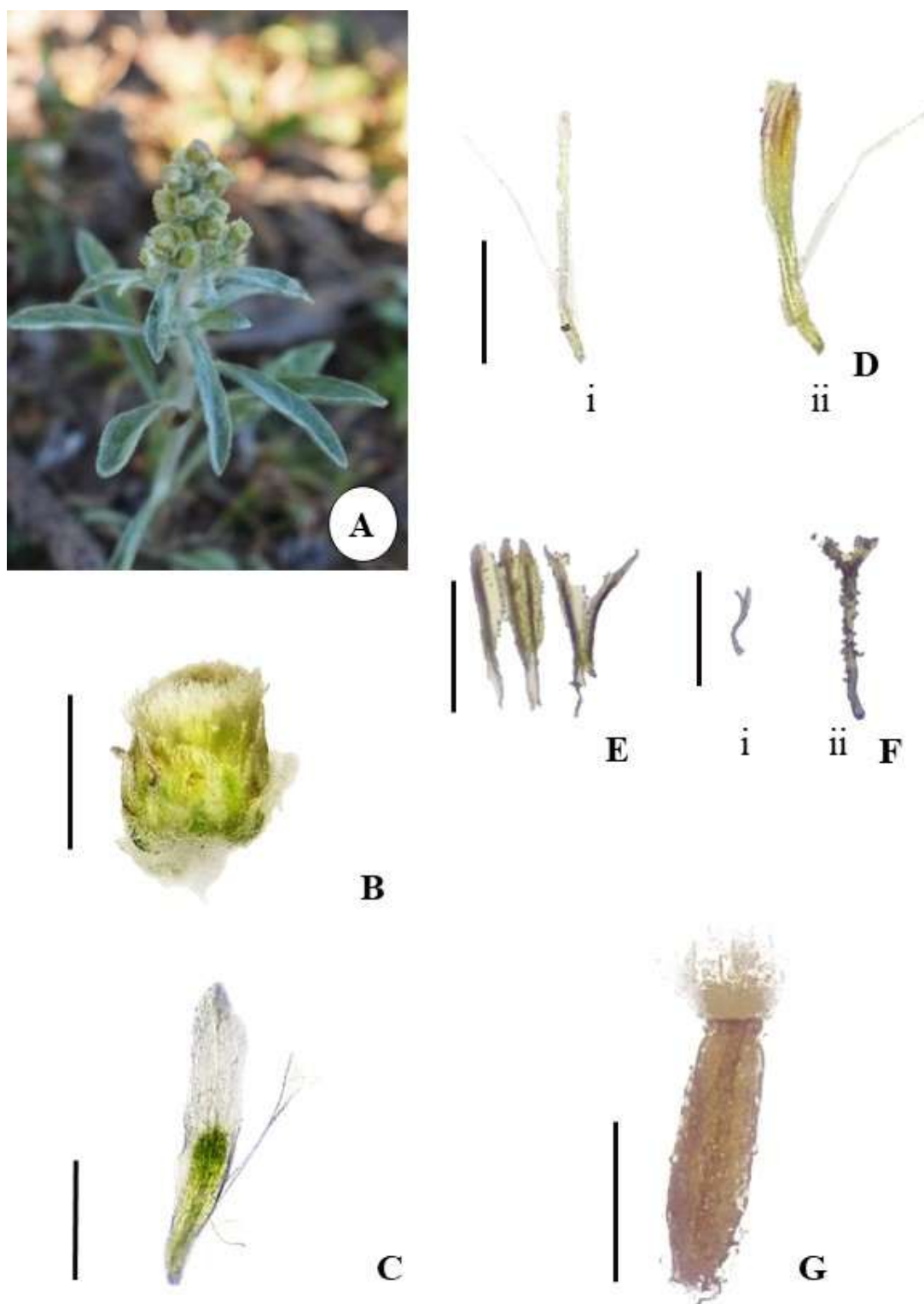


Plate 4.20 *Helichrysum indicum* (L.) Grierson **A**-Flowering twig; **B**- Capitulum (bar= 0.2 cm); **C**- Phyllary (bar= 1 mm); **D**- Floret (bar= 1 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 0.3 mm) (i= RF, ii= DF).

Tribe: Astereae Cass.

Key to the Genera

- 1a. Leaves lyrate (2)
- 1b. Leaves not lyrate (3)
- 2a. Leaves arrange in rosette, head discoid, florets yellow *Grangea*
- 2b. Leaves alternate, head disciform, florets purple *Cyathocline*
- 3a. Corolla absent in ray floret *Thespis*
- 3b. Corolla present in ray floret (4)
- 4a. Capitulescence panicle, head sub-terete *Erigeron*
- 4b. Capitulescence corymbose, head campanulate to spherical *Eschenbachia*

Genus: *Cyathocline* Cass., Ann. Sci. Nat. (Paris) 17: 419 (1829).

***Cyathocline purpurea* (Buch.-Ham. ex D.Don) Kuntze** in Revis. Gen. Pl. 1: 333 (1891); Hajra *et al.*, Fl. of India 12: 111. (1995); Shah 378. (1978); Raghavan *et al.* 44. (1981); Bole & Pathak, FS 2: 13. (1988). *Tanacetum purpureum* Buch.-Ham. ex D.Don in Prodr. Fl. Nepal.: 181 (1825). *Cyathocline stricta* DC. in Prodr. 5: 374 (1836). *Cyathocline lyrata* Cass. in Ann. Sci. Nat. (Paris) 17: 420 (1829); Hook.f., Fl. Brit. India 3: 289 (1883); Cooke, FBP 2: 15. (1904). *Blumea stricta* (DC.) Anderb. & Bengtson Willdenowia 52: 377 (2022).

Plate 4.21

Erect or diffuse herbs, aromatic, 15 - 60 cm high. Stems branched from base, glandular hairs present. Leaves simple, alternate, pinnatisect - lyrate, 2.5 - 15 cm long, margin serrate, acute, decurrent, glabrescent. Capitulescence corymb. Capitula disciform, 5 - 8 mm across. Involucre uniseriate; phyllary ovate-lanceolate, 3-5 mm, acute. Ray floret filiform, female, 1.5 mm, purple at mouth. Disc florets tubular, bisexual, ca 2 mm long, purple. Anther apex obtuse and base subentire, 1-2 mm. Style apex obtuse of both florets; undivided in disc floret, 0.5-1 mm. Cypsela produced by only ray floret; oblong, glabrous. Pappus absent.

Common Name: Purple bane

Vernacular Name: Okharad.

Specimen: JJS 115 (Bheskatri).

Coordinates: 20°56'25.44" N, 73°31'10.91" E.

Origin: India (Native).

Associated Species: *Alternanthera bettzickiana* (Regel) G.Nicholson, *Acmella ciliata* (Kunth) Cass., *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult., *Cyperus rotundus* L., *Sphaeranthus indicus* L.

Abundance: Common.

Flw-Fru: September - April.

Habitat: Aquatic areas.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: *C. purpurea* has been merged in *Blumea* as *Blumea stricta* (DC.) Anderb. & Bengtson on the basis of molecular phylogeny but it cannot be delimited on the basis of morphology as it not has tailed anthers. Hence, in current work this plant has been included in Astereae tribe.

Genus: *Erigeron* L., Sp. Pl. [Linnaeus] 2: 863 (1753).

***Erigeron bonariensis* L. Sp. Pl.: 863 (1753); Shah 380. (1978); Raghavan *et al.* 44. (1981). *Conyza bonariensis* (L.) Cronquist in Bull. Torrey Bot. Club 70: 632 (1943); Hajra *et al.*, Fl. of India 12: 104. (1995).**

Plate 4.22

Erect herbs, 0.8 - 1.5 m tall. Stem branched, polygonal, hirsute, glabrescent - pubescent. Leaves simple, alternate, attenuate, linear-lanceolate, 2 - 8 cm, serrate-incised margin, acute apex. Capitulescence panicle. Capitula disciform, 0.3 - 0.6 cm across. Involucre multiseriate; phyllaries linear, acuminate, 0.4 cm, coarsely hairy. Ray floret filiform, female, pale yellow, 0.3 - 0.4 cm. Disc floret tubular, bisexual, pale yellow, 3-4 mm. Anther apex obtuse and base subentire, 0.5-1 mm. Style apex of ray floret obtuse and of disc floret subulate, 0.3-0.6 mm. Cypsela obovoid, ca 1 mm long, subglabrous. Pappus bristles 3-4 mm.

Common Name: Hairy Fleabane

Vernacular Name: Nani Bat-dawana.

Specimen: JJS 77 (Navsari).

Coordinates: 20°56'47.85" N, 72°56'35.53" E.

Origin: South America.

Associated Species: *Euphorbia hirta* L., *Tridax procumbens* L., *Cynodon dactylon* (L.) Pers., *Dichanthium annulatum* (Forssk.) Stapf., *Sporobolus* sp., *Commelina benghalensis* L.

Abundance: Common.

Flw-Fru: Throughout the year.

Habitat: Wasteland, roadside, grasslands and cultivated areas.

Distribution: Surat, Tapi, Navsari, Dang, Valsad.

Genus: *Eschenbachia* Moench., Methodus (Moench) 573 (1794).

***Eschenbachia stricta* (Willd.) Raizada** in Indian Forester 85: 679 (1959). *Conyza stricta* Willd. in Sp. Pl., ed. 4. 3: 1922 (1803); Hook.f., Fl. Brit. India 3: 289 (1883); Hajra *et al.*, Fl. of India 12: 108. (1995); Cooke, FBP 2: 17. (1904); Shah 377. (1978); Raghavan *et al.* 44. (1981).

Plate 4.23

Erect herbs, 40 - 100 cm high. Stem branched, terete, hispid. Leaves simple, alternate, auricled, linear-spathulate, 2 - 5 cm, entire or coarsely sinuate, acute-obtuse, pubescent. Capitulescence corymb. Capitula disciform, 0.5 - 0.8 cm across. Involucre biseriate; phyllaries linear-lanceolate to ovate-lanceolate, 0.1 - 0.2 cm long, acute. Ray floret filiform, female, yellow. Disc floret tubular, bisexual, yellow, 2-3 mm. Anther apex acute and base subentire, 1.5-3.5 mm. Style apex of ray floret obtuse and of disc floret subulate, 0.5-1 mm. Cypsela obovoid, pubescent, 0.8-1.5 mm. Pappus capillary bristles, 1-2 mm.

Common Name: Erect Horseweed

Vernacular Name: Bat-dawana.

Specimen: JJS 4 (Wilson Hill).

Coordinates: 20°30'52.83" N, 73°21'21.01" E.

Origin: Indian Subcontinent (Native).

Associated Species: *Alternanthera bettzickiana* (Regel) G.Nicholson, *Blumea malcolmii* Hook.f., *Sporobolus* sp., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Digitaria adscendens* (Kunth) Henrard.

Abundance: Occasional.

Flw-Fru: November-February.

Habitat: Hilly areas and aquatic areas.

Distribution: Tapi and Valsad

Genus: *Grangea* Adans., Fam. Pl. (Adanson) 2: 121 (1763).

***Grangea maderaspatana* (L.) Poir.** J.B.A.M.de Lamarck, Encycl., Suppl. 2: 825 (1812); Fl. Brit. India 3: 247 (1883); Hajra *et al.*, Fl. of India 12: 127. (1995); Cooke, FBP 2: 16. (1904); Shah 384. (1978); Raghavan *et al.* 45. (1981); Bole & Pathak, FS 2: 20. (1988). *Artemisia maderaspatana* L. in Sp. Pl.: 849 (1753).

Plate 4.24

Diffuse herbs, 10 - 30 cm. Stems branched, terete, pubescent or villous. Leaves simple, alternate, decurrent, decompose, 2 - 6 cm long, margins sinuate, apex obtuse, pubescent. Capitulescence solitary. Capitula discoid, 6 - 9 mm across. Involucre biseriate; phyllaries ovate - obovate, obtuse, densely pubescent, 2-4 mm. Florets tubular, bisexual, yellow, 3-5 mm. Anther apex appendiculate and base subentire, 0.5-1 mm. Style apex subulate, 0.6-1 mm. Cypsela obovate, ca 2 mm long, scabrous. Pappus fimbriate cup or collar.

Common Name: Madras Carpet

Vernacular Name: Nani Gorakhmundi, Zinki Mundi

Specimen: JJS 34 (Killa Pardi).

Coordinates: 20°30'73.16" N, 72°56'08.28" E.

Origin: Indian subcontinent and Africa.

Associated Species: *Cynodon dactylon* (L.) Pers., *Eclipta prostrata* (L.) L., *Phyllanthus niruri* L., *Cyperus rotundus* L., *Solanum surattense* Burm.f.

Abundance: Common.

Flw-Fru: September-April.

Habitat: Aquatic areas.

Distribution: Tapi, Navsari, Dang and Valsad.

Genus: *Thespis* DC., Arch. Bot. (Paris) 2: 517 (1833).

***Thespis thakeri* J.J.Sharma & Nagar in Rheedeia 33: 193 (2023) sp.nov.**

Plate 4.25

Shrub, 1.2–2 m tall. Stem branched, terete, pubescent. Leaves simple, alternate, obovate–lanceolate or elliptic–lanceolate, 4.3–19.8 cm, serrate margin, acute apex, pubescent. Capitulescence a terminal compound corymb, 15–35 cm long. Capitula disciform, 2.1–2.75 mm across. Involucre uniseriate; phyllaries lanceolate-ovate, 2.6–3.8 mm long, acuminate, pubescent. Ray florets filiform, female, 3–3.9 mm, corolla completely absent. Disc florets tubular, bisexual, 3.4–4 mm, infertile, pink. Anthers apex apiculate and base entire, 1–1.25 mm. Style apex of ray floret obtuse and disc floret subulate. Cypsela obovate, 0.75–1 mm long, glabrous. Pappus bristles.

Common Name: - Thaker's Thespis

Vernacular Name: Gulabi Thespis or Khoti Rasna.

Specimen: JJS 81 (Saputara).

Coordinates: N 20°34'52.68", E 73°44'49.91"

Origin: Gujarat, India (Native)

Associated Species: *Argemone mexicana* L., *Trichodesma zeylanicum* (Burm.f.) R.Br., *Blumea oxyodonta* DC., *Sonchus oleraceus* L., *Crassocephalum crepidioides* (Benth.) S.Moore.

Abundance: Rare.

Flw-Fru: December-February.

Habitat: Hilly areas

Distribution: Dang (Saputara)

Taxonomic Note: In ray florets, corolla is absent.

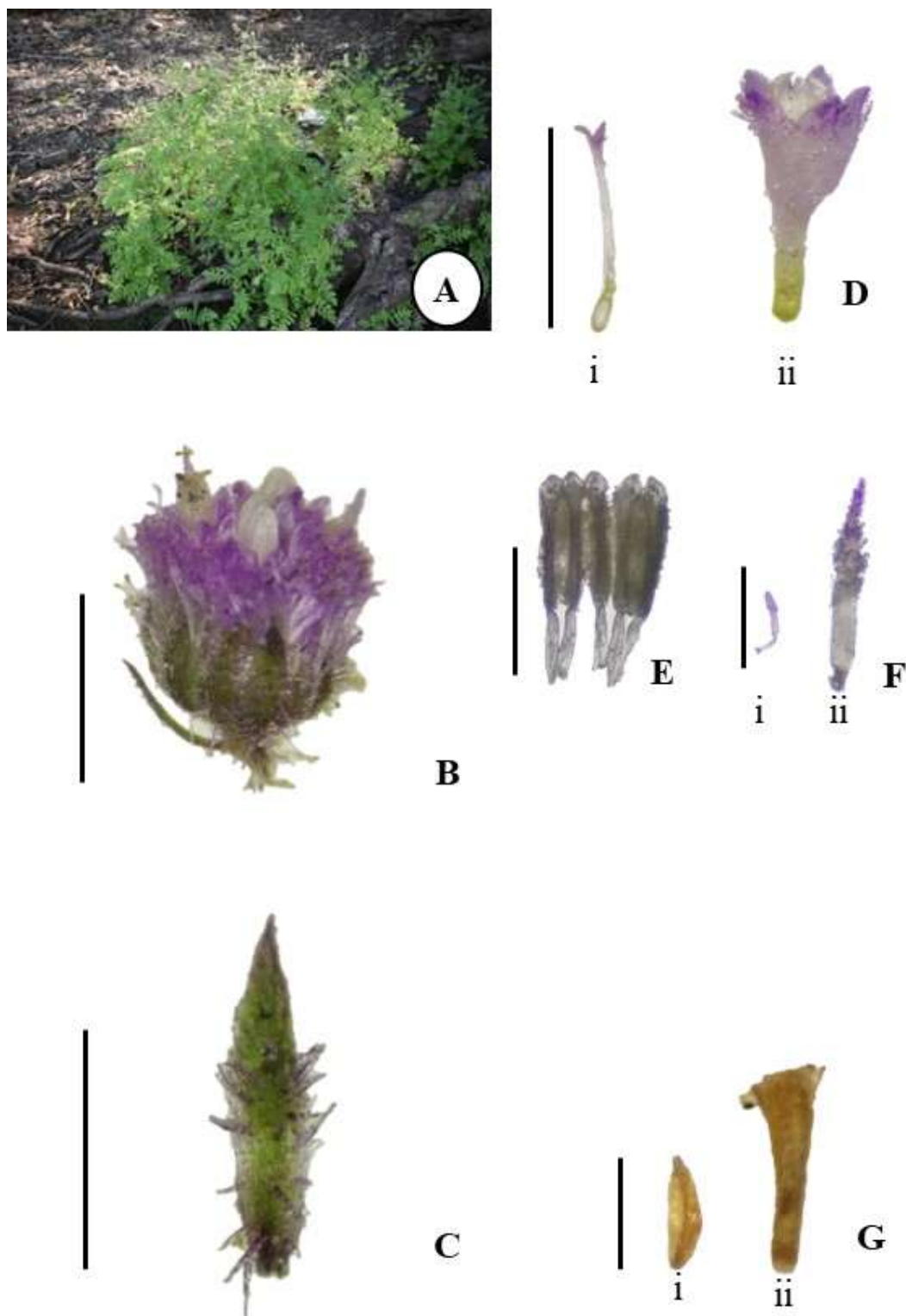


Plate 4.21 *Cytahocline purpurea* (Buch.-Ham. Ex D.Don) Kuntze **A**-Flowering twig ; **B**-Capitulum (bar= 0.3 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 2 mm); **E**- Anthers (bar= 0.5 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 1 mm) (i= RF, ii= DF).



Plate 4.22 *Erigeron bonariensis* L. **A**-Flowering twig ; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 3 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 1 mm) (i= RF, ii= DF).

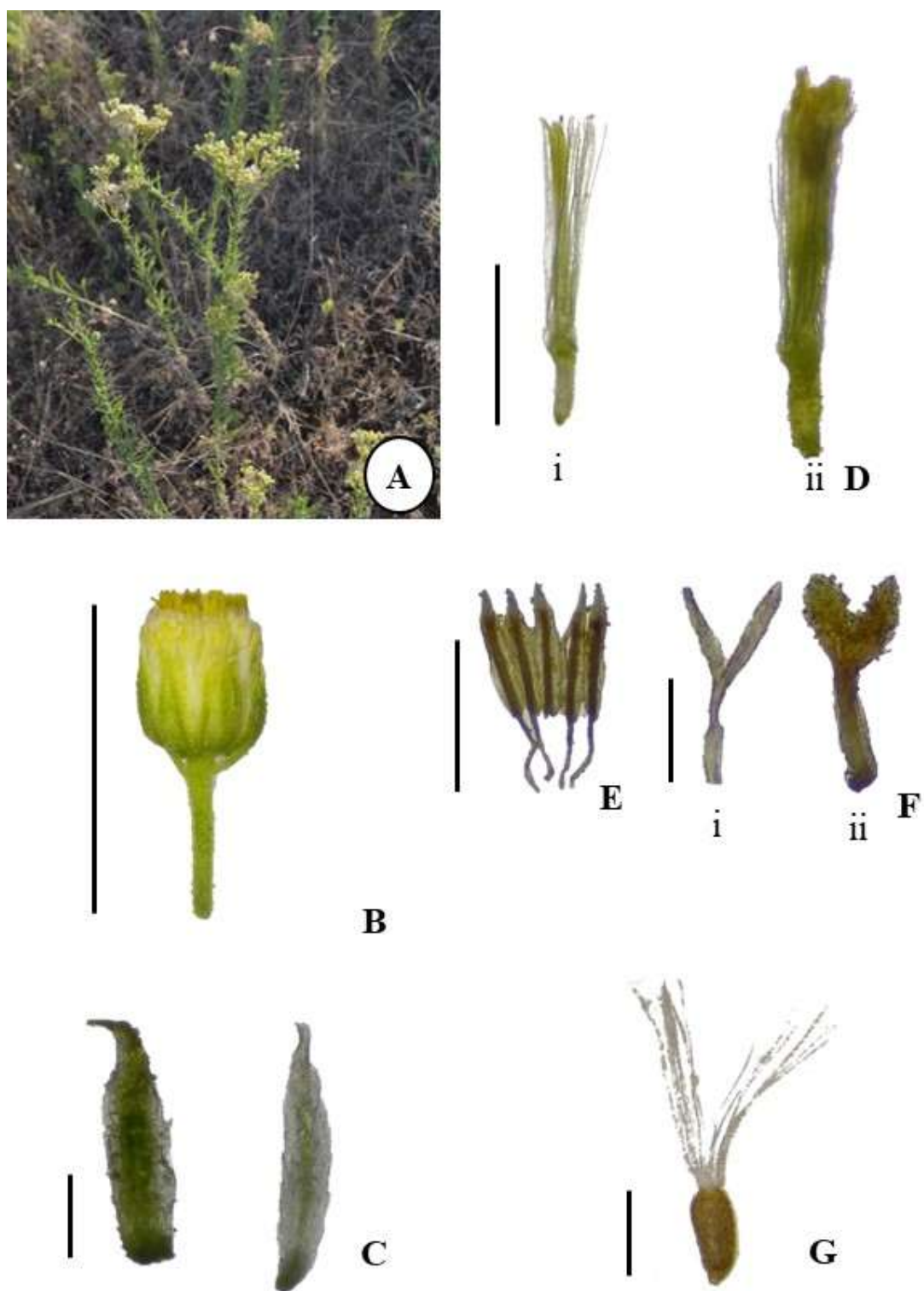


Plate 4.23 *Eschenbachia stricta* (Willd.) Raizada A-Flowering twig ; B- Capitulum (bar= 1 cm); C- Phyllary (bar= 1 mm); D- Floret (bar= 1 mm); E- Anthers (bar= 1 mm); F- Style (bar= 0.5 mm); G- Cypsela (bar= 1 mm) (i= RF, ii= DF).

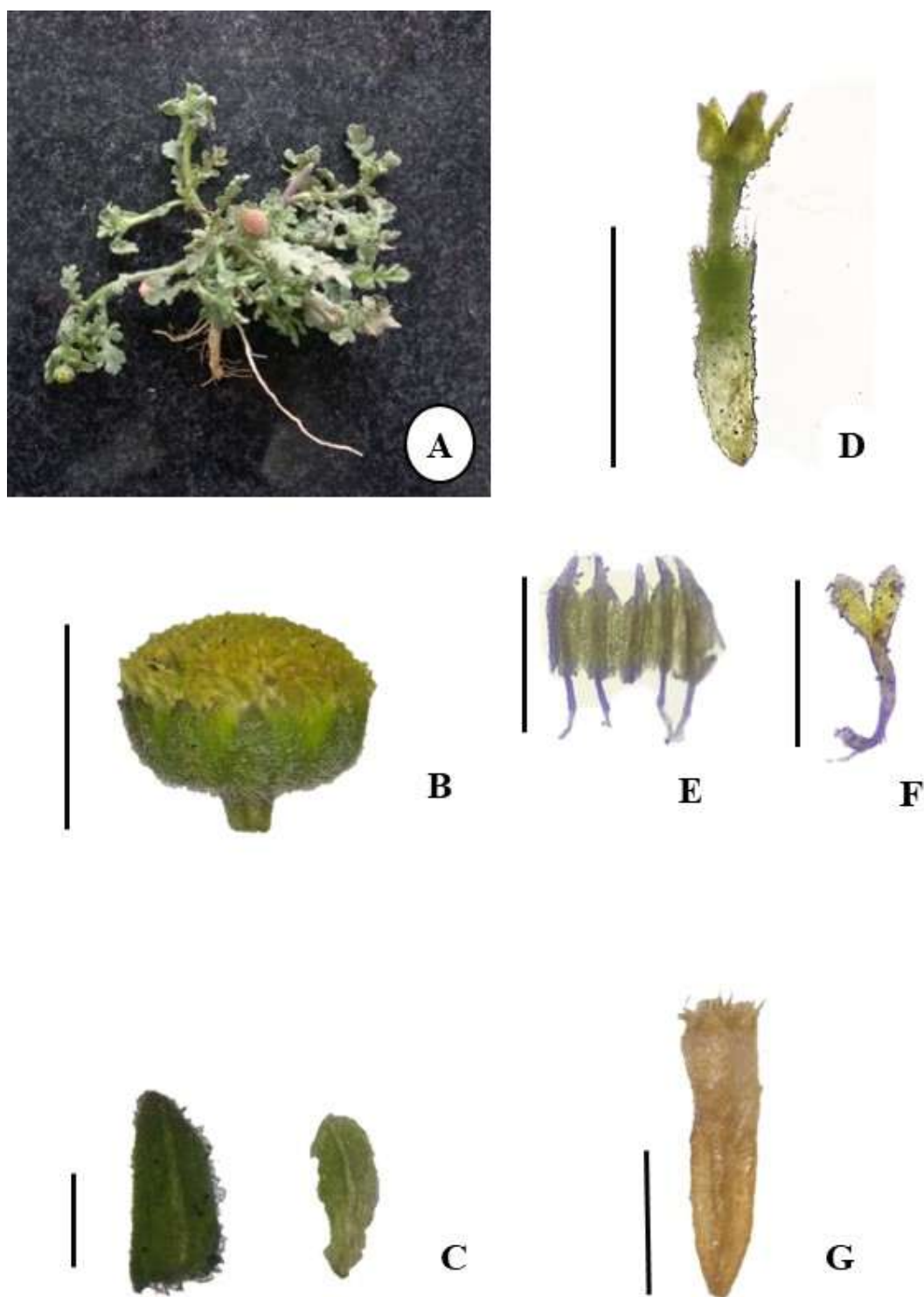


Plate 4.24 *Grangea maderaspatana* (L.) Poir. **A**-Flowering twig ; **B**- Capitulum (bar= 0.5 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 2 mm); **E**- Anthers (bar= 0.5 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 1 mm).

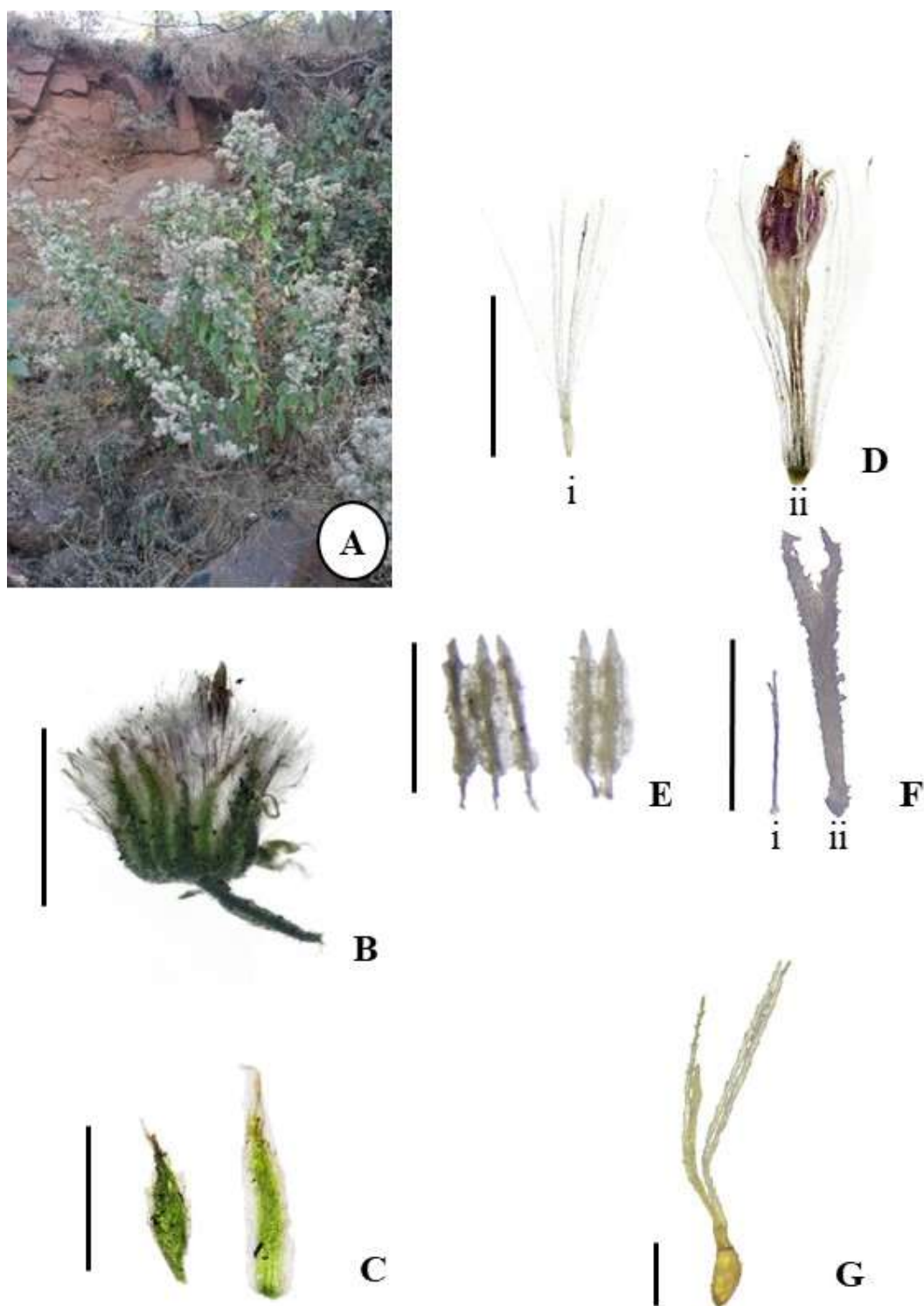


Plate 4.25 *Thespis thakeri* J.J.Sharma & Nagar **A**-Flowering twig ; **B**- Capitulum (bar= 0.4 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 2 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 1 mm) (i= RF, ii= DF).

Tribe: Inuleae Cass.

Key to the Genera

- 1a. Capitula homogamous *Caesulia*
- 1b. Capitula heterogamous (2)
- 2a. Head compound *Sphaeranthus*
- 2b. Head simple (3)
- 3a. Head radiate (4)
- 3b. Head disciform (5)
- 4a. Ray floret bilabiate *Vicoa*
- 4b. Ray florets ligulate *Pullicaria*
- 5a. Plant shrub *Pluchea*
- 5b. Plant herb (6)
- 6a. Leaves viscous and anthers tailed *Pseudoconyza*
- 6b. Leaves not viscous and anthers not tailed *Blumea*

Genus: *Blumea* DC., Arch. Bot. (Paris) 2: 514 (1833).

Key to the Species

- 1a. Prostrate diffuse herb and head campanulate *B. oxyodonta*
- 1b. Erect herb and head not campanulate (2)
- 2a. Florets pink to purple (3)
- 2b. Florets yellow (4)
- 3a. Leaf cuneate and lacerate *B. axillaris*
- 3b. Leaf not cuneate and distantly serrate *B. bovei*
- 4a. Mature capitulescence solitary or clustered (5)
- 4b. Mature capitulescence in panicle (6)
- 5a. Ray florets few, upper part of disc floret purple *B. belangeriana*
- 5b. Ray florets many, whole disc floret yellow *B. eriantha*
- 6a. Capitula small (7)
- 6b. Capitula large (8)
- 7a. Plant glabrous *B. virens*
- 7b. Plant hairy *B. membranacea*
- 8a. Leaves laciniate *B. sinuata*
- 8b. Leaves not laciniate *B. malcolmii*

***Blumea axillaris* (Lam.) DC.** in Prodr. 5: 434. (1836); *Conyza axillaris* Lam. in Encycl. 2: 84 (1786); *Blumea mollis* (D. Don) Merr. in Philip. J. Sci. (Bot.) 5: 395. (1910); Hajra *et al.*, Fl. of India 13: 135. (1995); Shah 374. (1978); Bole & Pathak, FS 2: 9. (1988); *Erigeron mollis* D. Don in Prodr. Fl. Nepal.: 172 (1825); *B. wightiana* DC. in Wight, Contrib. Bot. Ind. 14. (1834); Cooke, FBP 2: 19. (1904); *B. neilgherrensis* Hook.f., Fl. Brit. India 3: 261. (1883); *Blumea solidaginoides* (Poir.) DC. in Prodr. 5: 443. (1836); Raghavan *et al.* 44. (1981).

Plate 4.26

Erect herbs, 40 - 100 cm high. Stem branched, terete, softly pilose with hairs and glands. Leaves simple, alternate, ovate-elliptic, 3-12 cm, margin serrate, acute, densely silky-villous with hairs and glands. Capitulescence clustered or glomerulus. Capitula disciform, 3-5 mm in diameter. Involucre multiseriate; phyllaries distinctly purplish tinged, linear, attenuate apex, 2-5 mm long, densely soft-villous on dorsal surface with hairs and glands. Ray floret filiform, female, pink, 4-6 mm. Disc floret tubular, bisexual, purple or lilac 5-6 mm. Anther apex obtuse and base tailed, 1.5-2.5 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela oblong, subangular, shining, pubescent, 1 mm. Pappus bristles, 1.5-2 mm.

Common Name: Soft Blumea.

Vernacular Name: Bhutaco, Chanchadmari.

Specimen: JJS 109 (Narmada).

Coordinates: 20°65'55.35" N, 73°31'00.78" E.

Origin: Asia and Africa.

Associated Species: *Sida cordata* (Burm.f.) Borss.Waalk., *Euphorbia hirta* L., *Parthenium hysterophorus* L., *Chromolaena odorata* (L.) R.M.King & H.Rob.

Abundance: Common.

Flw-Fru: December-May.

Habitat: Wasteland, aquatic areas and grasslands.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: Capitulescence is glomerulus and florets are pink to white.

***Blumea belangeriana* DC.**, Prodr. 5: 555. (1836); Hook.f., Fl. Brit. India 3: 266. (1883); Hajra *et al.*, Fl. of India 13: 119. (1995); Cooke, FBP 2: 22. (1904); Shah 371. (1978); Raghavan *et al.* 43. (1981).

Plate 4.27

Erect herbs, 30 - 90 cm high. Stem branched, terete, pilose with hairs and glands. Leaves simple, alternate, obovate-spathulate, 4-15 cm, margin serrate, acute-apiculate, densely silky-villous with hairs and glands. Capitulescence clustered or solitary. Capitula disciform, 5-8 mm

in diameter, subsessile-sessile. Involucre multiseriate; phyllaries purplish tinged, linear, attenuate apex, 2-5 mm long, reflexed at maturity, ciliate on the margins. Ray floret filiform, female, yellow tube with red-purple tinge on lobes, 5-7 mm. Disc floret tubular, bisexual, yellow tube with red-purple tinge on lobes, 7-9 mm. Anther apex obtuse and base tailed, 3-4 mm. Style apex of both florets obtuse, 1.5-2 mm. Cypsela oblong, terete, pubescent, 1.5-2 mm. Pappus bristles, 2-2.5 mm.

Common Name: River Blumea.

Vernacular Name: Motu Kapuriyo.

Specimen: JJS 70 (Bheskatri).

Coordinates: 20°65'09.81" N, 73°31'47.39" E.

Origin: India (Native).

Associated Species: *Alternanthera sessilis* (L.) DC., *Haplanthodes verticillata* (Roxb.) R.B.Majumdar, *Eranthemum roseum* (Vahl) R.Br. ex Roem. & Schult.

Abundance: Common.

Flw-Fru: November- April.

Habitat: Hilly areas and roadside.

Distribution: Dang and Valsad

Taxonomic Note: This plant can be confused with *B. eriantha* but can be differentiated by unicellular hairs on corolla which is multicellular in *B. eriantha*.

***Blumea bovei* (DC.)** Vatke in *Linnaea* 39: 485 (1875); Hajra *et al.*, *Fl. of India* 13: 120. (1995); Raghavan *et al.* 43. (1981); Bole & Pathak, *FS* 2: 10. (1988); *Conyza bovei* DC. in *Ann. Sci. Nat., Bot., sér. 2*, 2: 261 (1834); *Doellia bovei* (DC.) Anderb. in *Willdenowia* 25: 21 (1995); *Erigeron bovei* (DC.) Boiss. in *Fl. Orient.* 3: 168 (1875); *Placus bovei* (DC.) Kuntze in *Revis. Gen. Pl.* 1: 357 (1891); *Blumea abyssinica* Sch.Bip. ex A.Rich. in *Tent. Fl. Abyss.* 1: 392 (1848)

Plate 4.28

Erect herbs, aromatic, 15-80 cm high. Stem branched, terete, pubescent. Leaves simple, alternate, auricled, spathulate or obovate-oblong, 4-7 cm, margin serrate, obtuse, pubescent. Capitulescence corymb or panicle. Capitula disciform, 3-5 mm in diameter. Involucre multiseriate; phyllaries, linear, acute apex, 2-9 mm long, reflexed at maturity, pubescent. Ray floret filiform, female, pink, 5-6 mm. Disc floret tubular, bisexual, pink, lobes pubescent, 6-7 mm. Anthers apex obtuse and base sagittate, 2.5-3.5 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela fusiform, ribbed, glabrous, 1-1.5 mm. Pappus bristles, 1.5-2 mm.

Common Name: Wingless Laggera.

Vernacular Name: Bhint Mulo.

Specimen: JJS 14 (Dundi).

Coordinates: 21°07'16.81" N, 72°48'29.27" E.

Origin: Indian subcontinent and Africa.

Associated Species: *Alternanthera sessilis* (L.) DC., *Echinops echinatus*, *Celosia argentea* L., *Launaea procumbens* (Roxb.) Ramayya & Rajagopal, *Merremia emarginata* (Burm.f.) Hallier f.

Abundance: Occasional.

Flw-Fru: December-May.

Habitat: Aquatic areas, roadsides and agricultural fields.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: This plant resembles to *Blumea obliqua* but this plant cannot be placed in *Blumea* since the leaf base is not cuneate but auricled and florets are yellow in case of *B. obliqua*. Still more detail work is required for its identification and systematic position.

***Blumea eriantha* DC.** in Wight, Contrib. Bot. Ind. 15. (1834); Hook.f., Fl. Brit. India 3: 266. (1883); Hajra *et al.*, Fl. of India 13: 122. (1995); Cooke, FBP 2: 22. (1904); Shah 372. (1978); Raghavan *et al.* 43. (1981).

Plate 4.29

Erect herbs, 10 - 80 cm high. Stem branched, terete, pale green with reddish tinge, tomentose with hairs and stalked glands. Leaves simple, alternate, ovate-obovate, 4-7 cm, margin serrate, obtuse, villous- scabrid. Capitulescence clustered. Capitula disciform, 4-6 mm in diameter. Involucre multiseriate; phyllaries purplish tinged, linear, acute apex, 2-5 mm long, reflexed at maturity, ciliate on the margins, pubescent. Ray floret filiform, female, yellow, hairs on tube and lobes, 5-7 mm. Disc floret tubular, bisexual, yellow, hairs on tube and lobes, 5.5-6 mm. Anther apex obtuse and base tailed 3-4 mm. Style apex of both florets obtuse, 1-1.5 mm. Cypsela oblong, angled, pubescent, 1-2 mm. Pappus bristles, 2-3 mm.

Common Name: Wool-Flower *Blumea*

Vernacular Name: Kapurio, Kalhar.

Specimen: JJS 51 (Parnera Hill).

Coordinates: 20°32'48.39" N, 72°56'51.025" E.

Origin: India (Native).

Associated Species: *Sida acuta* Burm.f., *Desmodium triflorum* (L.) DC., *Hyptis suaveolens* (L.) Poit.

Abundance: Occasional.

Flw-Fru: November- April.

Habitat: Hilly areas.

Distribution: Dang and Valsad

***Blumea malcolmii* (C.B. Clarke) Hook.f.**, Fl. Brit. India 3: 266. (1883); Hajra *et al.*, Fl. of India 13: 132. (1995); Cooke, FBP 2: 22. (1904); Shah 373. (1978); Raghavan *et al.* 44. (1981); Bole & Pathak, FS 2: 11. (1988); *Pluchea malcolmii* C.B. Clarke, Compo Ind. 95. (1876).

Plate 4.30

Erect herbs, aromatic, 30 - 100 cm high. Stem branched, terete, densely hairy. Leaves simple, alternate, elliptic-obovate or lanceolate, 4-10 cm, margin serrate, obtuse, densely tomentose. Capitulescence clustered to panicle. Capitula disciform, 5-7 mm in diameter. Involucre multiseriate; phyllaries, linear, acute apex, 2-9 mm long, reflexed at maturity,

pubescent. Ray floret filiform, female, yellow, hairs on tube and lobes. Disc floret tubular, bisexual, yellow, hairs on tube and lobes. Anther apex obtuse and base tailed. Style apex of both florets obtuse. Cypsela obovoid, terete, pubescent. Pappus bristles.

Common Name: Woolly Blumea

Vernacular Name: Bachari

Specimen: JJS 40 (Bajipura), 41 (Don).

Coordinates: 21°05'52.44" N, 73°18'34.14" E; 20°43'53.08" N, 73°51'34.56" E.

Origin: India (Native).

Associated Species: *Alysicarpus vaginalis* (L.) DC., *Digitaria ciliaris* (Retz.) Koeler, *Tridax procumbens* L., *Themeda triandra* Forssk., *Cynodon dactylon* (L.) Pers., *Chloris barbata* Sw., *Blumea oxyodonta* DC.

Abundance: Common.

Flw-Fru: November-May.

Habitat: Aquatic areas, roadsides and agricultural fields.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: This plant has been misidentified as *B. lacera* in many old literatures as *B. malcolmi* has woolly habit but the density of hairs can vary on the basis of habitat. The distinguishing characters between the two is the presence of hair on corolla tube. In *B. lacera* the unicellular hairs are present only on corolla lobe while in *B. malcolmi* the multicellular hairs are present on whole corolla tube. In current study, this was found that most commonly occur species is *B. malcolmi* not *B. lacera*.

***Blumea membranacea* DC.**, Prodr. 5: 440. (1836); Hook.f., Fl. Brit. India 3: 265. (1883); Hajra *et al.*, Fl. of India 13: 134. (1995); Cooke, FBP 2: 21. (1904); Shah 374. (1978); Raghavan *et al.* 44. (1981); Bole & Pathak, FS 2: 12. (1988).

Plate 4.31

Erect herbs, 50 - 150 cm high. Stem branched, polyangular, pubescent. Leaves simple, alternate, ovate-lanceolate or lyrate, 7-18 cm, margin serrate, acute, pubescent. Capitulescence

panicle. Capitula disciform, 5-7 mm in diameter. Involucre multiseriate; phyllaries, linear, acute apex, 2-9 mm long, reflexed at maturity, pubescent. Ray floret filiform, female, yellow, glabrous, 5-7 mm. Disc floret tubular, bisexual, yellow, hairs on lobes, 6-7 mm. Anther apex obtuse and base tailed, 2.5-3.5 mm. Style apex of both florets obtuse, 1-2 mm. Cypsela oblong, ribbed, pubescent, 1-2 mm. Pappus bristles, 2.5-3.5 mm.

Common Name: Panicked Camphorweed.

Vernacular Name: Patli Bachari.

Specimen: JJS 56 (Khadi).

Coordinates: 20°1'14.61" N, 72°56'01.75" E.

Origin: India (Native).

Associated Species: *Elephantopus scaber* L., *Eranthemum roseum* (Vahl) R.Br. ex Roem. & Schult., *Haplanthodes verticillata* (Roxb.) R.B.Majumdar, *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult.

Abundance: Occasional.

Flw-Fru: October- March.

Habitat: Hilly areas.

Distribution: Dang and Valsad.

Taxonomic Note: This can be confused with *B. virens* but can be differential ted on the basis of size of capitulum and hairs where *B viren* is glabrous.

***Blumea obliqua* (L.) Druce** in Rep. Bot. Soc. Exch. Club Brit. Isles 4 (Suppl. 2): 609 (1916 publ. 1917); Hajra *et al.*, Fl. of India 13: 137. (1995); Shah 374. (1978); Raghavan *et al.* 44. (1981); Bole & Pathak, FS 2: 10. (1988); *Erigeron obliquus* L. in Mant. Pl. 2: 573 (1771); *Blumea amplexens* DC. in R.Wight, Contr. Bot. India: 13 (1834); Fl. Brit. India 3: 260 (1883); Cooke, FBP 2: 19. (1904).

Plate 4.32

Erect herbs, 8 - 15 cm high. Stem branched, pubescent. Leaves simple, opposite, obovate and lyrate, 2-7 cm, margin dentate, acute, scabrid. Capitulescence clustered-panicle.

Capitula disciform, 5-7 mm in diameter. Involucre multiseriate; phyllaries, linear, acuminate apex, 2-9 mm long, reflexed at maturity. Ray floret filiform, female, yellow, glabrous, 5-6 mm. Disc floret tubular, bisexual, yellow, hairs on lobes, 5.5-6.5 mm. Anther apex obtuse and base tailed 2.5-3 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela oblong, terete, pubescent, 1-1.5 mm. Pappus bristles, 1.5-2 mm.

Common Name: Oblique Blumea.

Vernacular Name: Aado Kapuriyo.

Specimen: JJS 63 (Atul).

Coordinates: 20°31'31.18" N, 72°55'32.67" E.

Origin: India (Native).

Associated Species: *Alternanthera sessilis* (L.) DC., *Tridax procumbens* L., *Celosia argentea* L., *Launaea procumbens* (Roxb.) Ramayya & Rajagopal, *Merremia emarginata* (Burm.f.) Hallier f.

Abundance: Rare.

Flw-Fru: October-May.

Habitat: Hilly areas, railway tracks and aquatic areas.

Distribution: Valsad.

Taxonomic Note: The florets of this plant are strictly yellow (Randeria, 1960; Cooke, 1904 etc.).

***Blumea oxyodonta* DC.** in Wight, Contrib. Bot. Ind. 15. (1834); Hook.f., Fl. Brit. India 3: 266. (1883); Hajra *et al.*, Fl. of India 13: 139. (1995); Cooke, FBP 2: 21. (1904); Shah 375. (1978); Raghavan *et al.* 44. (1981).

Plate 4.33

Decumbent or diffused herbs, 15 - 45 cm high. Stem unbranched or branched from base, villous or tomentose. Leaves simple, alternate, elliptic-lanceolate, 2-6 cm, margin serrate, acute, villous with hairs and stalked glands. Capitulescence solitary or biparous. Capitula disciform, 8-12 mm in diameter. Involucre multiseriate; phyllaries, linear, acute apex, 2-9 mm

long, reflexed at maturity. Ray floret filiform, female, yellow, lobes pubescent, 2.5-3.5 mm. Disc floret tubular, bisexual, yellow, lobes pubescent, 3-4 mm. Anthers abortive, apex obtuse and base tailed, 1.5-2 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela oblong, terete, pubescent, 1-1.5 mm. Pappus bristles, 1.5-2 mm.

Common Name: Spiny Leaved Blumea

Vernacular Name: Mahudi

Specimen: JJS 50 (Bheshkatri).

Coordinates: 20°55'43.30" N, 73°31'57.39" E.

Origin: Indian Subcontinent.

Associated Species: *Pennisetum* sp., *Hyptis suaveolens* (L.) Poit., *Solanum surattense* Burm.f., *Blumea malcolmii* Hook.f., *Heliotropium ovalifolium* Forssk., *Apluda mutica* L.

Abundance: Common.

Flw-Fru: Oct.- May.

Habitat: Banks of rivers and lakes, roadsides.

Distribution: Tapi, Navsari, Dang and Valsad.

Taxonomic Note: Although the habit is prostrate but it can be decumbent. The capitulum is campanulate in shape which can be helpful in identification.

***Blumea sinuata* (Lour.) Merr.** in Trans. Amer. Philos. Soc., n.s., 24(2): 388. (1935); *Gnaphalium sinuatum* Lour. in Fl. Cochinch. 2: 497 (1790); *Blumea laciniata* (Roxb.) DC., Prodr. 5: 436. (1836). Hook. f. in Fl. Brit. India 3: 264. (1883); Hajra *et al.*, Fl. of India 13: 128. (1995); Shah 373. (1978); Raghavan *et al.* 44. (1981); *Conyza laciniata* Roxb. in Fl. Ind., ed. 1832. 3: 427 (1832).

Plate 4.34

Erect herbs, aromatic, 60-180 cm high. Stem unbranched or branched, pubescent. Leaves simple, alternate, obovate-lyrate, 2-6 cm, margin lacerate or sinuate, acute, villous with hairs and stalked glands. Capitulescence cluster-panicle. Capitula disciform, 8-12 mm in diameter. Involucre multiseriate; phyllaries, linear, acute apex, 2-9 mm long, reflexed at

maturity. Ray floret filiform, female, yellow, glabrous, 5.5-6.5 mm. Disc floret tubular, bisexual, yellow, lobes pubescent, 6-7 mm. Anthers apex obtuse and base tailed, 2-2.5 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela oblong, ribbed, pubescent, 1-1.5 mm. Pappus bristles, 2.5-3 mm.

Common Name: Sow-Thistle *Blumea*

Vernacular Name: Aari.

Specimen: JJS 110 (Jalalpore).

Coordinates: 20°56'59.71" N, 72°53'48.24" E.

Origin: India and Southeast Asia.

Associated Species: *Cyanthillium cinereum* (L.) H. Rob., *Commelina benghalensis* L., *Tridax procumbens* L., *Sporobolus* sp., *Cynodon dactylon* (L.) Pers., *Dichanthium annulatum* (Forssk.) Stapf.

Abundance: Common.

Flw-Fru: January-June.

Habitat: Roadsides and wastelands

Distribution: Surat, Navsari and Valsad.

Taxonomic Note: Plant height may vary from place to place. Capitulescence is clustered at young stage while panicle at maturity.

***Blumea virens* DC.** in Wight, Contrib. Bot. Ind. 14. (1834); Hook.f., Fl. Brit. India 3: 264. (1883); Hajra *et al.*, Fl. of India 13: 143. (1995); Cooke, FBP 2: 21. (1904); Raghavan *et al.* 44. (1981).

Plate 4.35

Erect herbs, 20-45 cm high. Stem branched, terete, glabrous. Leaves simple, alternate, ovate-lanceolate or lyrate, 2-6 cm, margin serrate, acute, glabrous. Capitulescence cluster-panicle. Capitula disciform, 3-5 mm in diameter. Involucre multiseriate; phyllaries, linear, acuminate apex, 2-9 mm long, reflexed at maturity. Ray floret filiform, female, yellow, glabrous, 5-6 mm. Disc floret tubular, bisexual, yellow, lobes pubescent, 4.5-5.5 mm. Anthers

apex obtuse and base tailed, 1.5-2 mm. Style apex of both florets obtuse, 1-1.5 mm. Cypsela oblong, ribbed, pubescent, 1-1.5 mm. Pappus bristles, 1.5-2 mm.

Common Name: Shiny Blumea.

Vernacular Name: Nani Bachari.

Specimen: JJS 46 (Malegaon).

Coordinates: 20°35'27.98" N, 73°45'21.69" E.

Origin: India and Southeast Asia.

Associated Species: *Pennisetum* sp., *Cyanthillium cinereum* (L.) H. Rob., *Vicoa cernua* Dalzell, *Canscora diffusa* (Vahl) R. Br. ex Roem. & Schult.

Abundance: Occasional.

Flw-Fru: Oct. - June.

Habitat: Hilly areas.

Distribution: India: Tapi, Navsari, Dang and Valsad.

Genus: *Caesulia* Roxb., Pl. Coromandel 1(4): 64, t. 93 (1798).

***Caesulia axillaris* Roxb.**, Pl. Corom. 1: 64. t. 93. (1798); Hook.f., Fl. Brit. India 3: 291. (1881); Hajra *et al.*, Fl. of India 13: 2. (1995); Cooke, FBP 2: 35. (1904); Shah 375. (1978); Raghavan *et al.* 44. (1981).

Plate 4.36

Decumbent or erect herbs, succulent, 30-60 cm high, sometimes with rhizomatous roots. Leaves simple, alternate, linear, 2 - 15 cm, margin serrate, acute, narrowed at base, glabrous, sessile, one of the phyllary. Capitulescence solitary. Capitula discoid, axillary, ca 1.3 cm across, sessile. Involucre uniseriate; phyllaries 2 and one leaf, membranous, orbicular-ovate, acute. Florets tubular, bisexual, outer florets with paleae, 5-7 mm. Anther apex obtuse and base tailed, 1.5-2 mm. Style apex truncate, 0.5-1 mm. Cypsela obovoid, ca 1.5 mm, flat, winged. Pappus 2 scales, 1.5-1 mm.

Common Name: Pink Node Flower

Vernacular Name: Kala Maka.

Specimen: JJS 65 (Kilad).

Coordinates: 20°45'11.03" N, 73°29'14.75" E.

Origin: India (Native).

Associated Species: *Sphaeranthus indicus* L., *Rotala* sp., *Solanum surattense* Burm.f., *Cyperus rotundus* L., *Heliotropium ovalifolium* Forssk., *Brassica nigra* (L.) W.D.J.Koch.

Abundance: Common.

Flw-Fru: September-April.

Habitat: Aquatic areas and agricultural fields.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: The leaf on axis of which capitulum is present is also on of the phyllary in involucre.

Genus: *Pluchea* Cass., Bull. Sci. Soc. Philom. Paris 1817: 31 (1817).

Key to the Species

- 1a. Leaf ovate to elliptic and serrate *P. ovalis*
1b. Leaf lanceolate to obovate and entire or minutely dentate *P. wallichiana*

***Pluchea ovalis* (Pers.) DC.** in Prodr. 5: 450 (1836); *Baccharis ovalis* Pers. in Syn. Pl. 2: 424 (1807); *Pluchea tomentosa* DC. in Wight, Contrib. Bot. Ind. 16. (1834); Hook.f., Fl. Brit. India 3: 272. (1883); Hajra *et al.*, Fl. of India 13: 155. (1995); Cooke, FBP 2: 25. (1904); Shah 390. (1978); Raghavan *et al.* 46. (1981).

Plate 4.37

Shrubs, aromatic, 1.5-3 m high. Stem branched, striated, glandular pubescent. Leaves simple, alternate, decurrent, elliptical, 2-6 cm, margin serrate, obtuse, pubescent. Capitulescence corymb. Capitula disciform, 3-5 mm in diameter. Involucre multiseriate; phyllaries, ovate-linear, acute apex, 2-9 mm long, pubescent. Ray floret filiform, female, white

or light pink, 5-7 mm. Disc floret tubular, bisexual, white or light pink, 7-9 mm. Anthers apex obtuse and base tailed, 1-1.5 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela fusiform, angled, glabrous, 1-1.5 mm. Pappus plumose, 1-2 mm.

Common Name: Woolly Camphor-Weed

Vernacular Name: Kalambika.

Specimen: JJS 52 (Saputara).

Coordinates: 20°35'00.19" N, 73°44'48.96" E.

Origin: Western Asia and Africa.

Associated Species: *Apluda mutica* L., *Celosia argentea* L., *Colebrookea oppositifolia* Sm.

Abundance: Rare.

Flw-Fru: October- March.

Habitat: Hilly areas.

Distribution: Dang.

Taxonomic Note: The leaves are prominently serrate and the apex of phyllaries are acute.

***Pluchea wallichiana* DC.**, Prodr. 5: 451. (1836); Hook.f., Fl. Brit. India 3: 272. (1883); Hajra *et al.*, Fl. of India 13: 157. (1995); Cooke, FBP 2: 25. (1904); Shah 390. (1978); Raghavan *et al.* 46. (1981).

Plate 4.38

Shrubs, aromatic, 1-2.5 m high. Stem branched, striated, glandular pubescent. Leaves simple, alternate, auricled, oblong-obovate, 3-6 cm, margin obscurely serrate or entire, obtuse, pubescent. Capitulescence corymb. Capitula disciform, 3-5 mm in diameter. Involucre multiseriate; phyllaries, ovate-linear, acute apex, 2-9 mm long, pubescent. Ray floret filiform, female, white or light pink, 4-5 mm. Disc floret tubular, bisexual, white or light pink, 3.5-4 mm. Anthers apex obtuse and base tailed, 1.5-2 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela fusiform, angled, glabrous, 1-2 mm. Pappus plumose, 3-4 mm.

Common Name: Stalkless-Leaf Camphor-Weed

Vernacular Name: Tulsivatti

Specimen: JJS 122 (Saraigam).

Coordinates: 20°17'22.80" N, 72°51'08.68" E.

Origin: India (Native).

Associated Species: *Tridax procumbens* L., *Dichanthium annulatum* (Forssk.) Stapf, *Cyanthillium cinereum* (L.) H. Rob., *Commelina benghalensis* L., *Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult.

Abundance: Occasional.

Flw-Fru: January- May.

Habitat: Wasteland and grassland.

Distribution: Valsad

Taxonomic Note: This plant is confused with *P. lanceolata* which can be differentiated on the basis of apex of involucre where it is ovate in *P. lanceolata* and acute in *P. wallichiana*.

Genus: *Pseudoconyza* Cuatrec., Ciencia (Mexico) 21: 30 (1961).

***Pseudoconyza viscosa* (Mill.) D' Arcy** in Phytologia. 25(5): 281. (1973); Grierson & Springate, l.c. 1507. (2001); *Conyza viscosa* Mill. in Gard. Dict., ed. 8.: n.º 8 (1768); *Laggera aurita* Benth. ex C.B. Clarke in Compos. Ind.: 92 (1876); Hook. f., Fl. Brit. India 3: 271. (1883); Hajra *et al.*, Fl. of India 13: 150. (1995); Cooke, FBP 2: 24. (1904); Shah 386. (1978); Raghavan *et al.* 45. (1981); Bole & Pathak, FS 2: 25. (1988); *Conyza aurita* L.f., Suppl. 367. (1781).

Plate 4.39

Erect herbs, aromatic, 25-60 cm high. Stem branched, terete, pubescent. Leaves simple, alternate, decurrent, lyrate, 4-7 cm, margin serrate, acute, tomentose. Capitulescence panicle. Capitula disciform, 3-5 mm in diameter. Involucre multiseriate; phyllaries, linear, acuminate apex, 2-9 mm long, reflexed at maturity, pubescent. Ray floret filiform, female, white or pink. Disc floret tubular, bisexual, white or pink. Anthers apex obtuse and base sagittate. Style apex of both florets obtuse. Cypsela fusiform, ribbed, pubescent. Pappus bristles.

Common Name: Sticky Blumea

Vernacular Name: Bhint Mulo.

Specimen: JJS 123 (Khattalwada).

Coordinates: 20°12'34.52" N, 72°48'18.46" E.

Origin: Indian subcontinent and Africa.

Associated Species: *Synedrella nodiflora* (L.) Gaertn., *Oplismenus burmanni* (Retz.) P.Beauv., *Dichanthium annulatum* (Forssk.) Stapf, *Cyanthillium cinereum* (L.) H.Rob., *Commelina benghalensis* L., *Sida cordata* (Burm.f.) Borss.Waalk.

Abundance: Occasional.

Flw-Fru: March-June.

Habitat: Roadsides, aquatic areas and grasslands.

Distribution: Surat, Navsari and Valsad.

Taxonomic Note: The taxonomic position of this genus is been doubtful between *Blumea*, *Laggera* and *Pseudoconyza*. The presence of sagittate anthers and decurrent leaf base keeps it different from *Blumea*.

Genus: *Pulicaria* Gaertn., Fruct. Sem. Pl. 2: 461 (1791).

***Pulicaria angustifolia* DC.,** Prodr. 5: 479. (1836); Hook.f., Fl. Brit. India 3: 299. (1883); Hajra *et al.*, Fl. of India 13: 33. (1995); Cooke, FBP 2: 34. (1904); Bole & Pathak, FS 2: 30. (1988) Shah 390. (1978); Raghavan *et al.* 46. (1981).

Plate 4.40

Erect or decumbent herbs, 10-30 cm high. Stem branched, terete, pubescent. Leaves simple, alternate, linear-spathulate, 1-4 cm, margin serrate, acute, pubescent. Capitulescence solitary. Capitula radiate, 3-5 mm in diameter. Involucre multiseriate; phyllaries, obovate, acute apex, 2-9 mm long, pubescent. Ray floret ligulate, female, yellow. Disc floret tubular, bisexual, yellow. Anthers apex obtuse and base tailed, 1-2 mm. Style apex of both florets obtuse, 1-1.5 mm. Cypsela obovate, terete, glabrous, 1.5-2 mm. Pappus plumose, 2.5-3 mm.

Common Name: Thin Fleabane.

Vernacular Name: Chuhada.

Specimen: JJS 124 (Don).

Coordinates: 20°43'40.09" N, 73°51'54.10" E.

Origin: India (Native).

Associated Species: *Celosia argentea* L., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Ageratum conyzoides* L., *Sporobolus* sp.

Abundance: Occasional.

Flw-Fru: July-November.

Habitat: Hilly areas.

Distribution: Tapi, Dang and Valsad.

Genus: *Sphaeranthus* L., Sp. Pl. 2: 927 (1753).

***Sphaeranthus indicus* L., Sp. Pl. 927. (1753);** Hook.f., Fl. Brit. India 3: 275. (1883); Hajra *et al.*, Fl. of India 13: 160. (1995); Cooke, FBP 2: 23. (1904); Shah 395. (1978); Raghavan *et al.* 46. (1981); Bole & Pathak, FS 2: 34. (1988).

Plate 4.41

Procumbent herbs, 15-50 cm long. Stem branched, wing with dentations, glabrous. Leaves simple, alternate, decurrent, linear-spathulate, 1.5-4 cm, margin serrate, obtuse, glabrous. Capitulescence solitary. Capitula compound, disciform, 3-5 mm in diameter. Involucre uniseriate; phyllaries, ovate, acute apex, 2-9 mm long, glabrous. Ray floret filiform, female, pink-purple, 3-4 mm. Disc floret tubular, bisexual, pink-purple, 4-4.5 mm. Anthers apex obtuse and base sagittate, 1.5-2 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela obovoid, angled, pubescent or glabrous, 0.6-1 mm. Pappus absent.

Common Name: East Indian Globe Thistle

Vernacular Name: Gorakhmundi, Bhurandi.

Specimen: JJS 127 (Gadad), 128 (Nana Pondha).

Coordinates: 20°44'14.97" N, 73°51'24.71" E; 20°24'01.57" N, 73°07'03.08" E.

Origin: India and Northeast Asia.

Associated Species: *Heliotropium ovalifolium* Forssk., *Rotala* sp., *Cyperus rotundus* L., *Brassica nigra* (L.) W.D.J.Koch, *Caesulia axillaris* Roxb..

Abundance: Common.

Flw-Fru: August- April.

Habitat: Roadsides, aquatic areas, cultivated areas and grasslands.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: Head is compound with each unit disciform in nature.

Genus: *Vicoa* Cass., Ann. Sci. Nat. (Paris) 17: 418 (1829).

Key to the Species

- 1a. Involucre not recurved, ray florets without pappus *V. indica*
1b. Involucre recurved, ray florets with pappus *V. cernua*

***Vicoa cernua* Dalz.** in Dalz. & Gibs., Bombay Fl. 126. (1861); Hook.f., Fl. Brit. India 3: 279. (1883); Hajra *et al.*, Fl. of India 13: 28. (1995); Shah 399. (1978); Raghavan *et al.* 47. (1981); *Pentanema cernuum* (Dalz. et Gibs.) Ling in Acta Phyt. Sin. 10: 180. (1965).

Plate 4.42

Erect herbs, 15-40 cm high. Stem branched, striated, pubescent. Leaves simple, alternate, ovate-lanceolate, 2-8 cm, margin serrate, acute-acuminate, pubescent. Capitulescence panicle. Capitula radiate, 3-5 mm in diameter. Involucre multiseriate; phyllaries, linear, acuminate apex, 2-9 mm long, reflexed, pubescent. Ray floret ligulate, bilabiate, female, yellow, 1.5-2 mm. Disc floret tubular, bisexual, yellow, 1-2 mm. Anthers apex obtuse and base tailed, 1-1.5 mm. Style apex of both florets obtuse, 1-1.5 mm. Cypsela obovoid, terete, pubescent, 1.5-2 mm. Pappus bristles, 2-3 mm.

Common Name: Small Daisy.

Vernacular Name: Nani Sonsari.

Specimen: JJS 131(Malegaon).

Coordinates: 20°35'27.98" N, 73°45'21.69" E.

Origin: India (Native).

Associated Species: *Blumea virens* DC., *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult., *Alternanthera sessilis* (L.) DC., *Eranthemum roseum* (Vahl) R.Br. ex Roem. & Schult., *Haplanthodes verticillata* (Roxb.) R.B.Majumdar.

Abundance: Restricted.

Flw-Fru: November-March.

Habitat: Hilly areas

Distribution: Dang (Malegaon-Saputara)

Taxonomic Note: It has small ray florets which are bilabiate.

***Vicoa indica* (L.) DC.** in Wight Contrib. Bot. Ind. 10. 1834; Shah 399. (1978); Raghavan *et al.* 47. (1981); Bole & Pathak, FS 2: 40. (1988); *Inula indica* L. in Sp. Pl., ed. 2.: 1236 (1763); *Pentanema indicum* (L.) Ling in Acta Phyt. Sin. 10: 179. (1965); Hajra *et al.*, Fl. of India 13: 28. (1995); *Vicoa auriculata* Cass. in Ann. Sci. Nat. (Paris) 17: 418 (1829); Hook.f., Fl. Brit. India 3: 297. (1883); Cooke, FBP 2: 32. (1904).

Plate 4.43

Erect herbs, 35-80 cm high. Stem branched, striated, hispid. Leaves simple, alternate, auricled, linear-oblong, 2-7 cm, margin crenate, acute, scabrid. Capitulescence corymb. Capitula radiate, 3-5 mm in diameter. Involucre multiseriate; phyllaries, linear, acute apex, 2-9 mm long, glabrous. Ray floret ligulate, bilabiate, female, yellow, 7-8 mm. Disc floret tubular, bisexual, yellow, 4-6 mm. Anthers apex obtuse and base tailed, 1.5-2 mm. Style apex of both florets obtuse, 0.5-1 mm. Cypsela obovoid, terete, pubescent, 1-1.5 mm. Pappus bristles in disc florets only; absent in ray florets, 2-3 mm.

Common Name: Golden Daisy.

Vernacular Name: Sonsari.

Specimen: JJS 17 (Barpuda).

Coordinates: 20°19'05.71" N, 73°23'47.67" E.

Origin: Asia and Africa.

Associated Species: *Chromolaena odorata* (L.) R.M.King & H.Rob., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Digitaria* sp., *Oplismenus burmanni* (Retz.) P.Beauv., *Haplanthodes tentaculata* (L.) R.B.Majumdar.

Abundance: Common.

Flw-Fru: November-May.

Habitat: Hilly areas and agricultural fields.

Distribution: Tapi, Navsari, Dang and Valsad.

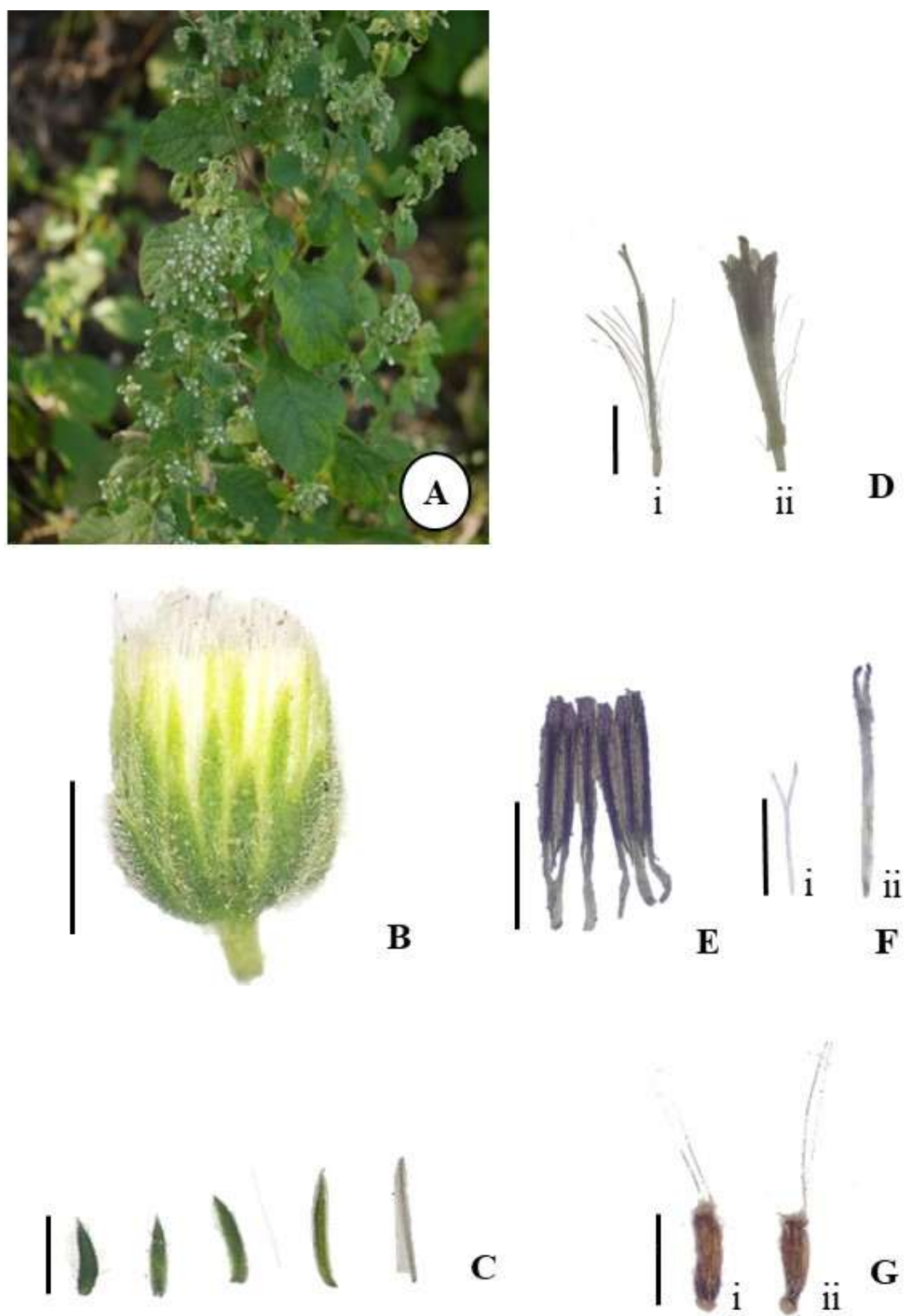


Plate 4.26 *Blumea axillaris* (Lam.) DC. **A-** Flowering Twig; **B-** Capitulum (bar = 0.3 cm); **C-** Phyllary (bar = 2 mm); **D-** Floret (bar = 2 mm); **E-** Anthers (bar = 1 mm); **F-** Style (bar = 1 mm); **G-** Cypsela (bar = 1 mm) (i=RF, ii=DF).

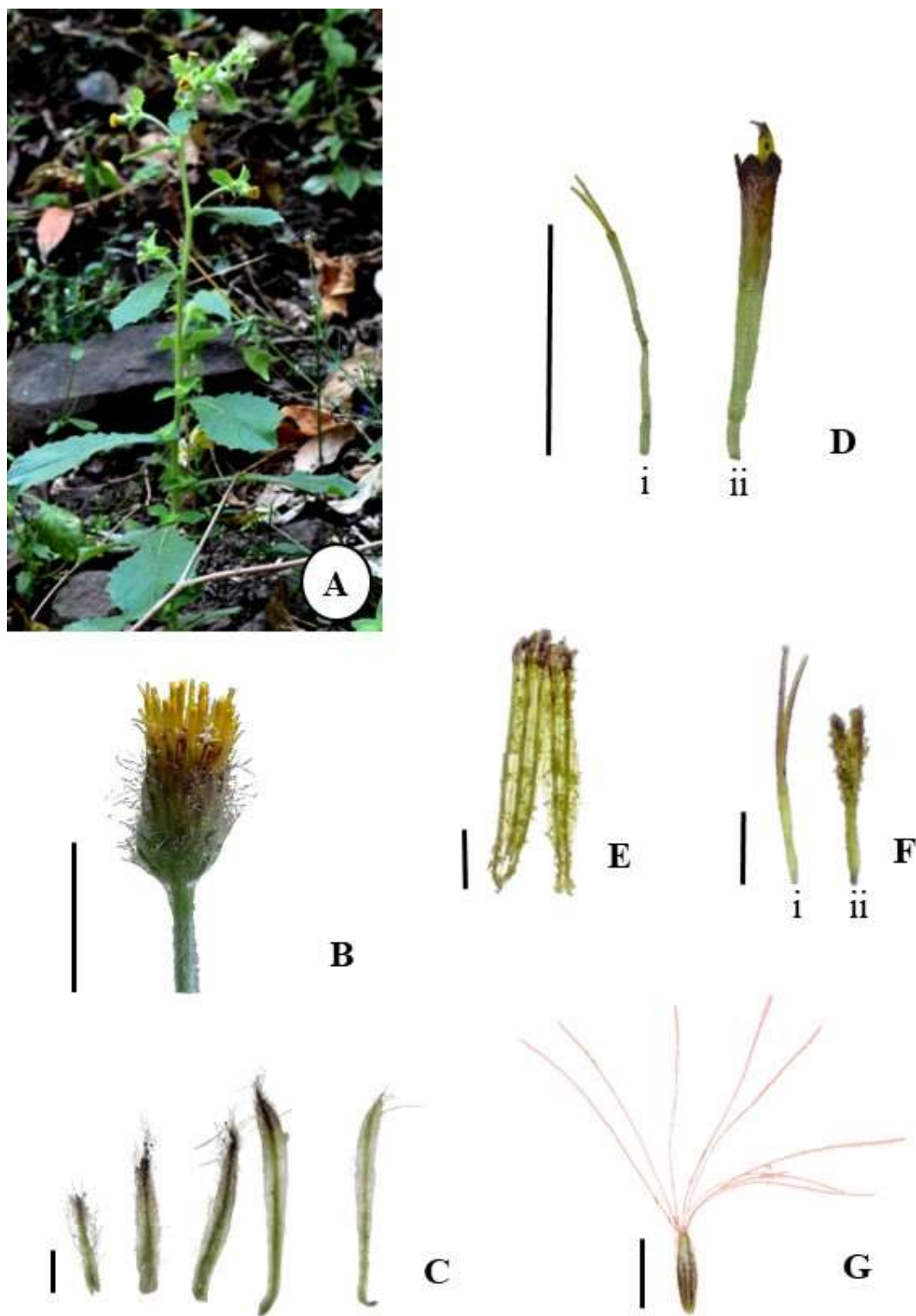


Plate 4.27 *Blumea belangeriana* DC. A- Habit; B- Capitulum (bar = 1 cm); C- Phyllary (bar = 1 mm); D- Floret (bar = 5 mm); E- Anthers (bar = 1 mm); F- Style (bar = 1 mm); G-Cypsela (bar = 2 mm) (i=RF, ii=DF).

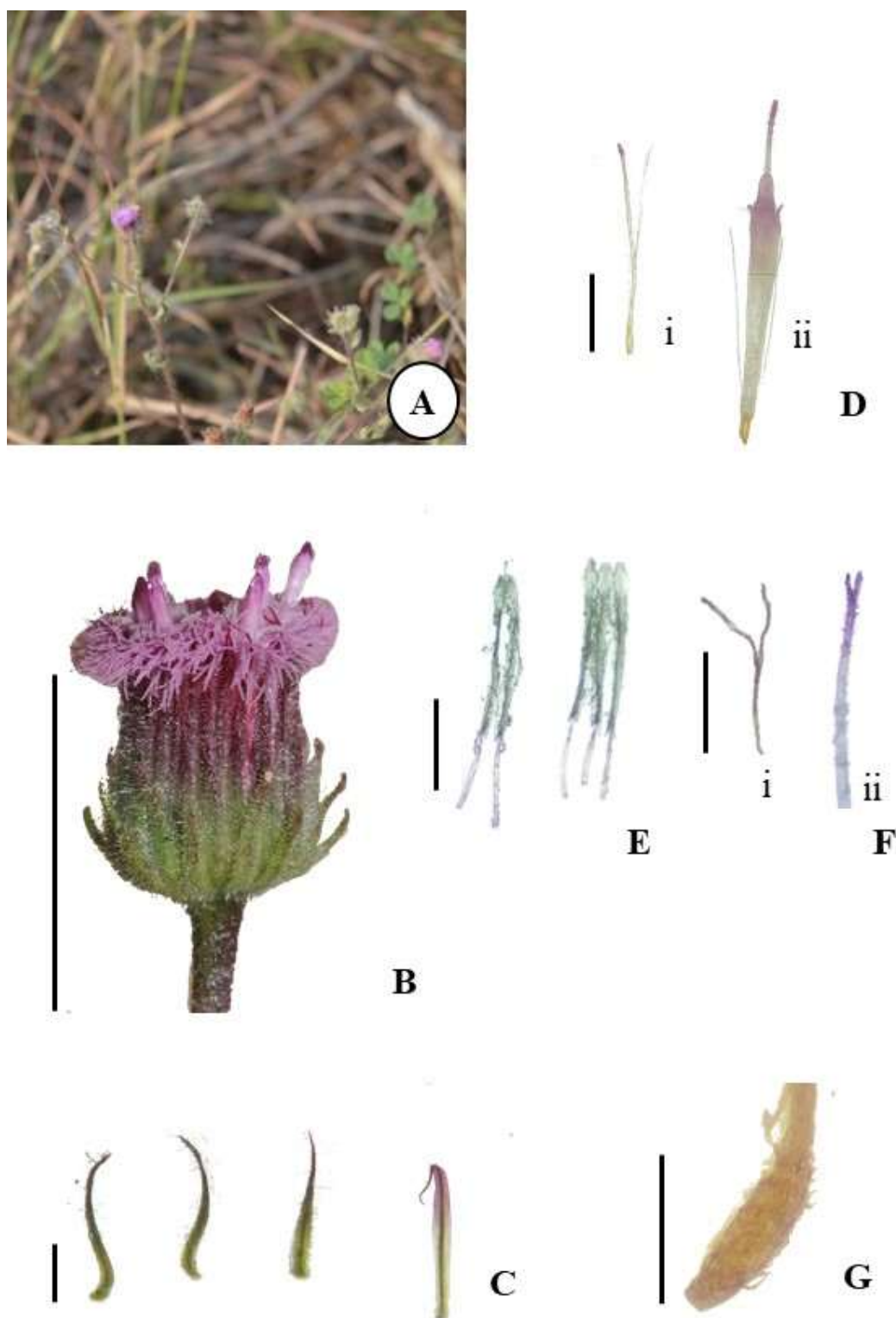




Plate 4.29 *Blumea eriantha* DC. **A-** Habit; **B-** Capitulum (bar = 1 cm); **C-** Phyllary (bar = 2 mm); **D-** Floret (bar = 2 mm); **E-** Anthers (bar = 1 mm); **F-** Style (bar = 1 mm); **G-** Cypsela (bar = 1 mm) (i=RF, ii=DF).



Plate 4.30 *Blumea malcolmii* Hook.f. **A**- Habit; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 2 mm); **D**- Floret (bar = 1 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm) (i=RF, ii=DF).

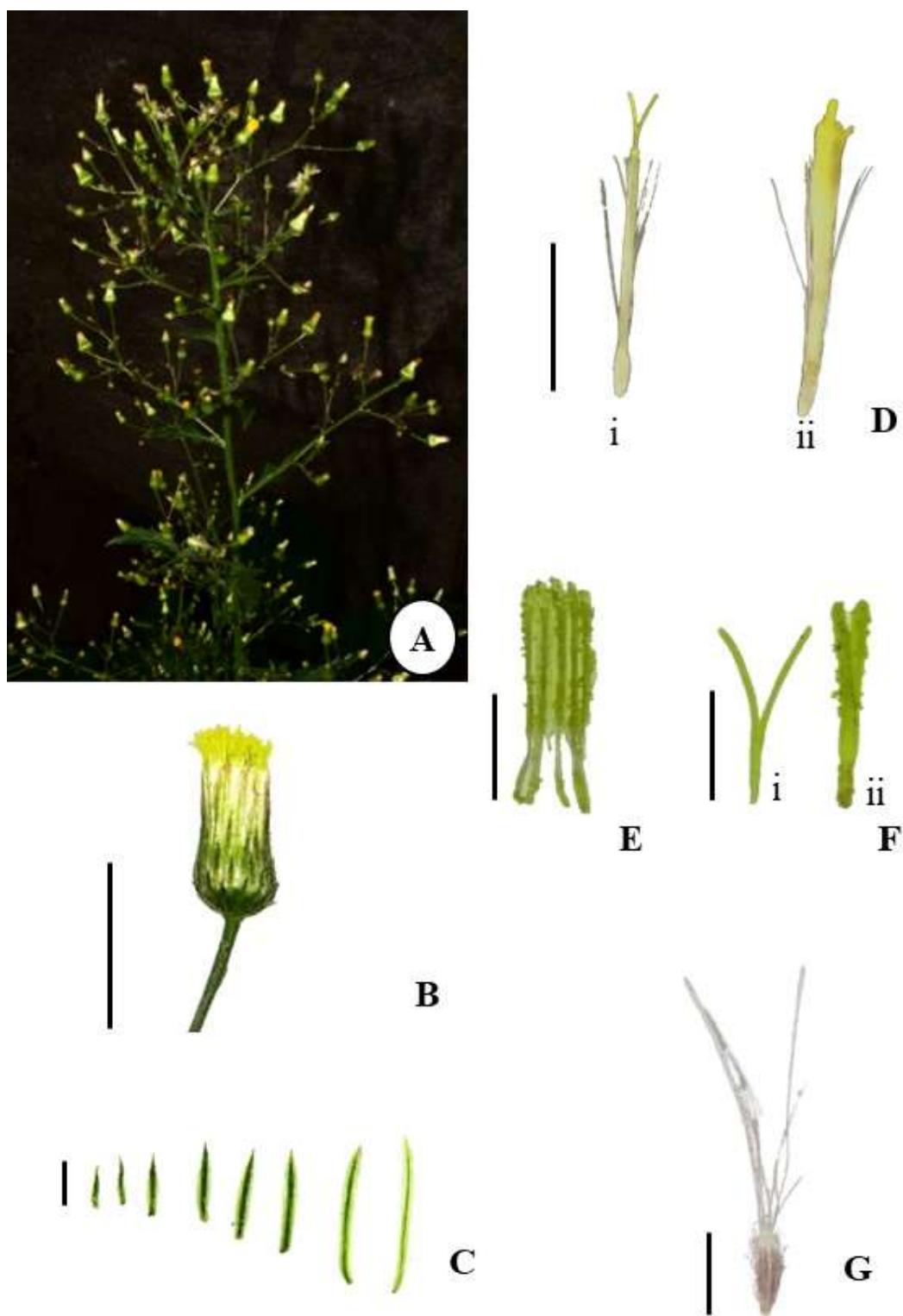


Plate 4.31 *Blumea membranacea* DC. **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 2 mm); **D**- Floret (bar = 3 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm) (i=RF, ii=DF).

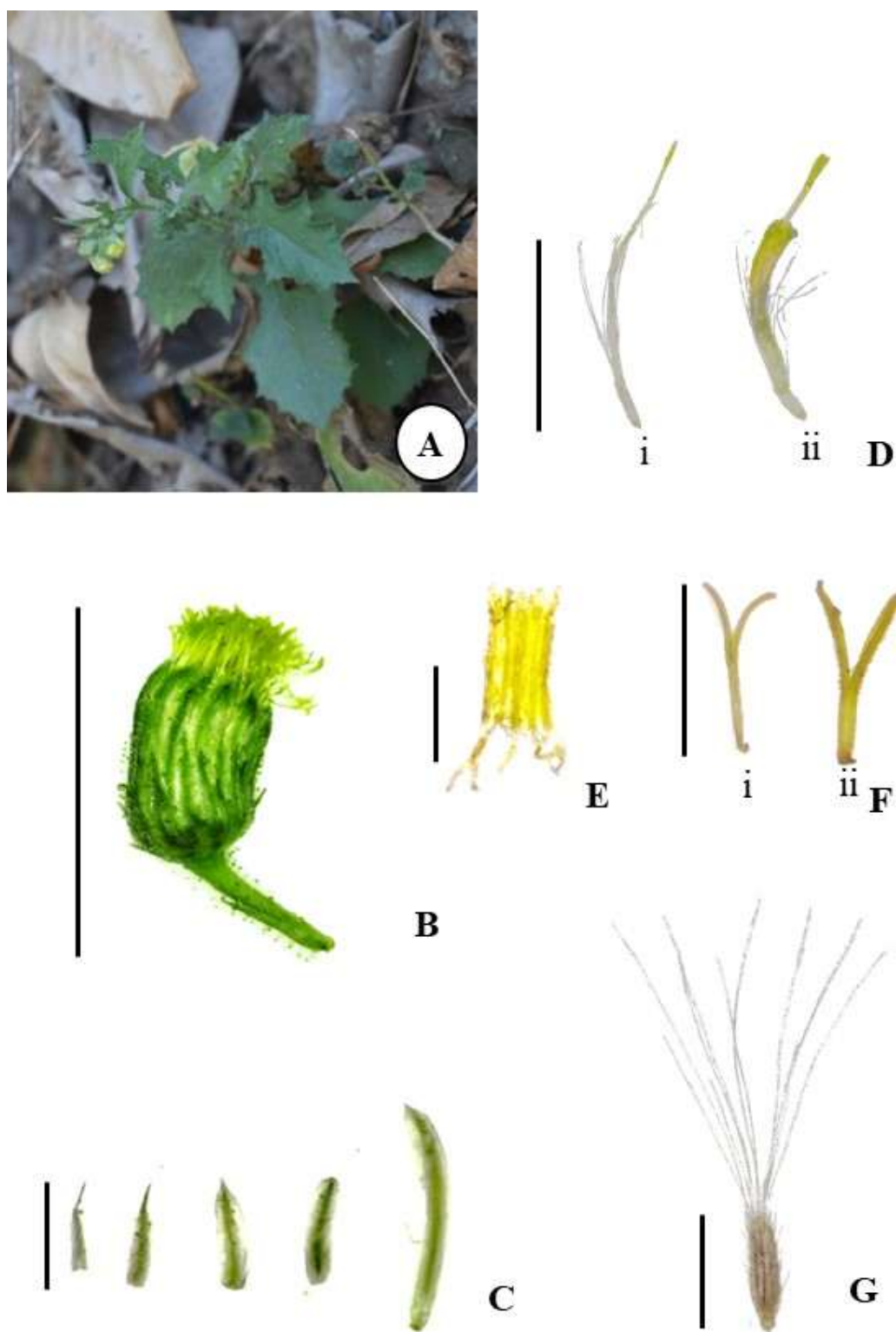


Plate 4.32 *Blumea obliqua* (L.) Druce **A**- Habit; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 2 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm) (i=RF, ii=DF).

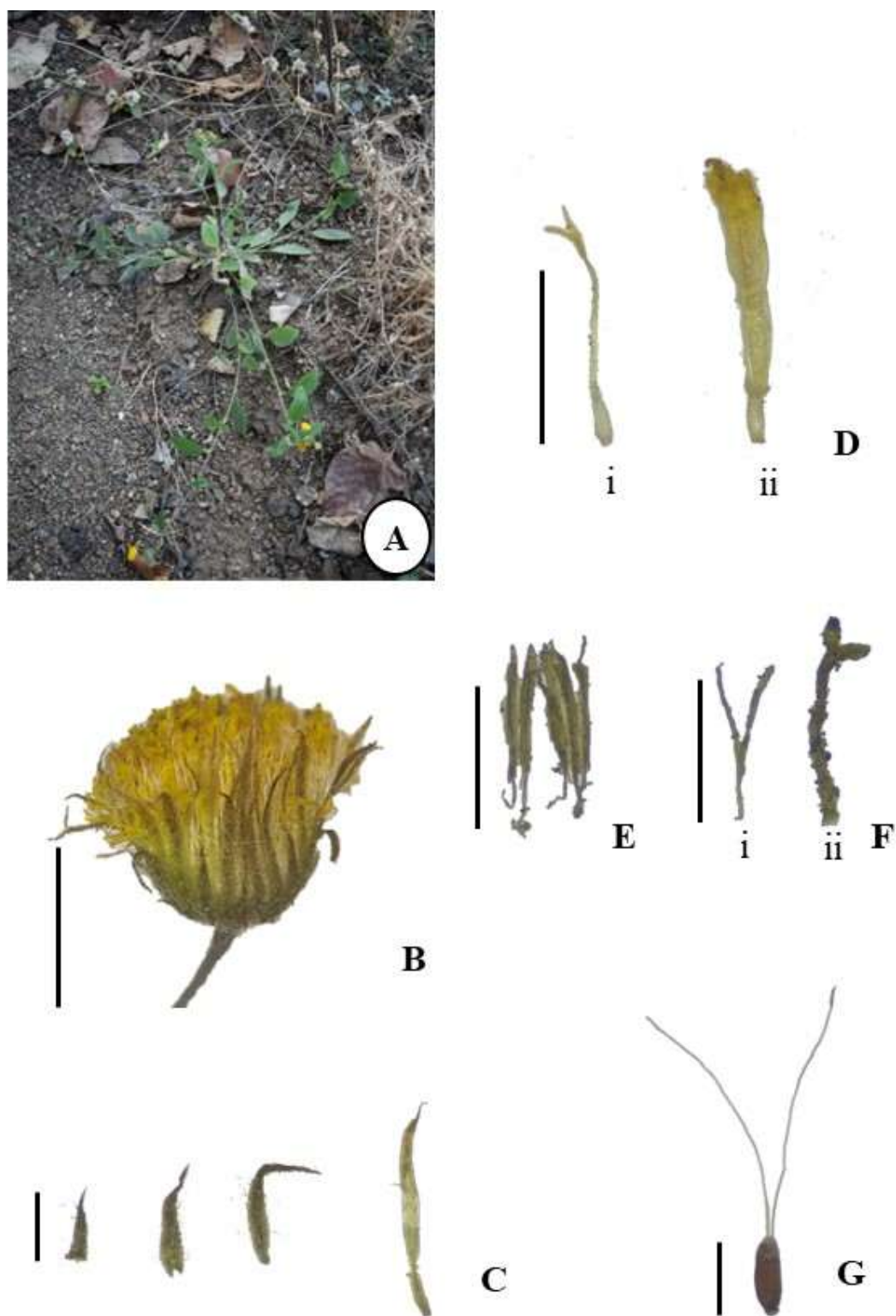


Plate 4.33 *Blumea oxyodonta* DC. **A**- Habit; **B**- Capitulum (bar = 0.4 cm); **C**- Phyllary (bar = 1 mm); **D**- Floret (bar = 2 mm); **E**- Anthers (bar = 2 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm).

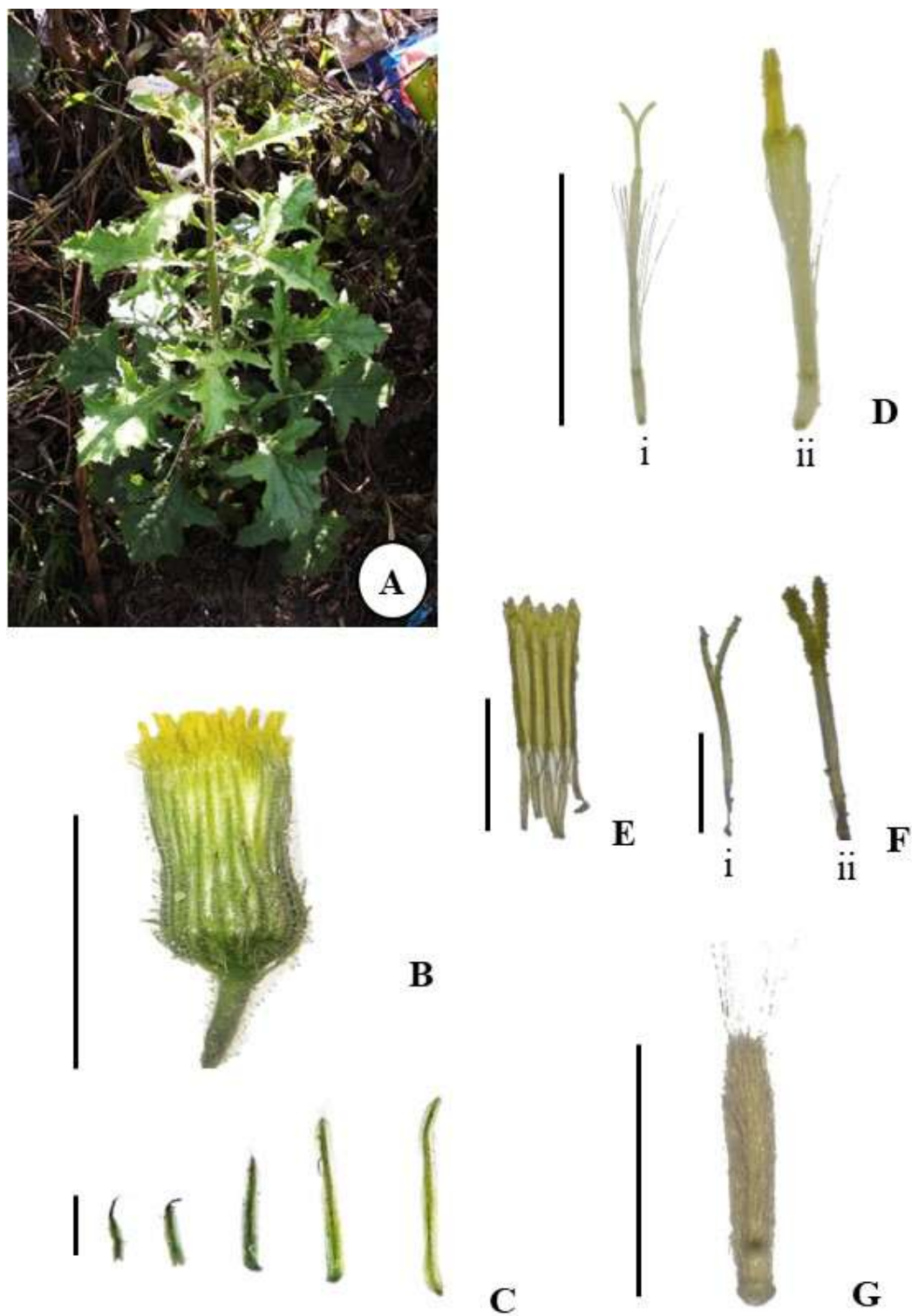


Plate 4.34 *Blumea sinuata* (Lour.) Merr. **A**- Habit; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 2 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**- Cypsel (bar = 1 mm) (i=RF, ii=DF).



Plate 4.35 *Blumea virens* DC. **A**- Habit; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 2 mm); **D**- Floret (bar = 2 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm) (i=RF, ii=DF).

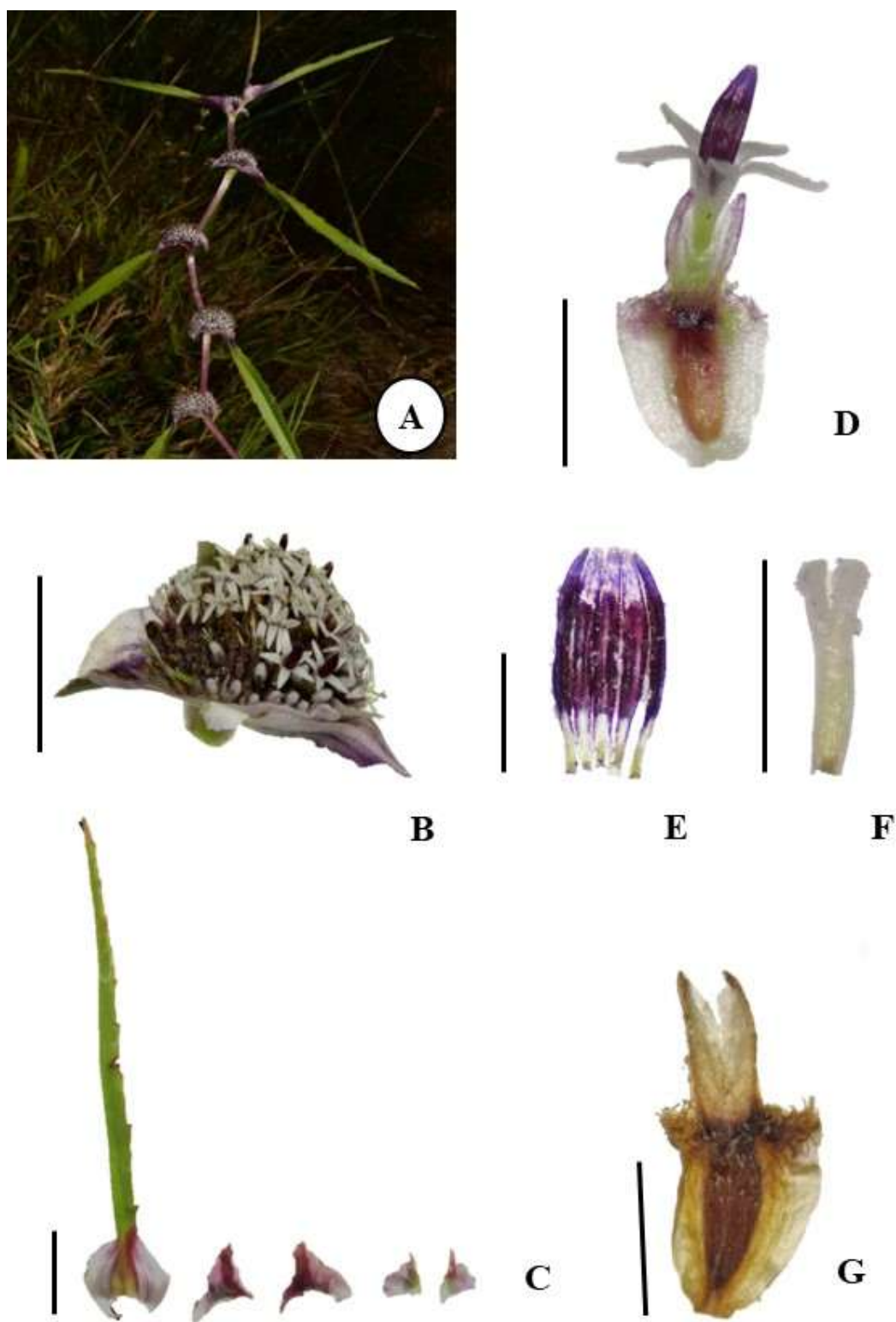


Plate 4.36 *Caesulia axillaris* Roxb. **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 10 mm); **D**- Floret (bar = 2 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm).

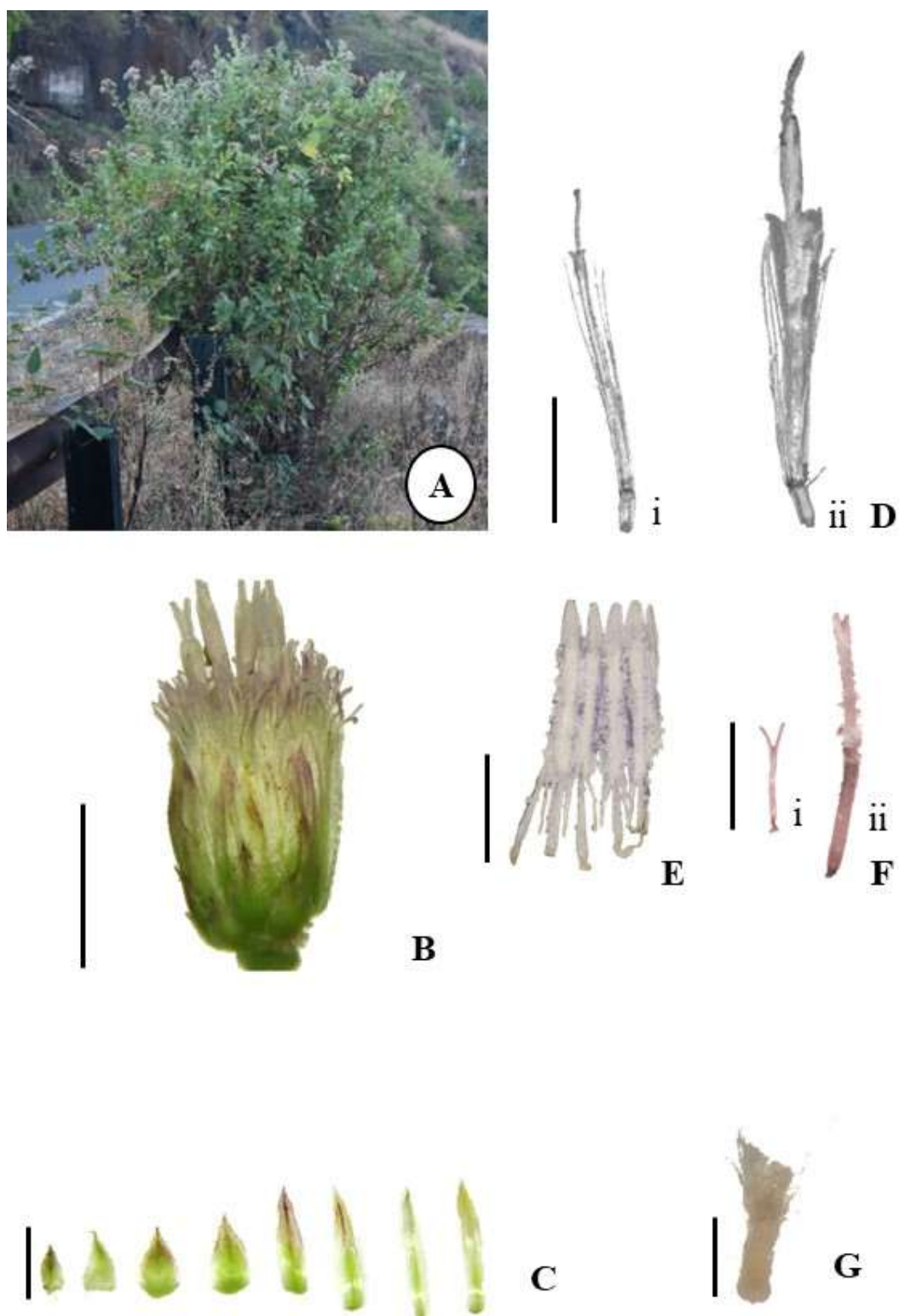


Plate 4.37 *Pluchea ovalis* (Pers.) DC. **A-** Habit; **B-** Capitulum (bar = 1 cm); **C-** Phyllary (bar = 2 mm); **D-** Floret (bar = 2 mm); **E-** Anthers (bar = 1 mm); **F-** Style (bar = 2 mm); **G-** Cypsela (bar = 1 mm) (i=RF, ii=DF).

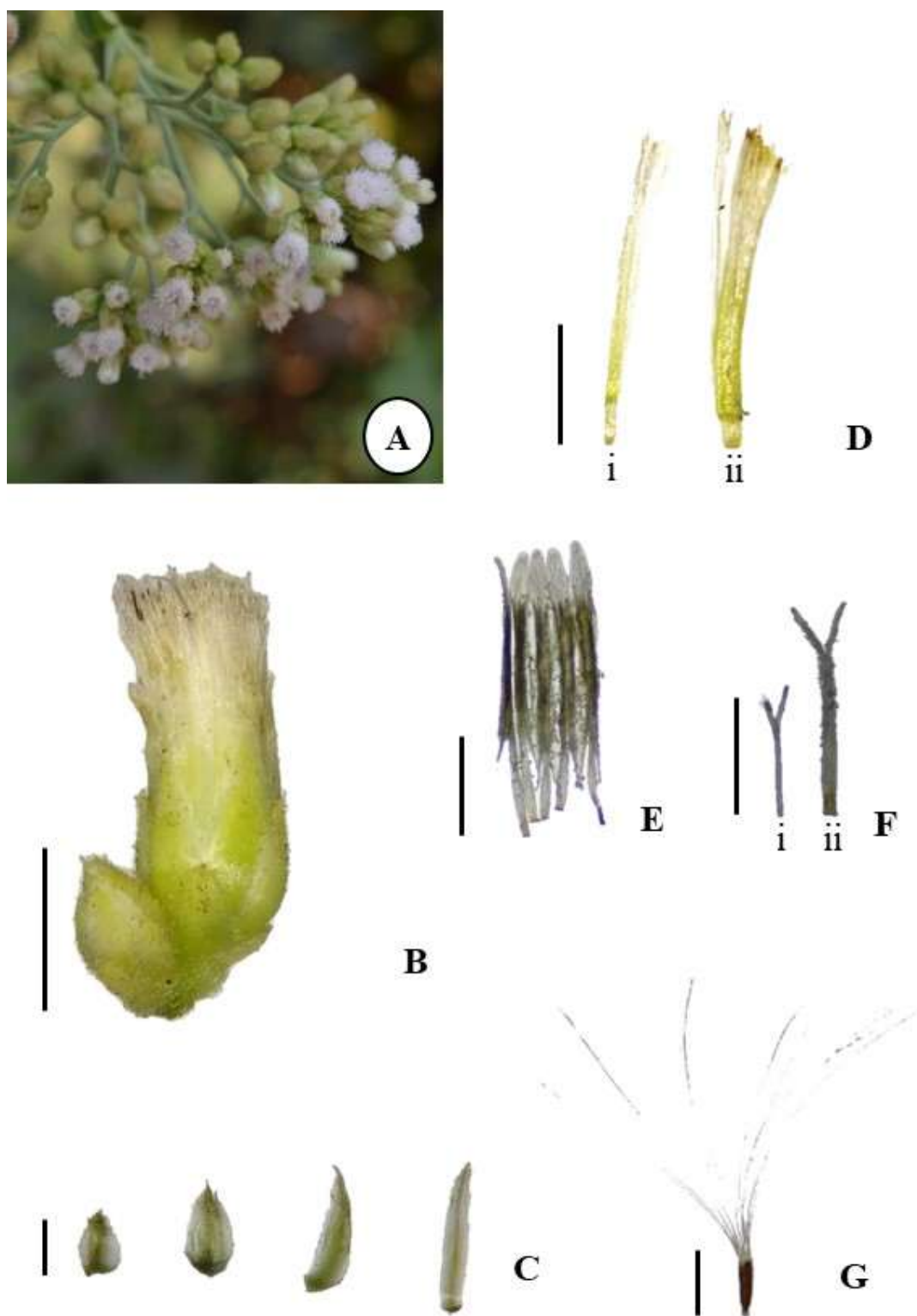


Plate 4.38 *Pluchea wallichiana* DC. **A**- Flowering Twig; **B**- Capitulum (bar = 0.2 cm); **C**- Phyllary (bar = 1 mm); **D**- Floret (bar = 1 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm) (i=RF, ii=DF).

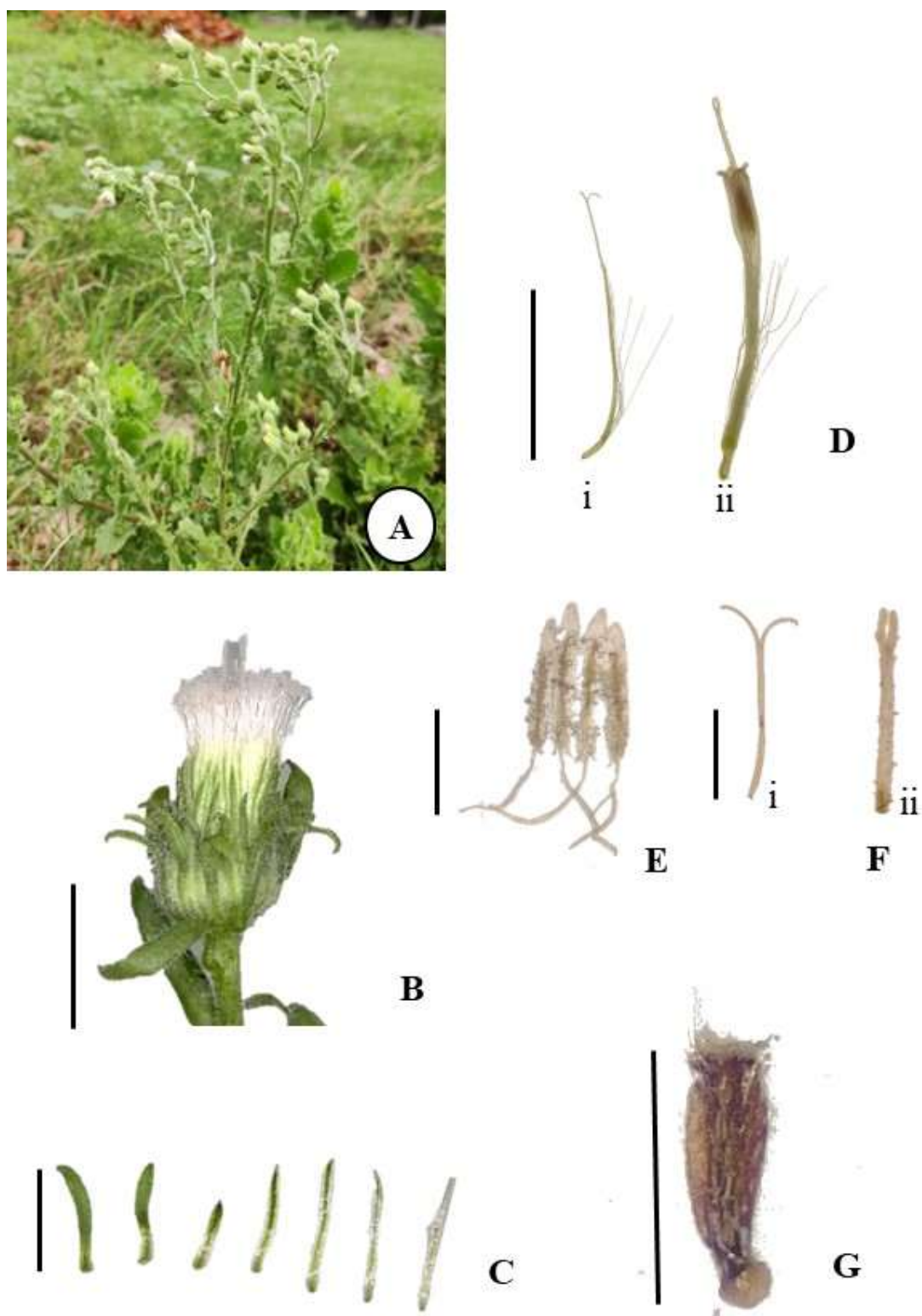


Plate 4.39 *Pseudoconyza viscosa* (Mill.) D'Arcy **A**- Flowering Twig; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 5 mm); **D**- Floret (bar = 5 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**- Cypsela (bar = 1 mm) (i=RF, ii=DF).

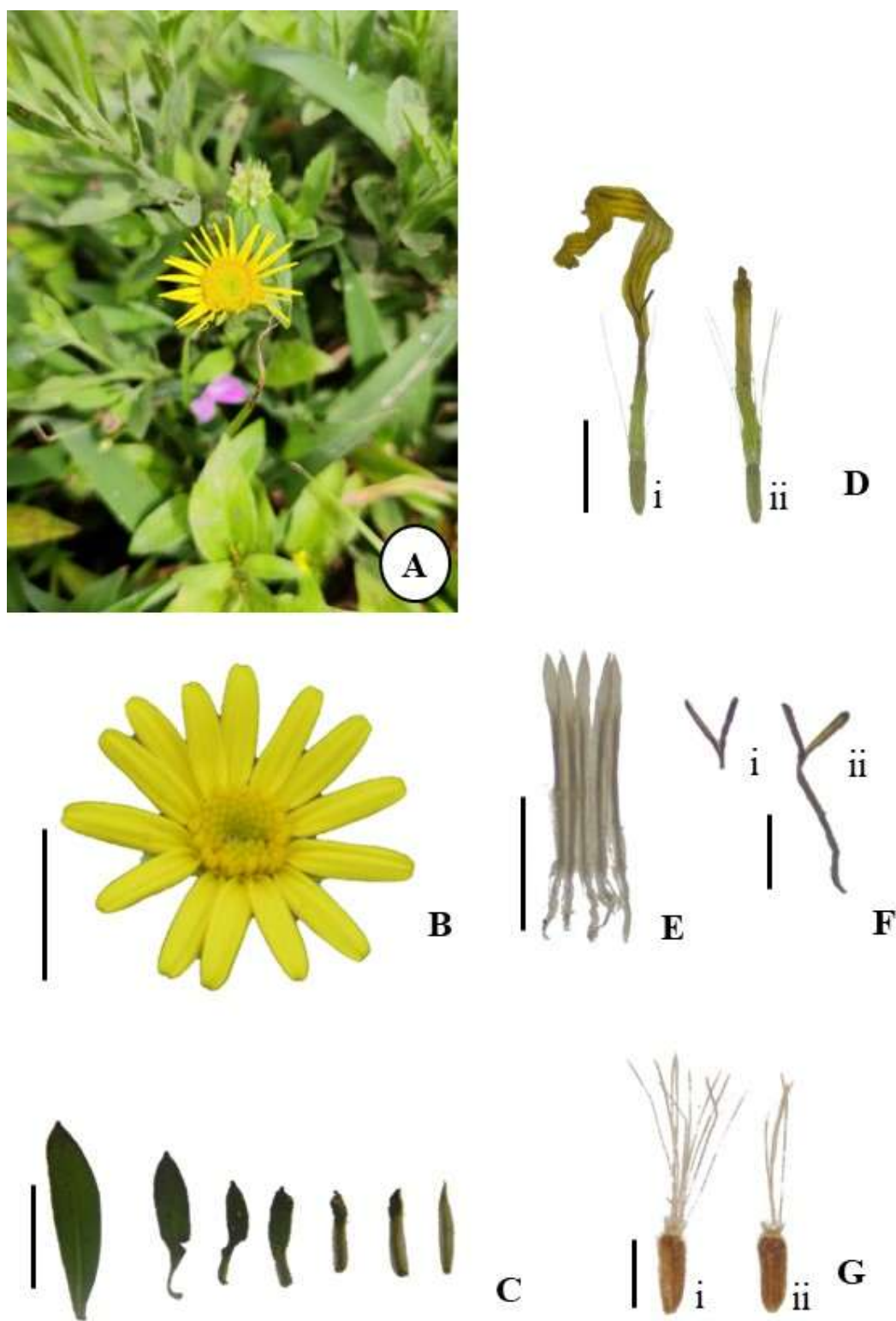


Plate 4.40 *Pulicaria angustifolia* DC. **A-** Habit; **B-** Capitulum (bar = 3 cm); **C-** Phyllary (bar = 10 mm); **D-** Floret (bar = 10 mm); **E-** Anthers (bar = 1 mm); **F-** Style (bar = 1 mm); **G-** Cypselas (bar = 2 mm) (i=RF, ii=DF).

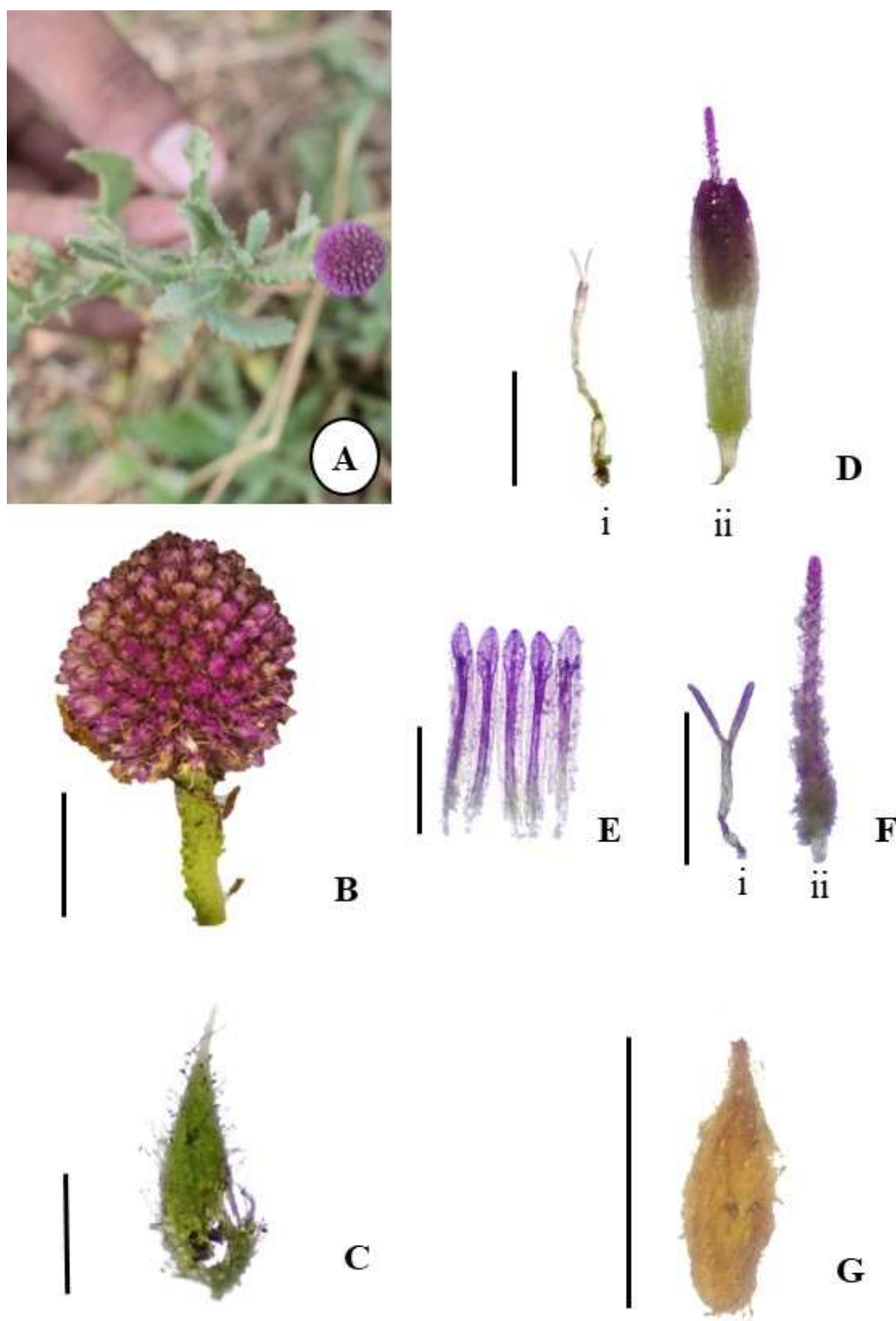


Plate 4.41 *Sphaeranthus indicus* L. **A**- Flowering Twig; **B**- Capitulum (bar = 2 cm); **C**- Phyllary (bar = 1 mm); **D**- Floret (bar = 1 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**-Cypsela (bar = 1 mm) (i=RF, ii=DF).

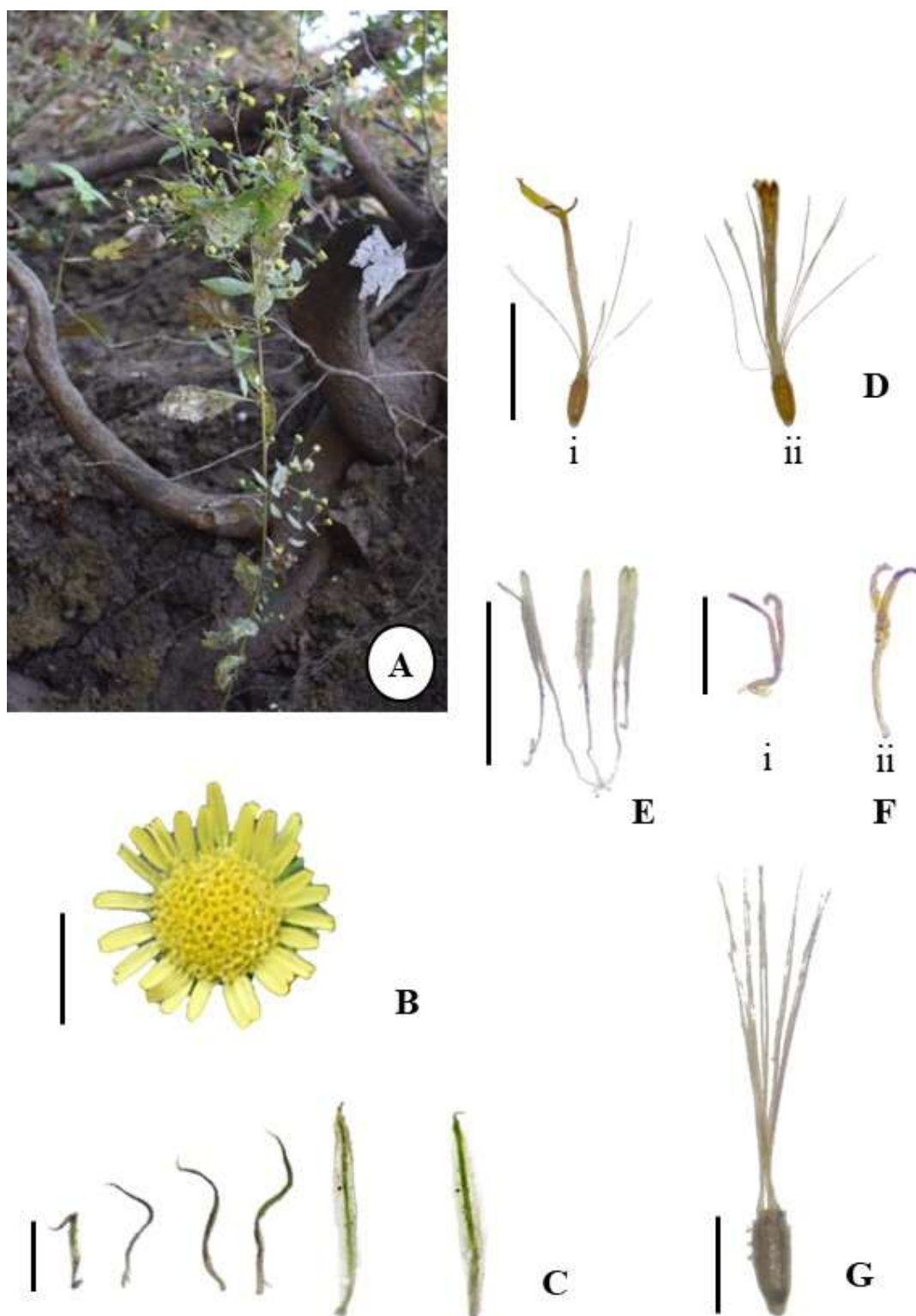


Plate 4.42 *Vicoa cernua* Dalzell **A**- Habit; **B**- Capitulum (bar = 1 cm); **C**- Phyllary (bar = 1 mm); **D**- Floret (bar = 2 mm); **E**- Anthers (bar = 0.5 mm); **F**- Style (bar = 0.5 mm); **G**-Cypsela (bar = 1 mm) (i=Rf, ii=DF).

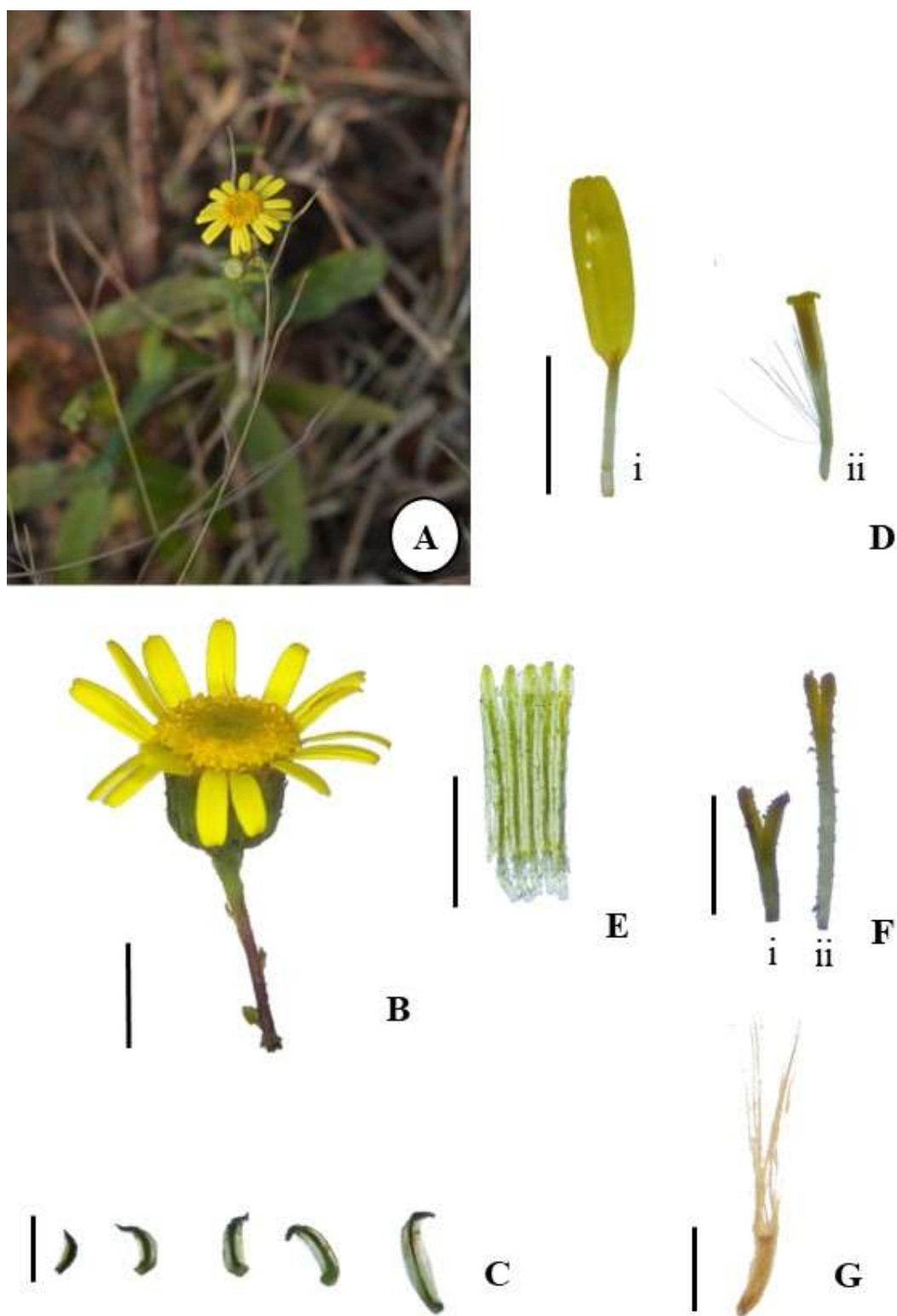


Plate 4.43 *Vicoa indica* (L.) DC. **A**- Flowering Twig; **B**- Capitulum (bar = 2 cm); **C**- Phyllary (bar = 2 mm); **D**- Floret (bar = 3 mm); **E**- Anthers (bar = 1 mm); **F**- Style (bar = 1 mm); **G**- Cypsela (bar = 1 mm) (i=RF, ii=DF).

Tribe: Coreopsideae Lindl.

Key to the Genera

- 1a. Stems are modified to phylloclade, leaves absent, ray floret fertile *Glossocardia*
- 1b. Stems are not modified to phylloclade, leaves present, ray floret sterile (2)
- 2a. Ray floret 5, cypsela not beaked *Bidens*
- 2b. Ray florets more than 5, cypsela beaked *Cosmos*

Genus: *Bidens* L., Sp. Pl. [Linnaeus] 2: 831 (1753).

Key to the Species

- 1a. Leaf biternate, leaflet ovate *B. biternata*
- 1b. Leaf bipinnate, leaflet lanceolate *B. bipinnata*

***Bidens bipinnata* L. Sp. Pl.: 832 (1753); Hajra *et al.*, Fl. of India 12: 367. (1995); Shah 369. (1978); Raghavan *et al.* 43. (1981); *Bidens pilosa* var. *bipinnata* Hook.f., Fl. Brit. India 3: 309 (1883).**

Plate 4.44

Erect herbs, 20-40 cm high. Stem branched, tetragonal, glabrous. Leaves bipinnate, opposite, ovate, 2-7 cm, margin serrate, acute, glabrescent. Capitulescence solitary. Capitula radiate, 3-5 mm in diameter. Involucre biseriate; phyllaries, linear-ovate, acute apex, 2-9 mm long, ciliate margin. Ray floret ligulate, neuter, yellow, 4-4.5 mm. Disc floret tubular, bisexual, yellow, 4-6 mm. Anthers apex acute and base subentire, 1.5-2 mm. Style apex acute, 1-1.5 mm. Cypsela fusiform, angles, hispid, 12-14 mm. Pappus barbed awns, 2-3 mm.

Common Name: Spanish Needles.

Vernacular Name: Chirchita.

Specimen: JJS 106 (Morzira).

Coordinates: 20°44'55.37" N, 73°49'38.54" E.

Origin: North America.

Associated Species: *Impatiens balsamina* L., *Oplismenus burmanni* (Retz.) P.Beauv., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Sporobolus* sp., *Celosia argentea* L.

Abundance: Occasional.

Flw-Fru: June-October.

Habitat: Roadsides and wastelands.

Distribution: Tapi, Navsari, Dang and Valsad

Taxonomic Note: This plant is similar to *B. biternata* but differs in leaflet shape.

***Bidens biternata* (Lour.) Merr. & Sherff** in Bot. Gaz. 88: 293 (1929); Hajra *et al.*, Fl. of India 12: 367. (1995); Shah 369. (1978); Raghavan *et al.* 43. (1981); Bole & Pathak, FS 2: 7. (1988); *Coreopsis biternata* Lour., Fl. Cochinch. 508 (1790).

Plate 4.45

Erect herbs, 15-30 cm high. Stem branched, tetragonal, pubescent. Leaves biternately lobed, opposite, lanceolate, 1-5 cm, margin serrate, acute, pubescent. Capitulescence solitary or dichotomous. Capitula radiate, 3-5 mm in diameter. Involucre biseriate; phyllaries, linear-obovate, acute apex, 2-9 mm long, ciliate margin. Ray floret ligulate, neuter, yellow. Disc floret tubular, bisexual, yellow. Anthers apex obtuse and base subentire. Style apex acute. Cypsela fusiform, tetragonous, glabrous. Pappus barbed awns.

Common Name: Yellow Flowered Blackjack

Vernacular Name: Karakokdi, Samara Kokdi.

Specimen: JJS 23 (Kanadu), 24 (Songadh).

Coordinates: 20°18'56.65" N, 72°50'33.86" E; 21°10'12.95" N, 73°33'06.42" E.

Origin: Africa.

Associated Species: *Alternanthera bettzickiana* (Regel) G.Nicholson, *Celosia argentea* L., *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult., *Oplismenus burmanni* (Retz.) P.Beauv., *Blumea oxyodonta* DC.

Abundance: Common.

Flw-Fru: June-December.

Habitat: Hilly areas and roadsides.

Distribution: Dang and Valsad

Genus: *Cosmos* Cav., Icon. [Cavanilles] 1(1): 9, t. 14, 79 (1791).

Key to the Species

1a. Ray floret pink *C. caudatus*

1b. Ray floret yellow or orange *C. sulphureus*

***Cosmos caudatus* Kunth** in F.W.H.von Humboldt, A.J.A.Bonpland & C.S.Kunth, Nov. Gen. Sp., ed. fol., 4: 188 (1818); *Bidens artemisiifolia* var. *caudata* (Kunth) Kuntze in Revis. Gen. Pl. 1: 321 (1891); *Bidens caudata* (Kunth) Sch.Bip. in B.Seemann, Bot. Voy. Herald: 308 (1856).

Plate 4.46

Erect herb, 30–150 cm. Stem woody from base, terete, sparsely pubescent. Leaves pinnatisect, opposite, ovate-lanceolate, 4–9 cm, margins entire, acuminate, pubescent. Capitulescence corymb. Capitula radiate, 2.5 – 3 cm across. Involucres biseriate; phyllaries oblong-lanceolate, 7–10 mm, apices of outer acute and of inner obtuse. Ray floret ligulate, neuter, 8–15 mm, rose-pink. Disc floret tubular, bisexual, 8 - 16 mm, yellow. Anther articulated, apex acute and base subentire, 1.8 – 2.1 mm. Style arm apex subulate, 1.6 – 2 mm. Cypsela ovate, 2.2 – 2.7 cm, beaked, with one central groove, glabrous or scabridulous. Pappus barbed awns, 0.5-1 mm.

Common Name: Wild Cosmos.

Vernacular Name: Jungli Cosmos.

Specimen: JJS 32 (Bhisya).

Coordinates: 20°46'07.75" N, 73°43'25.42" E.

Origin: Central America.

Associated Species: *Digitaria* sp., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Celosia argentea* L., *Tridax procumbens*, *Oplismenus burmanni* (Retz.) P.Beauv., *Haplanthodes tentaculata* (L.) R.B.Majumdar.

Abundance: Abundant.

Flw-Fru: October - March.

Habitat: Roadside and hilly areas.

Distribution: Dang and Valsad.

Taxonomic Note: This plant resembles to *C. bipinnatus* but differs in leaflet shape. Leaflet is filiform in *C. bipinnatus* while it is lanceolate in *C. caudatus*.

***Cosmos sulphureus* Cav.** Icon. 1: 56 (1791); Bole & Pathak, FS 2: 13. (1988); *Bidens sulphurea* (Cav.) Sch.Bip. in B.Seemann, Bot. Voy. Herald: 308 (1856); Hajra *et al.*, Fl. of India 12: 373. (1995); Raghavan *et al.* 43. (1981); *Cosmos artemisiifolius* (Jacq.) M.R.Almeida in Fl. Maharashtra 3A: 93 (2001).

Plate 4.47

Erect herb, 60–180 cm. Stem woody from base, terete, sparsely pubescent. Leaves pinnatisect, opposite, linear-lanceolate, 6–12 cm, margins entire, apex acuminate, pubescent. Capitulescence solitary. Capitula radiate, 3 – 5 cm across. Involucres biseriate; phyllaries ovate, 7–10 mm, apices of outer acute and of inner obtuse. Ray floret ligulate, neuter, 8–15 mm, yellow-orange. Disc floret tubular, bisexual, 8 - 16 mm, yellow-orange. Anther articulated, apex acute and base subentire, 1.8 – 2.1 mm. Style arm apex acute, 1.6 – 2 mm. Cypsela obovate, 2.2 – 2.7 cm, beaked, with one central groove, hispid. Pappus absent.

Common Name: Sulphur Cosmos or Yellow Cosmos.

Vernacular Name: Cosmos

Specimen: JJS 112 (Chikhalda).

Coordinates: 20°41'23.29" N, 73°35'5.58" E.

Origin: Central America.

Associated Species: *Tridax procumbens* L., *Commelina benghalensis* L., *Oplismenus burmanni* (Retz.) P.Beauv., *Celosia argentea* L.

Abundance: Occasional.

Flw-Fru: Throughout the year.

Habitat: Roadside (escaped).

Distribution: Dang and Valsad.

Genus: *Glossocardia* Cass., Bull. Sci. Soc. Philom. Paris 1817: 138 (1817).

Glossocardia bosvallia (L.f.) DC., Contr. Bot. India [Wight] 19 (1834).; Hajra *et al.*, Fl. of India 12: 391. (1995); Shah 381. (1978); Raghavan *et al.* 45. (1981); Bole & Pathak, FS 2: 18. (1988); *Verbesina bosvallia* L.f. in Suppl. Pl.: 379 (1782); *Glossocardia setosa* Blatt. & Hallb. in J. Bombay Nat. Hist. Soc. 26: 536 (1919); *Glossocardia linearifolia* Cass. in G.-F.Cuvier, Dict. Sci. Nat., ed. 2. 19: 62 (1821); Hook.f., Fl. Brit. India 3: 308 (1883); Cooke, FBP 2: 34. (1904).

Plate 4.48

Diffused herb, 5–12 cm. Stem branched, green, angular, glabrous. Leaves decompound, opposite, decurrent, linear, 0.5–1 cm, margins entire, apex acuminate, glabrous. Capitulescence solitary. Capitula radiate, 3–5 mm across. Involucres biseriate; phyllaries ovate-lanceolate, 7–10 mm, apex truncate. Ray floret ligulate, female, 8–15 mm, yellow. Disc floret tubular, bisexual, 8 - 16 mm, yellow. Anther apex acute and base subentire, 1.8 – 2.1 mm. Style arm apex acute, 1.6 – 2 mm. Cypsela obovate, 2.2 – 2.7 cm, pubescent. Pappus awns.

Common Name: Glossocardia

Vernacular Name: Adbau Suva.

Specimen: JJS 118 (Dabhadi).

Coordinates: 20°19'44.75" N, 73°17'57.30" E.

Origin: Indian Subcontinent.

Associated Species: *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Oplismenus burmanni* (Retz.) P.Beauv., *Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult.

Abundance: Occasional.

Flw-Fru: July-October.

Habitat: Grasslands.

Distribution: Tapi, Dang and Valsad.

Taxonomic Note: Capitulum and cypsela resembles to that of *Synedrella* but differs in habit where stem is modified to phylloclade and cladodes.

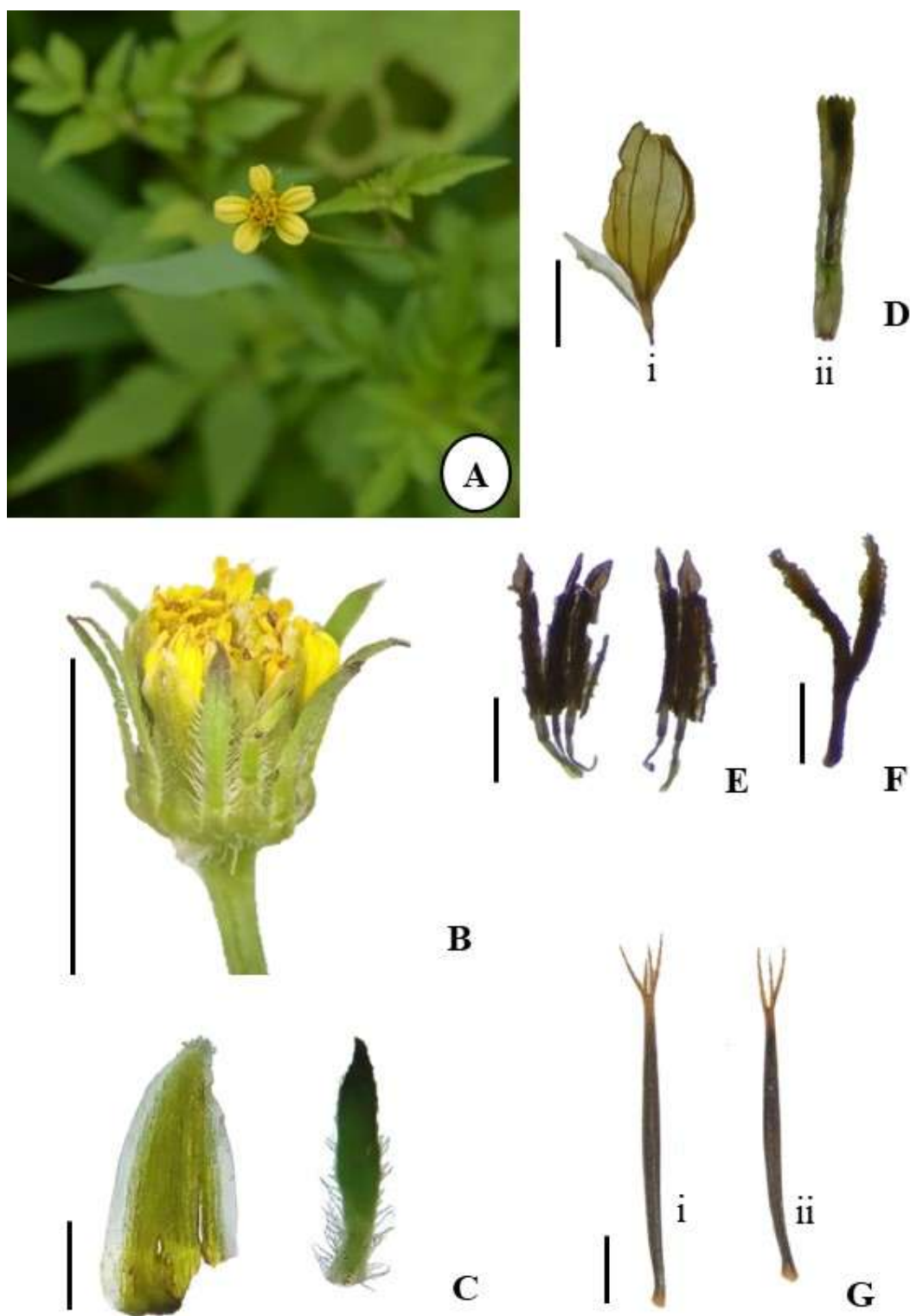


Plate 4.44 *Bidens bipinnata* L. **A**-Flowering twig ; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 2 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 3 mm) (i=RF, ii=DF).

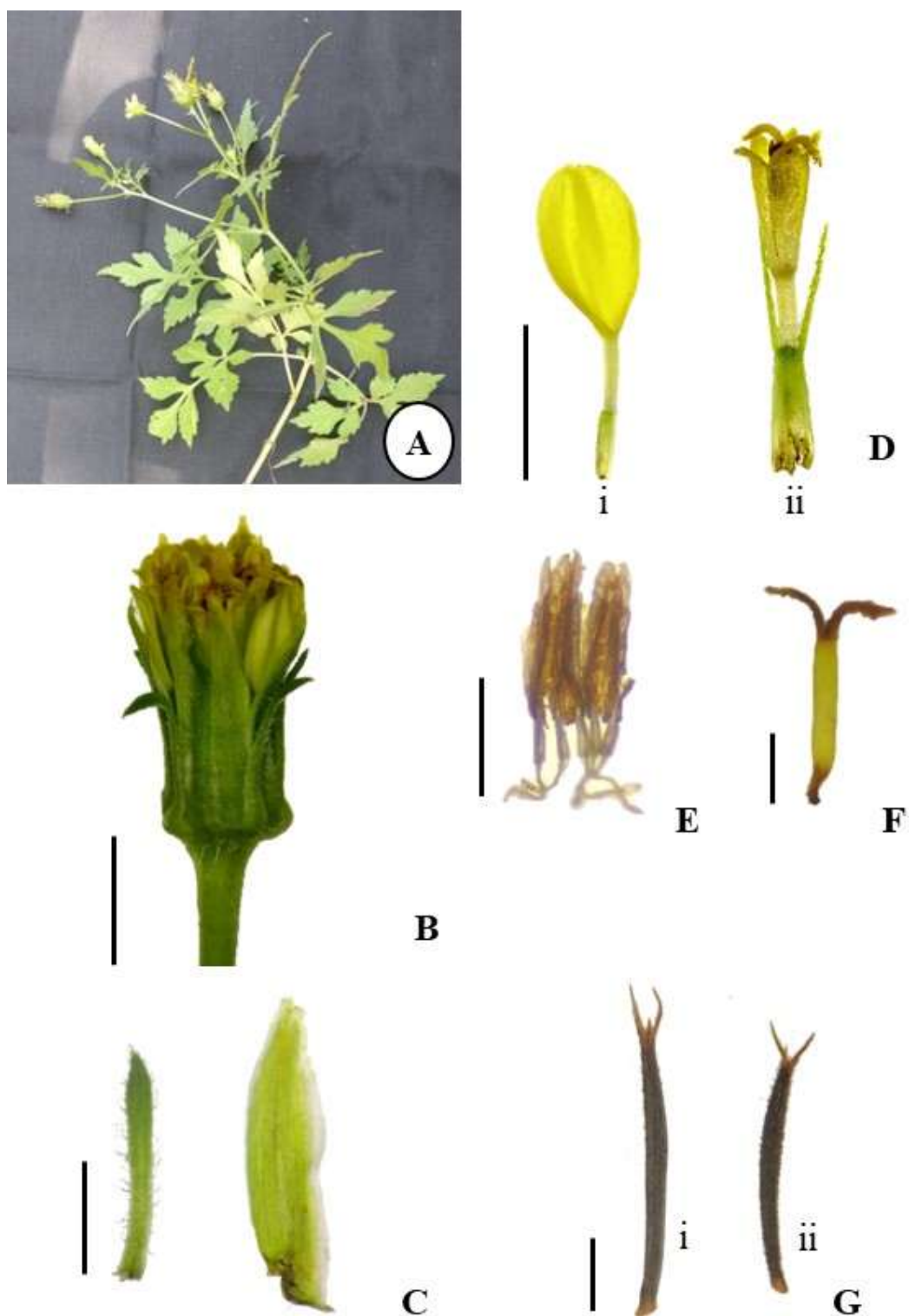


Plate 4.45 *Bidens biternata* (Lour.) Merr. & Shreff **A**-Habit; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 3 mm); **D**- Floret (bar= 5 mm); **E**- Anthers (bar= 2 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 3 mm) (i=RF, ii=DF).

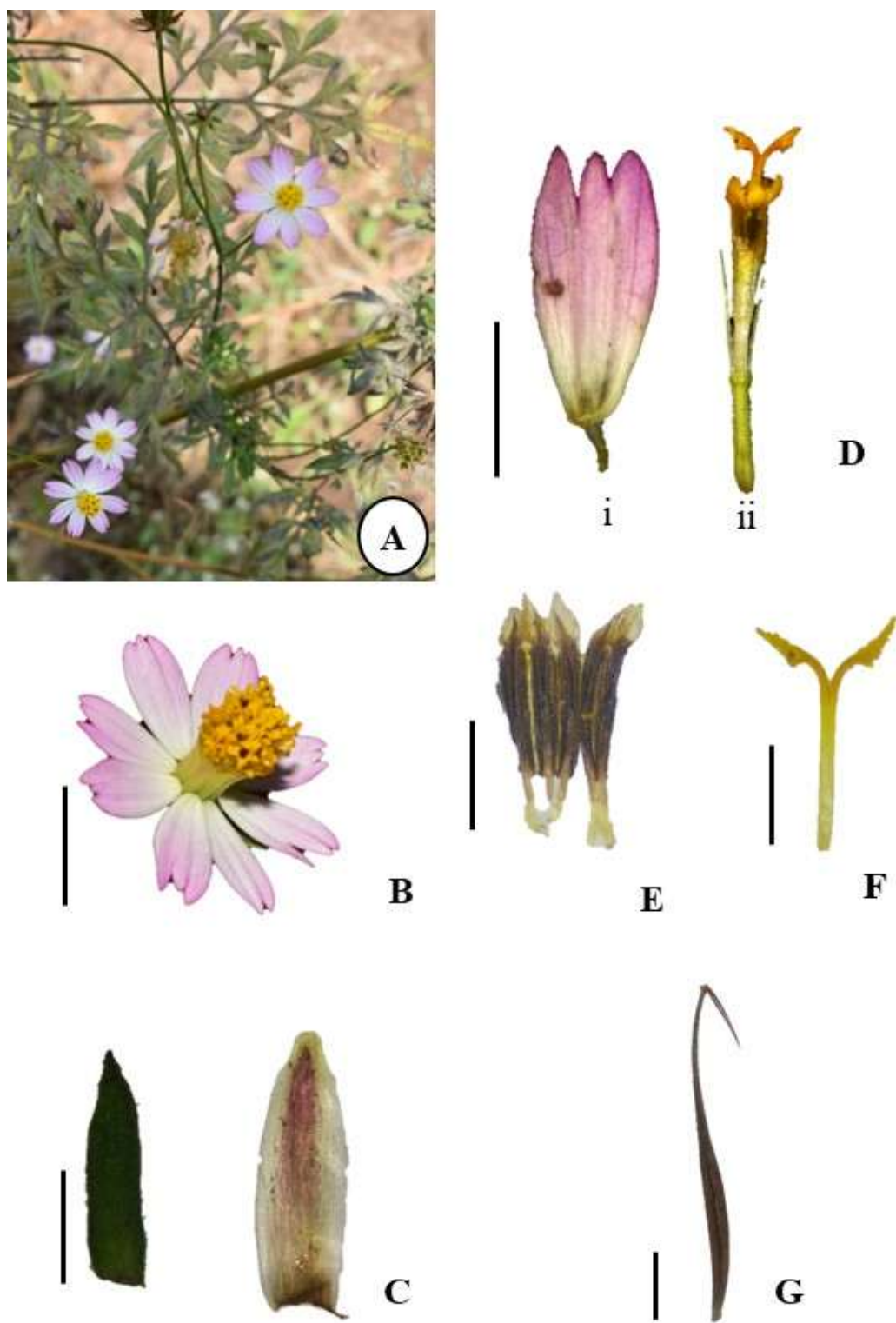


Plate 4.46 *Cosmos caudatus* Kunth **A**-Habit; **B**- Capitulum (bar= 2 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 5 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 2 mm); **G**- Cypsela (bar= 5 mm) (i=RF, ii=DF).

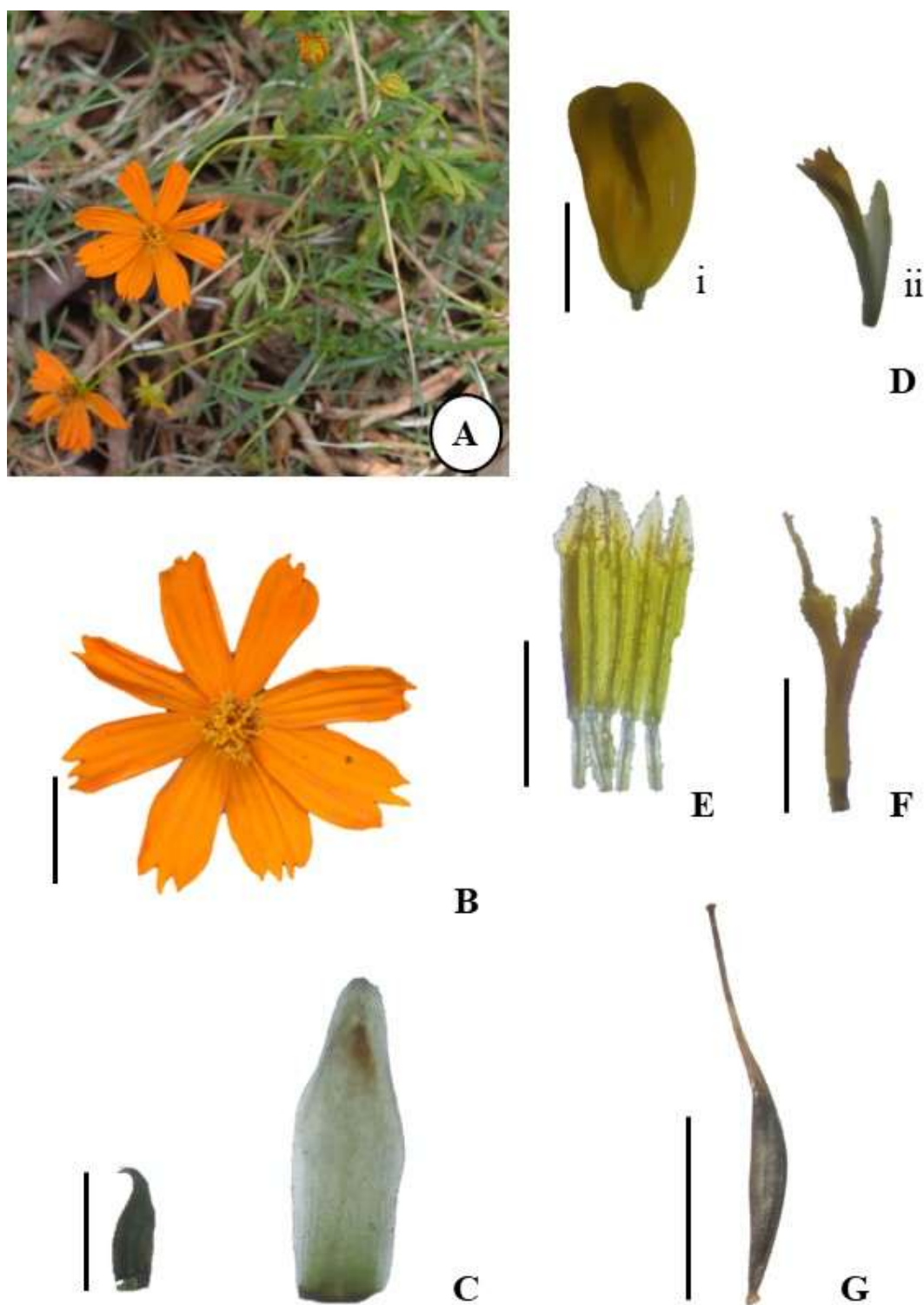


Plate 4.47 *Cosmos sulphureus* Cav. **A**-Habit; **B**- Capitulum (bar= 3 cm); **C**- Phyllary (bar= 3 mm); **D**- Floret (bar= 5 mm); **E**- Anthers (bar= 2 mm); **F**- Style (bar= 2 mm); **G**- Cypsela (bar= 8 mm) (i=RF, ii=DF).

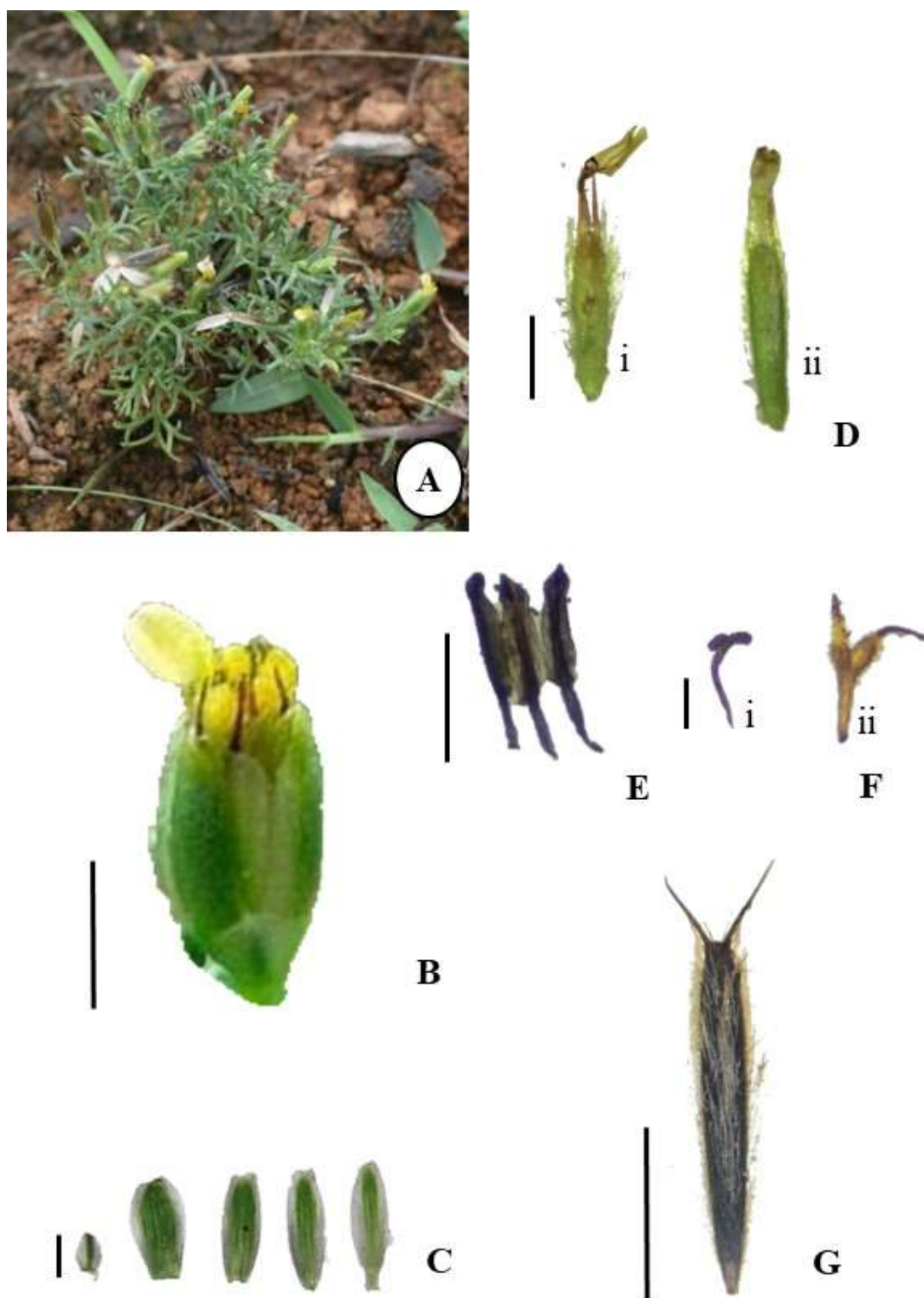


Plate 4.48 *Glossocardia bosvalia* (L.f.) DC. **A**- Habit; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 2 mm); **E**- Anthers (bar= 0.5 mm); **F**- Style (bar= 0.2 mm); **G**- Cypsela (bar= 4 mm) (i=RF, ii=DF).

Tribe: Heliantheae Cass.

Key to the Genera

- 1a. Capitula unisexual, fruit is bur *Xanthium*
- 1b. Capitula not unisexual, fruit is cypsela (2)
- 2a. Plant shrub *Tithonia*
- 2b. Plant not shrub (3)
- 3a. Pappus absent (4)
- 3b. Pappus present (7)
- 4a. Leaves decompose *Parthenium*
- 4b. Leaves not decompose (5)
- 5a. Cypsela dimorphic *Acmella*
- 5b. Cypsela monomorphic (6)
- 6a. Florets yellow, cypsela gibbous *Sclerocarpus*
- 6b. Florets white, cypsela not gibbous *Eclipta*
- 7a. Head discoid, pappus setose awns *Lagascea*
- 7b. Head radiate, pappus not setose awns (8)
- 8a. Outer or ray cypsela erose and flat *Synedrella*
- 8b. Outer or ray cypsela not erose and triangular (9)
- 9a. Florets white *Blainvillea*
- 9b. Florets yellow (10)
- 10a. Leaf trilobed *Sphagneticola*
- 10b. Leaf simple (11)
- 11a. Corolla of disc floret 5 lobed *Lipoblepharis*
- 11b. Corolla of disc floret 4 lobed *Lipochaeta*

Genus: *Acmella* Rich. ex Pers., Syn. Pl. [Persoon] 2: 472 (1807).

Key to the Species

- 1a. Head discoid (2)
- 1b. Head radiate (4)
- 2a. Head white *A. radicans*
- 2b. Head not white (3)
- 3a. Head sphearical, young florets red and mature florets yellow *A. oleracea*
- 3b. Head deltoid, all florets yellow *A. paniculata*
- 4a. Head small and ray florets 5 *A. uliginosa*
- 4b. Head large and ray florets more than 5 *A. ciliata*

***Acmella ciliata* (Kunth) Cass.,** Dict. Sci. Nat., ed. 2. [F. Cuvier] 24: 331 (1822).; *Spilanthes ciliata* Kunth in F.W.H.von Humboldt, A.J.A.Bonpland & C.S.Kunth, Nov. Gen. Sp., ed. fol., 4: 163 (1818); Hajra *et al.*, Fl. of India 12: 409. (1995).

Plate 4.49

Diffused herbs, 20–45 cm. Stem branched, terete, glabrous. Leaves simple, opposite, ovate, 2–7 cm, serrate, acute, glabrous. Capitulescence solitary. Capitula radiate, 6–10 mm across. Involucres uniseriate; phyllaries ovate, 7–10 mm, apex obtuse. Ray floret ligulate, female, 8–15 mm, yellow. Disc floret tubular, bisexual, 8 - 16 mm, yellow. Paleae present. Anther apex obtuse and base subentire, 1.8 – 2.1 mm. Style apex truncate, 1.6 – 2 mm. Cypsela dimorphic, obovate, outer trigonous and inner flat, 2.2 – 2.7 cm, ciliated margin. Pappus bristles or absent.

Common Name: Fringed Pod Toothache Plant

Vernacular Name: Akalkaro.

Specimen: JJS 105 (Talavchora).

Coordinates: 20°44'12.64" N, 73°03'29.12" E.

Origin: South America.

Associated Species: *Synedrella nodiflora* (L.) Gaertn., *Tridax procumbens* L., *Oplismenus burmanni* (Retz.) P.Beauv.

Abundance: Occasional.

Flw-Fru: December-May.

Habitat: Aquatic areas.

Distribution: Tapi, Dang and Valsad.

Taxonomic Note: This plant resembles to *A. calva* and in many literatures this plant has been misidentified as *A. calva*. This plant differs in presence of cilia on cypsela which is absent in *A. calva*.

***Acmella oleracea* (L.) R.K. Jansen**, Syst. Bot. Monogr. 8: 65 (1985); *Spilanthus oleracea* L. in Syst. Nat., ed. 12. 2: 534 (1767);; Hajra *et al.*, Fl. of India 12: 410. (1995); *Spilanthus acmella* var. *oleracea* (L.) C.B.Clarke ex Hook.f. in Fl. Brit. India 3: 307 (1883); Cooke, FBP 2: 42. (1904); *Spilanthus calva* var. *oleracea* (Jacq.) Mehrotra, Aswal & B.S.Bisht in Companion to Chopra's Gloss. Indian Medicin. Pl.: 143 (1987).

Plate 4.50

Erect herbs, 30–55 cm. Stem branched, terete, glabrous. Leaves simple, opposite, ovate, 2–7 cm, serrate, acute, pubescent. Capitulescence solitary. Capitula discoid, 15–20 mm across. Involucres uniseriate; phyllaries ovate, 7–10 mm, apex obtuse. Floret tubular, bisexual, 8 - 16 mm, young red and mature yellow. Paleae present. Anther apex obtuse and base subentire, 1.8 – 2.1 mm. Style apex truncate, 1.6 – 2 mm. Cypsela dimorphic, obovate, outer trigonous and inner flat, 2.2 – 2.7 cm, ciliated margin. Pappus bristles or absent.

Common Name: Toothache Plant

Vernacular Name: Akarkar, Marethi.

Specimen: JJS 111 (Girmal).

Coordinates: 20°58'59.71" N, 73°42'41.28" E.

Origin: Brazil.

Associated Species: *Alternanthera bettzickiana* (Regel) G.Nicholson, *Persicaria glabra* (Willd.) M.Gómez, *Cyperus rotundus* L., *Sphaeranthus indicus* L.

Abundance: Rare.

Flw-Fru: April - November.

Habitat: Forest and near aquatic areas.

Distribution: Dang (find once in wild at forest behind Girmal waterfall).

***Acmella paniculata* (Wall. ex DC.) R.K.Jansen**, Syst. Bot. Monogr. 8: 67 (1985); *Spilanthes acmella* var. *paniculata* (Wall. ex DC.) C.B.Clarke in Compos. Ind.: 139 (1876); Hook.f. in Fl. Brit. India 3: 307 (1883); *Spilanthes paniculata* Wall. ex DC. in Prodr. 5: 625 (1836); Hajra *et al.*, Fl. of India 12: 410. (1995); Raghavan *et al.* 46. (1981); Bole & Pathak, FS 2: 34. (1988).

Plate 4.51

Erect herbs, 15–30 cm. Stem branched, terete, glabrous. Leaves simple, opposite, ovate-lanceolate, 2–4 cm, entire, obtuse, glabrous. Capitulescence solitary or biparous. Capitula discoid, 15–20 mm across. Involucres biseriate; phyllaries ovate-lanceolate, 7–10 mm, apex obtuse. Floret tubular, bisexual, 8 - 16 mm, yellow. Paleae present. Anther apex obtuse and base subentire, 1.8 – 2.1 mm. Style apex truncate, 1.6 – 2 mm. Cypsela dimorphic, obovate, outer trigonous and inner flat, 2.2 – 2.7 cm, ciliated margin. Pappus awns.

Common Name: Paniced Toothache Plant.

Vernacular Name: Marethi, Akkalkara

Specimen: JJS 107 (Bheskatri).

Coordinates: 20°56'20.00" N, 73°31'32.02" E.

Origin: India and Southeast Asia.

Associated Species: *Blumea belangeriana* DC., *Sporobolus* sp. *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Acmella radicans* (Jacq.) R.K.Jansen.

Abundance: Occasional.

Flw-Fru: July - Oct.

Habitat: Roadside and Aquatic areas.

Distribution: Dang.

Taxonomic Note: This plant has solitary capitulescence and lacks ray florets.

Acmella radicans (Jacq.) R.K.Jansen, Syst. Bot. Monogr. 8: 69 (1985); *Spilanthes radicans* Jacq. in Collectanea 3: 229 (1791); Hajra *et al.*, Fl. of India 12: 412. (1995).

Plate 4.52

Erect or diffuse herbs, 8–20 cm. Stem branched, terete, glabrous. Leaves simple, opposite, ovate, 2–6 cm, entire, acute, pubescent. Capitulescence solitary or biparous. Capitula discoid, 15–20 mm across. Involucres uniseriate; phyllaries ovate, 7–10 mm, apex obtuse. Floret tubular, bisexual, 8 - 16 mm, young red mature white. Paleae present. Anther apex obtuse and base subentire, 1.8 – 2.1 mm. Style apex truncate, 1.6 – 2 mm. Cypsela dimorphic, obovate, outer trigonous and inner flat, 2.2 – 2.7 cm, ciliated margin. Pappus awned.

Common Name: White Spot-Flower

Vernacular Name: Safed Akalkaro.

Specimen: JJS 97 (Kudkas).

Coordinates: 20°47'33.14" N, 73°31'14.37" E.

Origin: Central America.

Associated Species: *Sporobolus sp.*, *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Tridax procumbens* L., *Commelina benghalensis* L., *Indigofera sp.*, *Acmella uliginosa* (Sw.) Cass.

Abundance: Common.

Flw-Fru: September-May.

Habitat: Roadside and aquatic areas.

Distribution: Tapi, Navsari, Dang and Valsad.

Acmella uliginosa (Sw.) Cass., Dict. Sci. Nat., ed. 2. [F. Cuvier] 24: 331 (1822).; *Spilanthes acmella* var. *uliginosa* (Sw.) Baker in C.F.P.von Martius & auct. suc. (eds.), Fl. Bras. 6(3): 233 (1884); *Spilanthes uliginosa* Sw. in Prodr. Veg. Ind. Occ.: 110 (1788); Hajra *et al.*, Fl. of India 12: 412. (1995).

Plate 4.53

Diffused herbs, 10–25 cm. Stem branched, terete, glabrous. Leaves simple, opposite, ovate, 2–7 cm, entire, obtuse, glabrous. Capitulescence biparous. Capitula radiate, 6–10 mm across. Involucres uniseriate; phyllaries ovate, 7–10 mm, apex obtuse. Ray floret ligulate, female, 8–15 mm, yellow. Disc floret tubular, bisexual, 8 - 16 mm, yellow. Anther apex obtuse and base subentire, 1.8 – 2.1 mm. Style apex truncate, 1.6 – 2 mm. Cypsela dimorphic, obovate, outer trigonous and inner flat, 2.2 – 2.7 cm, ciliated margin. Pappus absent.

Common Name: Marsh Para Cress.

Vernacular Name: Nani Marethi.

Specimen: JJS 95 (Tichakiya).

Coordinates: 21°03'00.15" N, 73°26'25.63" E.

Origin: South America.

Associated Species: *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Cyathocline purpurea* (Buch.-Ham. ex D.Don) Kuntze, *Acmella radicans* (Jacq.) R.K.Jansen, *Oplismenus burmanni* (Retz.) P.Beauv.

Abundance: Common.

Flw-Fru: September-May.

Habitat: Roadside and aquatic areas.

Distribution: Tapi, Navsari, Dang and Valsad.

Taxonomic Note: This plant resembles to *A. ciliata* but differs in tetralobate corolla and presence of five ray florets.

Genus: *Blainvillea* Cass., Dict. Sci. Nat., ed. 2. [F. Cuvier] 29: 493 (1823).

***Blainvillea acmella* (L.) Philipson** in Blumea 6: 350 (1950); Hajra *et al.*, Fl. of India 12: 377. (1995); Shah 370. (1978); Raghavan *et al.* 43. (1981); Bole & Pathak, FS 2: 3. (1988); *Verbesina acmella* L. in Sp. Pl.: 901 (1753); *Blainvillea latifolia* (L.f.) DC. in R.Wight, Contr. Bot. India: 17 (1834); Hook.f. in Fl. Brit. India 3: 305 (1883); *Blainvillea rhomboidea* Cass. G.-F.Cuvier, Dict. Sci. Nat., ed. 2. 29: 493 (1823); Cooke, FBP 2: 40. (1904).

Plate 4.54

Erect herbs, 50-120 cm. Stem branched, terete, pubescent-scabrid. Leaves simple, opposite, ovate, 5–12 cm, serrate, acute, pubescent. Capitulescence solitary. Capitula radiate, 10–15 mm across. Involucres biseriate; phyllaries linear-ovate, 7–10 mm, apex acute. Ray floret ligulate, female, 8–15 mm, white. Disc floret tubular, bisexual, 8 - 16 mm, white. Anther articulated, apex acute and base subentire, 1.8 – 2.1 mm. Style arm apex acute, 1.6 – 2 mm. Cypsela dimorphic, obovate, trigonous of ray floret and flat of disc floret, 2.2 – 2.7 cm, pubescent. Pappus ciliated cup with 2-3 awns.

Common Name: Para Cress.

Vernacular Name: Dholu Fuldu.

Specimen: JJS 27 (Parnera Hill).

Coordinates: 20°33'26.18" N, 72°56'42.84" E.

Origin: Indian Subcontinent.

Associated Species: *Tridax procumbens* L., *Cynodon dactylon* (L.) Pers., *Cyanthillium cinereum* (L.) H.Rob., *Euphorbia hirta* L.

Abundance: Abundant.

Flw-Fru: June - October.

Habitat: Hilly areas.

Distribution: Dang and Valsad

Taxonomic Note: Cypsela resembles to that of *Wedelia* hence this plant was included in *Wedelia* by Clarke.

Genus: *Eclipta* L., Mant. Pl. Altera 157 (286) (1771).

***Eclipta prostrata* (L.) L.** in Mant. Pl. 2: 286 (1771); Hajra *et al.*, Fl. of India 12: 381. (1995); Shah 379. (1978); Bole & Pathak, FS 2: 15. (1988); *Eclipta alba* (L.) Hassk. in Pl. Jav. Rar.: 528 (1848); Hook.f. in Fl. Brit. India 3: 304 (1883); Raghavan *et al.* 44. (1981); *Ecliptica alba* var. *prostrata* (L.) Kuntze in Revis. Gen. Pl. 1: 334 (1891); *Eclipta erecta* L. Mant. Pl. 2: 286 (1771); Cooke, FBP 2: 38. (1904).

Plate 4.55

Erect or sometimes decumbent herbs, 20-50 cm. Stem branched, terete, pubescent. Leaves simple, opposite, oblong- lanceolate, 3–10 cm, entire, acute, pubescent. Capitulescence solitary. Capitula radiate, 10–15 mm across. Involucres biseriate; phyllaries ovate-lanceolate, 7–10 mm, apex acute. Ray floret ligulate, female, 8–15 mm, white. Disc floret tubular, bisexual, 8 - 16 mm, white. Anther apex obtuse and base sagittate, 1.8 – 2.1 mm. Style apex obtuse, 1.6 – 2 mm. Cypsela obovoid, 2.2 – 2.7 cm, surface with warty excrescence. Pappus ciliated cup with awns.

Common Name: False Daisy.

Vernacular Name: Bhringaraj, Bhangro.

Specimen: JJS 116 (Palsana), 117 (Mahal).

Coordinates: 21°05'09.05" N, 72°57'50.62" E; 20°54'31.74", 73°38'35.48" E.

Origin: Central and South America.

Associated Species: *Phyllanthus niruri* L., *Desmodium triflorum* (L.) DC., *Alternanthera bettzickiana* (Regel) G.Nicholson, *Boerhavia diffusa* L.

Abundance: Common.

Flw-Fru: Throughout the year.

Habitat: Grasslands, wastelands and aquatic areas.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: Cypsela possess transparent layer of warty excrescence.

Genus: *Lagascea* Cav., Anales Ci. Nat. 6: 331 (1803), nom. et orth. cons.

***Lagascea mollis* Cav.** in Anales Ci. Nat. 6: 332 (1803); Hook.f. in Fl. Brit. India 3: 302 (1883); Hajra *et al.*, Fl. of India 12: 397. (1995); Cooke, FBP 2: 36. (1904); Shah 385. (1978); Raghavan *et al.* 45. (1981); Bole & Pathak, FS 2: 24. (1988).

Plate 4.56

Decumbent or erect herbs, 60-120 cm. Stem branched, terete, tomentose. Leaves simple, opposite, ovate, 2–5 cm, undulate, acute, tomentose. Capitulescence solitary. Capitula discoid, 15–20 mm across. Involucres uniseriate; phyllaries obovate-lanceolate, 7–10 mm, apex acute. Floret tubular, bisexual, 8 - 16 mm, white. Anther apex obtuse and base sagittate, 1.8 – 2.1 mm. Style apex acute, 1.6 – 2 mm. Cypsela obovate, tetragonous, 2.2 – 2.7 cm, tomentose. Pappus setose awns.

Common Name: Silk Leaf.

Vernacular Name: Jharwad.

Specimen: JJS 119 (Udhna).

Coordinates: 21°09'32.29" N, 72°47'06.27" E.

Origin: Central and South America.

Associated Species: *Tridax procumbens* L., *Euphorbia hirta* L., *Apluda mutica* L., *Digitaria adscendens* (Kunth) Henrard, *Dichanthium annulatum* (Forssk.) Stapf.

Abundance: Occasional.

Flw-Fru: September-May.

Habitat: Westlands, aquatic areas and agricultural fields.

Distribution: Surat and Valsad.

Taxonomic Note: Capitulum appears like that of *Elephantopus* but here the capitulum is simple while in *Elephantopus* it is compound.

Genus: *Lipoblepharis* Orchard, Nuytsia 23: 438 (2013).

***Lipoblepharis urticifolia* subsp. *urticifolia* (Blume) Orchard** in Nuytsia 23: 440 (2013); *Verbesina urticifolia* Blume in Bijdr. Fl. Ned. Ind.: 911 (1826); *Wedelia montana* var. *wallichii* (Less.) H.Koyama in Acta Phytotax. Geobot. 36: 168 (1985); Hajra *et al.*, Fl. of India 12: 424. (1995); *Wedelia urticifolia* var. *wallichii* (Less.) DC. in R.Wight, Contr. Bot. India: 18 (1834); Cooke, FBP 2: 41. (1904); Shah 400. (1978); Raghavan *et al.* 47. (1981); *Wedelia wallichii* Less. in Linnaea 6: 162 (1831); Hook.f. in Fl. Brit. India 3: 307 (1883).

Plate 4.57

Suffrutescent, 40-90 cm. Stem branched, terete, Hispid. Leaves simple, opposite, ovate, 5–12 cm, serrate, acute, hispid. Capitulescence solitary. Capitula radiate, 10–15 mm across. Involucres biseriata; phyllaries ovate-lanceolate, 7–10 mm, apex acute. Ray floret ligulate, female, 8–15 mm, yellow. Disc floret tubular, bisexual, 8 - 16 mm, yellow. Paleae present. Anther articulated, apex obtuse and base sagittate, 1.8 – 2.1 mm. Style arm apex acute, 1.6 – 2 mm. Cypselas obovate, trigonous of ray floret and flat of disc floret, 2.2 – 2.7 cm, glabrous. Pappus cup in ray floret and ciliated ring in disc floret.

Common Name: Nettle Leaved Wedelia

Vernacular Name: Solanki.

Specimen: JJS 1 (Pindval).

Coordinates: 20°29'59.42" N, 73°19'52.05" E.

Origin: India and Southeast Asia.

Associated Species: *Synedrella nodiflora* (L.) Gaertn., *Trichodesma zeylanicum* (Burm.f.) R.Br., *Blumea oxyodonta* DC., *Commelina benghalensis* L.

Abundance: Restricted.

Flw-Fru: September-November.

Habitat: Hilly areas.

Distribution: Valsad (Wilson Hills).

Genus: *Lipochaeta* DC., Prodr. [A. P. de Candolle] 5: 610, partim. (1836).

***Lipochaeta lobata* subsp. *lobata* W.L.Wagner & H.Rob.**, Brittonia 53(4): 547 (2002).
Lipochaeta lobata var. *lobata* O.Deg. & Sherff in Bot. Gaz. 95: 92 (1933). *Lipochaeta lobata* (Gaud.) DC. in Prodr. 5:611. (1836). *Verbesina lobata* Gaud, in L.C.D. de Freycinet (ed.), Voyage Autour de Monde, Botanique 4:464. (1829). *Lipotriche australis* Less. Linnæa 6:510. (1831). *Lipochaeta australis* var. *lobata* (Gaud.) A. Gray, Proc. Amer. Acad. Arts 5:129. (1861).

Plate 4.58

Lianas, 1-3 m. Stem branched, terete, pubescent. Leaves simple, opposite, ovate-oblong, 4-10 cm, serrate, acute, hispid. Capitulescence solitary. Capitula radiate, 3-5 cm across. Involucres biseriata; phyllaries ovate-lanceolate, 4-7 mm, apex acute. Ray floret ligulate, female, 10-14 mm, yellow. Disc floret tubular, bisexual, 8-10 mm, yellow. Paleae present. Anther articulated, apex obtuse and base subentire, 2.5-3 mm. Style arm apex acute. Cypsela obovate, trigonous of ray floret and flat of disc floret, 3-5 mm, glabrous. Pappus ciliated ring.

Common Name: Scendent Wedelia.

Vernacular Name: Patlo Solanki.

Specimen: JJS 87 (Malegaon).

Coordinates: 20°35'33.68" N, 73°45'12.91" E.

Origin: Hawaii.

Associated Species: *Apluda mutica* L., *Argemone mexicana* L., *Trichodesma zeylanicum* (Burm.f.) R.Br., *Blumea oxyodonta* DC., *Sonchus oleraceus* L., *Crassocephalum crepidioides* (Benth.) S.Moore.

Abundance: Restricted.

Flw-Fru: October-December

Habitat: Hilly areas.

Distribution: Dang (Malegaon-Saputara)

Taxonomic Note: This resembles to *L. urticifolia* but differs in climbing habit, ovate leaf and tetra lobed corolla tube.

Genus: *Parthenium* L., Sp. Pl. 2: 988 (1753).

***Parthenium hysterophorus* L.** in Sp. Pl.: 988 (1753); Hajra *et al.*, Fl. of India 12: 403. (1995); Shah 388. (1978); Raghavan *et al.* 46. (1981).

Plate 4.59

Erect herbs, 40-110 cm. Stem branched, ribbed, pubescent. Leaves simple, alternate, decompose, 8–15 cm, entire, obtuse, pubescent. Capitulescence corymb. Capitula radiate, 3–5 mm across. Involucres uniseriate; phyllaries oblong-lanceolate, 7–10 mm, apex obtuse. Ray floret ligulate, female, 8–15 mm, white. Disc floret tubular, bisexual (functionally male), 8–16 mm, white. Anther apex obtuse and base subentire, 1.8 – 2.1 mm. Style apex of ray floret obtuse and undivided in disc floret, 1.6 – 2 mm. Cypsela only produced by ray floret, obovoid, 2.2 – 2.7 cm, trigonous, glabrous. Pappus absent.

Common Name: Congress grass

Vernacular Name: Gajar ghas

Specimen: JJS 121 (Maroli).

Coordinates: 21°01'37.29" N, 72°52'14.88" E.

Origin: Central and South America.

Associated Species: *Boerhavia diffusa* L., *Themeda triandra* Forssk., *Commelina benghalensis* L., *Cynodon dactylon* (L.) Pers., *Sporobolus* sp.

Abundance: Common.

Flw-Fru: Throughout year.

Habitat: Grasslands, wastelands and agricultural fields.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: Ray florets produce cypsela.

Genus: *Sclerocarpus* Jacq., Syst. Veg., ed. 14 (J. A. Murray). 783 (1784).

***Sclerocarpus africanus* Jacq.** in J.A.Murray (ed.), Syst. Veg., ed. 14.: 783 (1784); Hajra *et al.*, Fl. of India 12: 405. (1995); Cooke, FBP 2: 39. (1904); Shah 392. (1978); Raghavan *et al.* 46. (1981); Hook.f. in Fl. Brit. India 3: 305 (1883); Bole & Pathak, FS 2: 31. (1988).

Plate 4.60

Erect or decumbent herbs, 20-80 cm high. Stem branched, striated, pubescent. Leaves simple, alternate-opposite, ovate, 1-5 cm, serrate, acute, scabrid. Capitulescence solitary. Capitula radiate, 10-15 mm in diameter. Involucre uniseriate; phyllaries, linear-oblong, obtuse apex, 2-9 mm long, ciliate margin. Ray floret ligulate, female, yellow, 6-7 mm. Disc floret tubular, bisexual (functionally male), 8 - 16 mm, yellow. Anthers apex appendiculate and base subentire, 1-2 mm. Style apex acute, 0.5-1 mm. Cypsela obovoid, gibbous, pubescent. Pappus cup or tubular.

Common Name: African Bonebract

Vernacular Name: Videshi Jahr.

Specimen: JJS 25 (Bardipada).

Coordinates: 20°59'10.83" N, 73°37'32.02" E.

Origin: Africa.

Associated Species: *Barleria prattensis* Santapau, *Blainvillea acmella* (L.) Philipson, *Ruellia tuberosa* L., *Bidens biternata* (Lour.) Merr. & Sherff.

Abundance: Occasional.

Flw-Fru: August-October.

Habitat: Hilly areas and forests.

Distribution: Tapi, Navsari, Dang and Valsad.

Taxonomic Note: Ray florets produce cypsela and has gibbous condition.

Genus: *Sphagneticola* O.Hoffm., Notizbl. Königl. Bot. Gart. Berlin 3: 36 (1900).

Sphagneticola trilobata (L.) Pruski in Mem. New York Bot. Gard. 78: 114 (1996); *Silphium trilobatum* L. in Syst. Nat., ed. 10. 2: 1233 (1759); *Wedelia trilobata* (L.) Hitchc. in Rep. (Annual) Missouri Bot. Gard. 4: 99 (1893); Hajra *et al.*, Fl. of India 12: 426. (1995).

Plate 4.61

Diffuse herbs, 40-90 cm, rooting from nodes. Stem branched, terete, pubescent. Leaves simple, opposite, trilobed, ovate-lanceolate, 3-7 cm, serrate, acute, sparsely pubescent. Capitulescence solitary. Capitula radiate, 2-4 cm across. Involucres biseriate; phyllaries lanceolate-oblong, 4-7 mm, apex acute. Ray floret ligulate, female, 10-14 mm, yellow. Disc floret tubular, bisexual, 8-10 mm, yellow. Paleae present. Anther apex obtuse and base subentire, 2.5-3 mm. Style apex acute. Cypsela obovate, trigonous of ray floret and flat of disc floret, 3-5 mm, glabrous. Pappus ciliated cup.

Common Name: Creeping daisy

Vernacular Name: Solanki.

Specimen: JJS 129 (Vadkhambha).

Coordinates: 20°27'02.07" N, 73°08'58.04" E.

Origin: Central and South America.

Associated Species: *Euphorbia hirta* L., *Desmodium triflorum* (L.) DC., *Boerhavia diffusa* L., *Synedrella nodiflora* (L.) Gaertn.

Abundance: Rare.

Flw-Fru: June - Sept.

Habitat: Wastelands and aquatic areas (escaped).

Distribution: Valsad.

Genus: *Synedrella* Gaertn., Fruct. Sem. Pl. 2: 456 (1791).

***Synedrella nodiflora* (L.) Gaertn.** in Fruct. Sem. Pl. 2: 456 (1791); Hook.f. in Fl. Brit. India 3: 308 (1883); Hajra *et al.*, Fl. of India 12: 413. (1995); Shah 395. (1978); *Verbesina nodiflora* L. in Cent. Pl. I: 28 (1755).

Plate 4.62

Erect herbs, 20-80 cm. Stem dichotomously branched, terete, pubescent. Leaves simple, opposite, ovate, 6-8 cm, serrate, acute, sparsely pubescent. Capitulescence solitary. Capitula radiate, 5-8 mm across. Involucres biseriate; phyllaries ovate-oblong, 4-7 mm, apex obtuse. Ray floret ligulate, female, 10-14 mm, yellow. Disc floret tubular, bisexual, 8-10 mm, yellow. Anther articulated, apex obtuse and base subentire, 2.5-3 mm. Style apex acute. Cypsela obovate, flat, erose margin in ray floret, 3-5 mm, glabrous. Pappus awns.

Common Name: Nodeweed.

Vernacular Name: Lilo Jahr

Specimen: JJS 45 (Kalibel).

Coordinates: 20°55'58.24" N, 73°34'34.79" E.

Origin: Central and South America.

Associated Species: *Boerhavia diffusa* L., *Phyllanthus niruri* L., *Alternanthera bettzickiana* (Regel) G.Nicholson, *Euphorbia hirta* L.

Abundance: Common.

Flw-Fru: July-December.

Habitat: Marshy places and forest.

Distribution: Dang and Valsad.

Taxonomic Note: Margin of cypsela is erose.

Genus: *Tithonia* Desf. ex Juss., Gen. Pl. [Jussieu] 189 (1789).

***Tithonia diversifolia* (Hemsl.) A.Gray** in Proc. Amer. Acad. Arts 19: 5 (1883); *Mirasolia diversifolia* Hemsl. in Biol. Cent.-Amer., Bot. 2: 168 (1881); Hajra *et al.*, Fl. of India 12: 416. (1995).

Plate 4.63

Shrubs, 3–5 m. Stem branched, woody, terete, glabrous. Leaves simple, opposite, palmately lobed, 9–17 cm, margins serrate, apex acute, hispid. Capitulescence solitary. Capitula radiate, 8–12 cm across. Involucres biseriate; phyllaries ovate-oblong, 7–10 mm, apices of outer acute and of inner obtuse, persistent. Ray floret ligulate, neuter, 8–15 mm, yellow-orange. Disc floret tubular, bisexual, 8 - 16 mm, yellow-orange. Paleae present. Anther articulated, apex obtuse and base subentire, 1.8 – 2.1 mm. Style arm apex acute, 1.6 – 2 mm. Cypsela obovoid, angled, 2.2 – 2.7 cm, glabrous. Pappus scales with awns.

Common Name: Giant Mexican Sunflower

Vernacular Name: Moti Surajmukhi.

Specimen: JJS 67 (Valsad).

Coordinates: 20°37'06.67" N, 72°56'05.97" E.

Origin: Central America.

Associated Species: *Digitaria adscendens* (Kunth) Henrard, *Apluda mutica* L., *Oplismenus burmanni* (Retz.) P.Beauv., *Hyptis suaveolens* (L.) Poit.

Abundance: Rare.

Flw-Fru: September-May.

Habitat: Roadside and railway tracks.

Distribution: Dang and Valsad

Genus: *Xanthium* L., Sp. Pl. 2: 987 (1753).

***Xanthium strumarium* L.** in Sp. Pl.: 987 (1753); Hook.f. in Fl. Brit. India 3: 303 (1883); Cooke, FBP 2: 37. (1904); Shah 400. (1978); Raghavan *et al.* 47. (1981); Bole & Pathak, FS

2: 40. (1988); *Xanthium indicum* J. Koenig ex Roxb. in Fl. Ind., ed. 1832. 3: 601 (1832); Hajra *et al.*, Fl. of India 12: 427. (1995).

Plate 4.64

Erect herbs, 0.6 to 1.5 m tall. Leaves simple, alternate, ovate-cordate or palmately lobed, 5 - 12 cm, irregularly serrate, acute, hispid. Capitulescence spike; male capitula on top and female capitula on bottom. Male Capitula discoid, 5 - 9 mm across; female capitula discoid, 2-3 cm long. Involucre in male uniseriate; phyllaries lanceolate-ovate, 2 - 3 mm long, acute, pubescent; in female phyllaries are modified to spiny hooks. Male florets tubular, green; female florets two, without corolla. Stamens monodelphous; anthers 3, apex truncate and base subentire. Style apex acute. Infructescence is bur consisting of two cypselas surrounded by spiny hooked involucre; cypselas ovate, 1 - 1.5 x 2 - 3.5 mm, glabrous. Pappus absent.

Common Name: Common Cocklebur

Vernacular Name: Gokhru, Gadariyu.

Specimen: JJS 133 (Sanjan).

Coordinates: 20°11'33.43" N, 72°48'24.75" E.

Origin: Asia.

Associated Species: *Argemone mexicana* L., *Boerhavia diffusa* L., *Datura innoxia* Mill., *Euphorbia hirta* L., *Martynia annua* L.

Abundance: Common.

Flw-Fru: Throughout the year.

Habitat: Wastelands, grasslands, roadsides, cultivated fields and aquatic areas.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Taxonomic Note: Male and female capitula are separated, stamens are monodelphous not syngeneious, fruit is bur not cypselas.

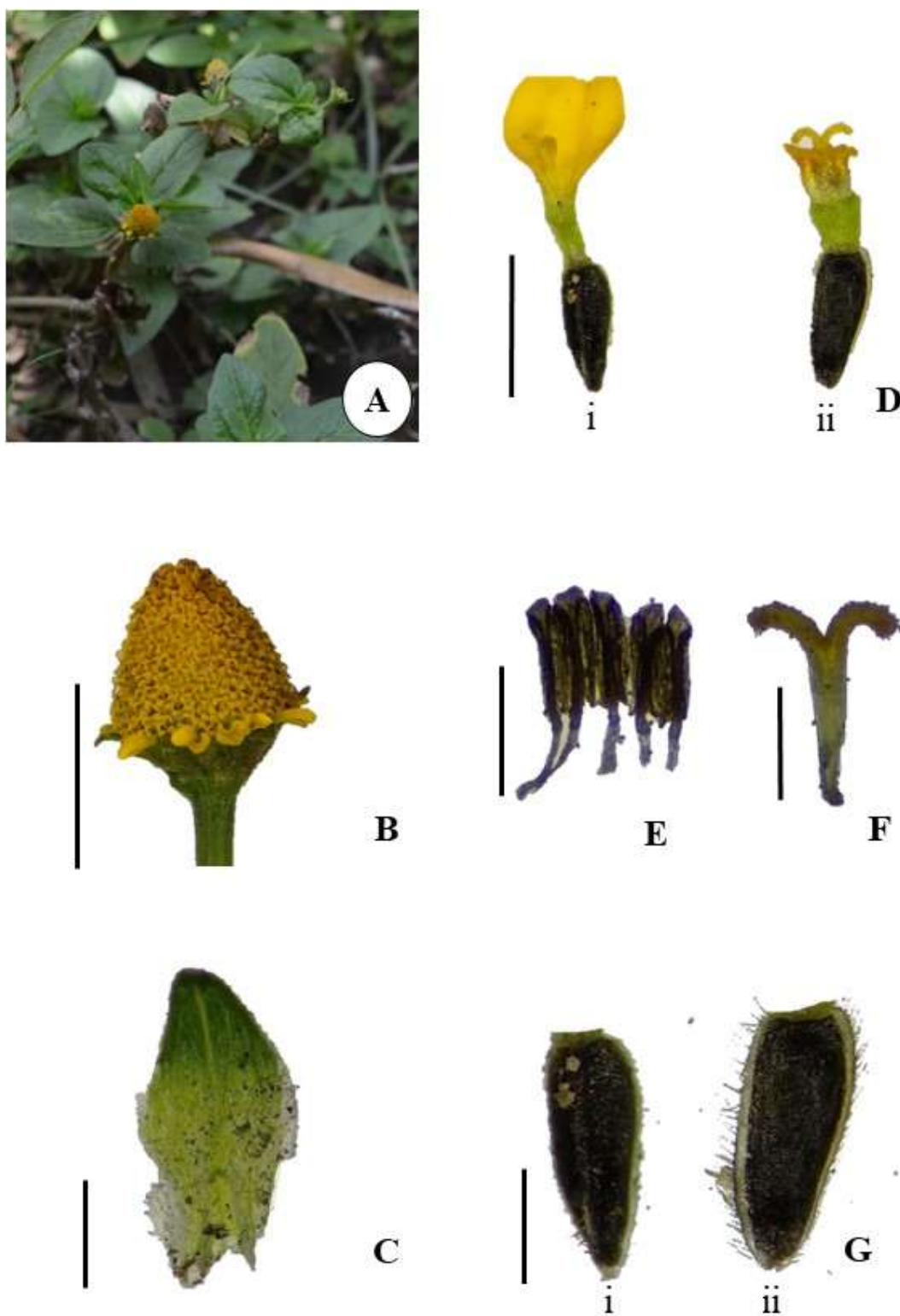


Plate 4.49 *Acmella ciliata* (Kunth) Cass. **A**-Habit; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 1.5 mm); **D**- Floret (bar= 1.5 mm); **E**- Anthers (bar= 0.5 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 2 mm) (i=RF, ii=DF).

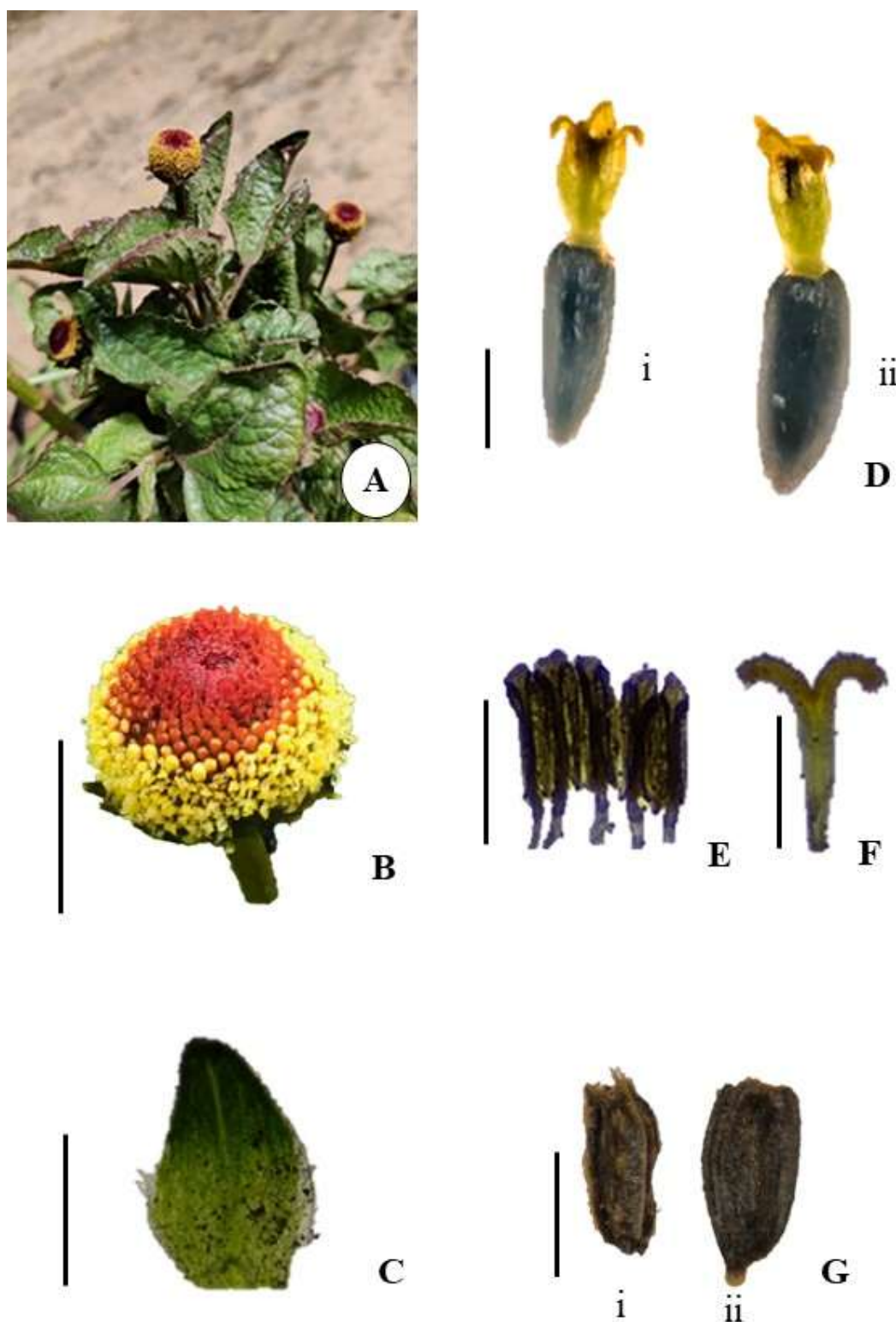


Plate 4.50 *Acmella oleracea* (L.) R.K.Jansen **A**-Habit ; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 5 mm); **D**- Floret (bar= 3 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 2 mm) (i=OF, ii=IF).

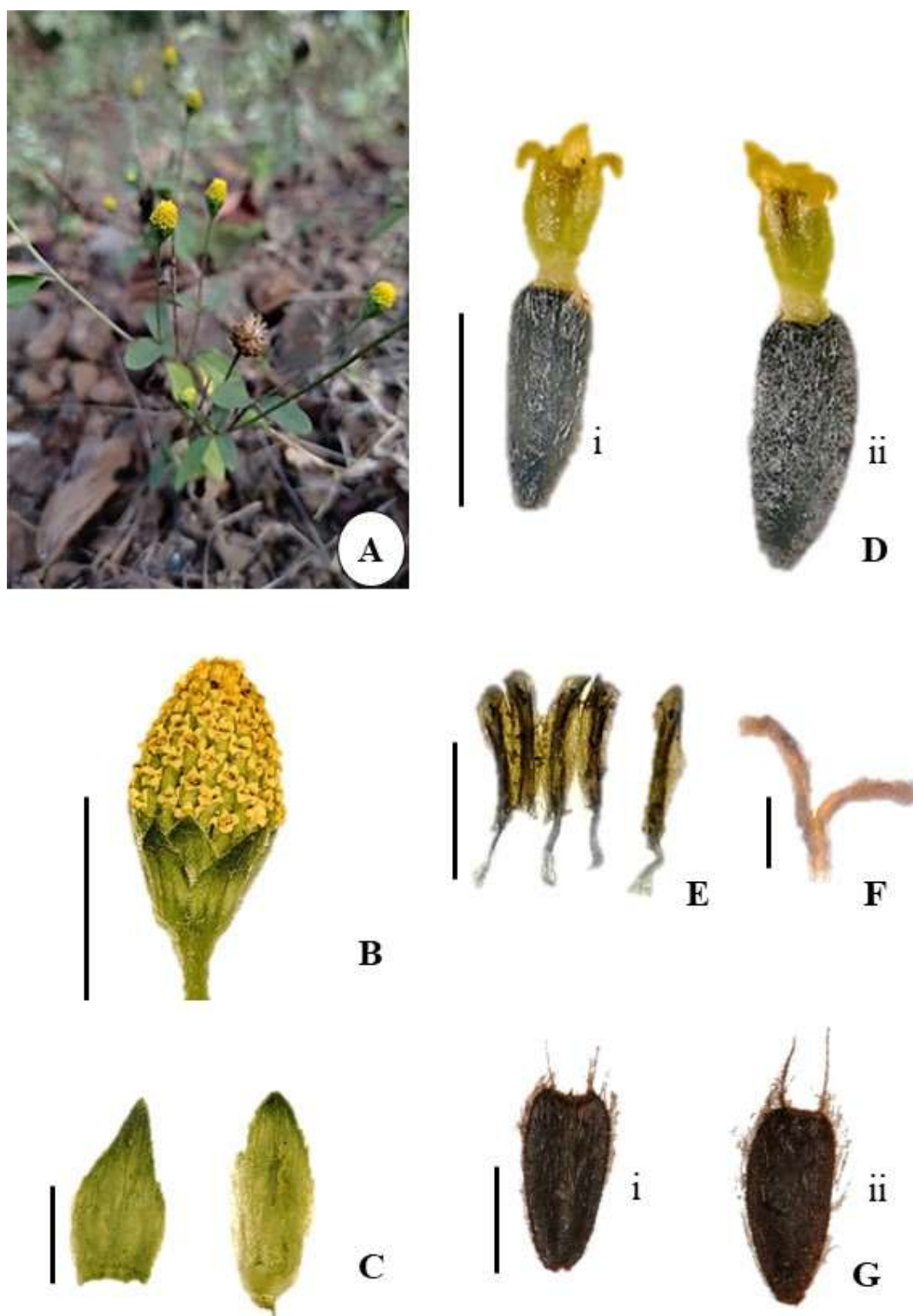


Plate 4.51 *Acmella paniculata* (Wall.ex DC) R.K.Jansen **A**-Habit ; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 5 mm); **D**- Floret (bar= 4 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 2 mm) (i=OF, ii=IF).

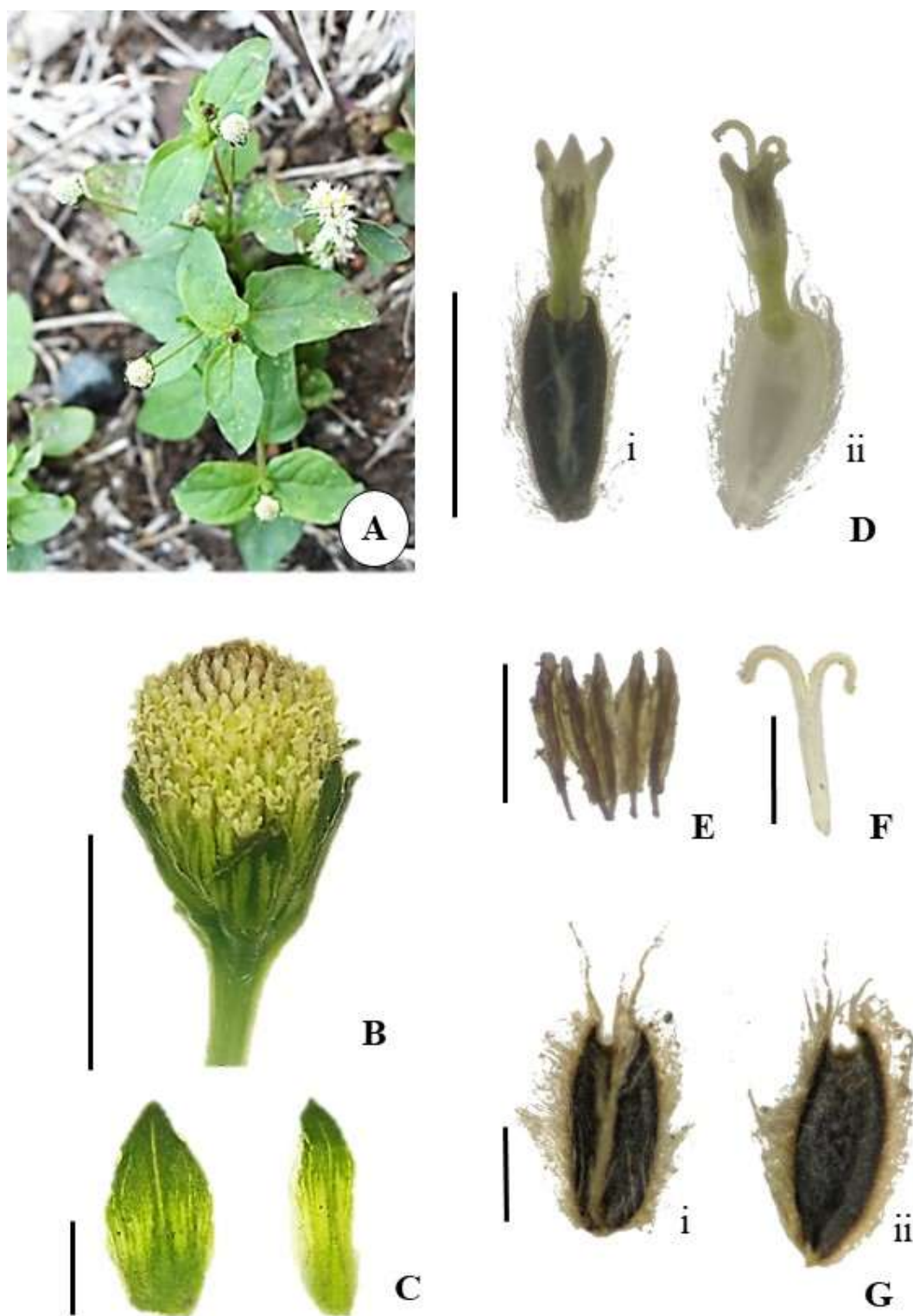
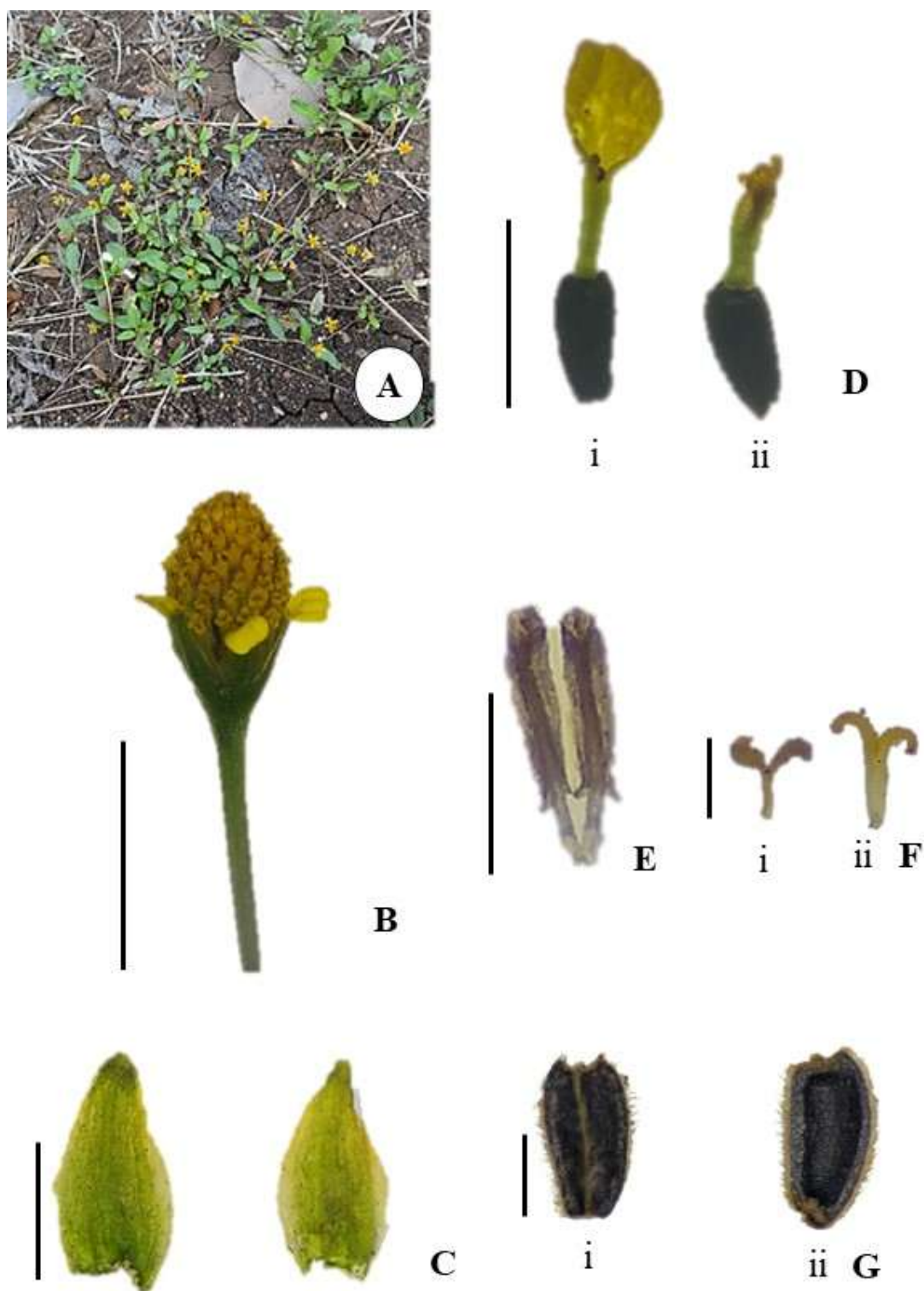


Plate 4.52 *Acemella radicans* (Jacq.) R.K.Jansen **A**-Habit; **B**- Capitulum (bar= 0.4 cm); **C**- Phyllary (bar= 3 mm); **D**- Floret (bar= 3 mm); **E**- Anthers (bar= 0.5 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 1 mm) (i=OF, ii=IF).



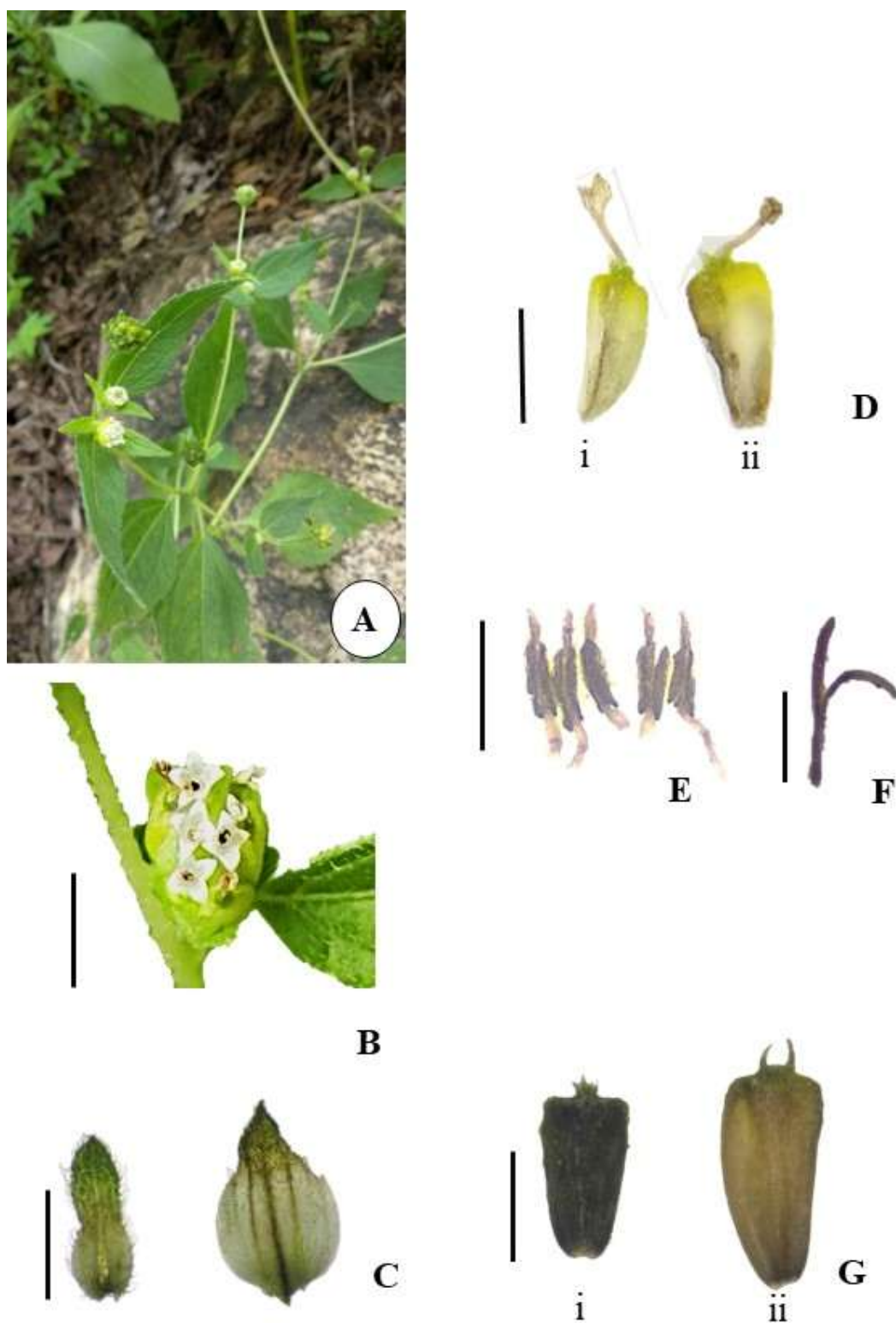


Plate 4.54 *Blainvillea acmella* (L.) Philipson. **A**-Flowering twig; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 2 mm); **E**- Anthers (bar = 0.5 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 2 mm) (i=RF, ii=DF).

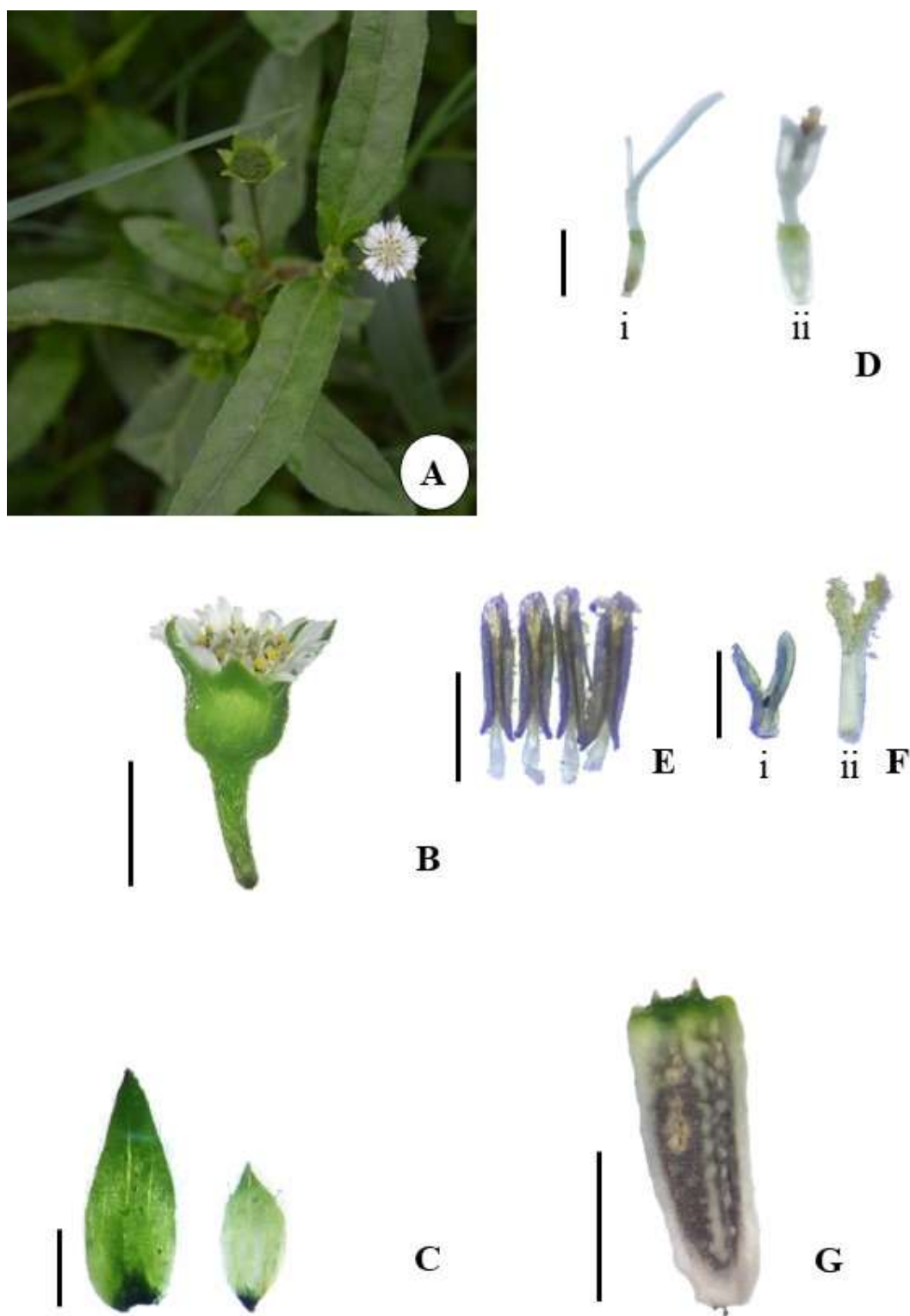


Plate 4.55 *Eclipta prostate* (L.) L. **A**-Flowering twig; **B**- Capitulum (bar= 0.3 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 1 mm); **E**- Anthers (bar= 0.5 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 1 mm) (i=RF, ii=DF).

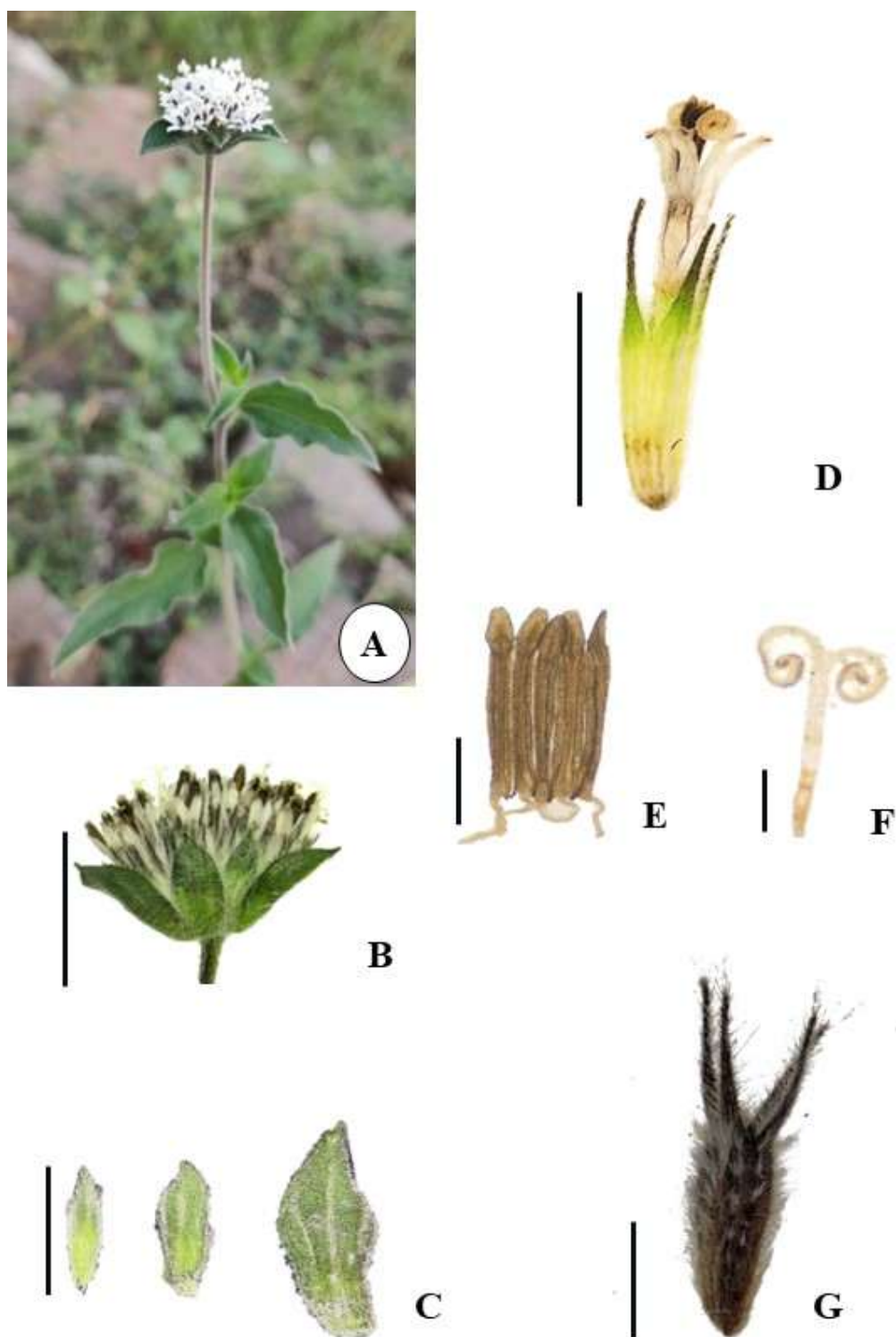


Plate 4.56 *Lagascea mollis* Cav. **A**-Flowering twig; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 5 mm); **D**- Floret (bar= 5 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 2 mm).

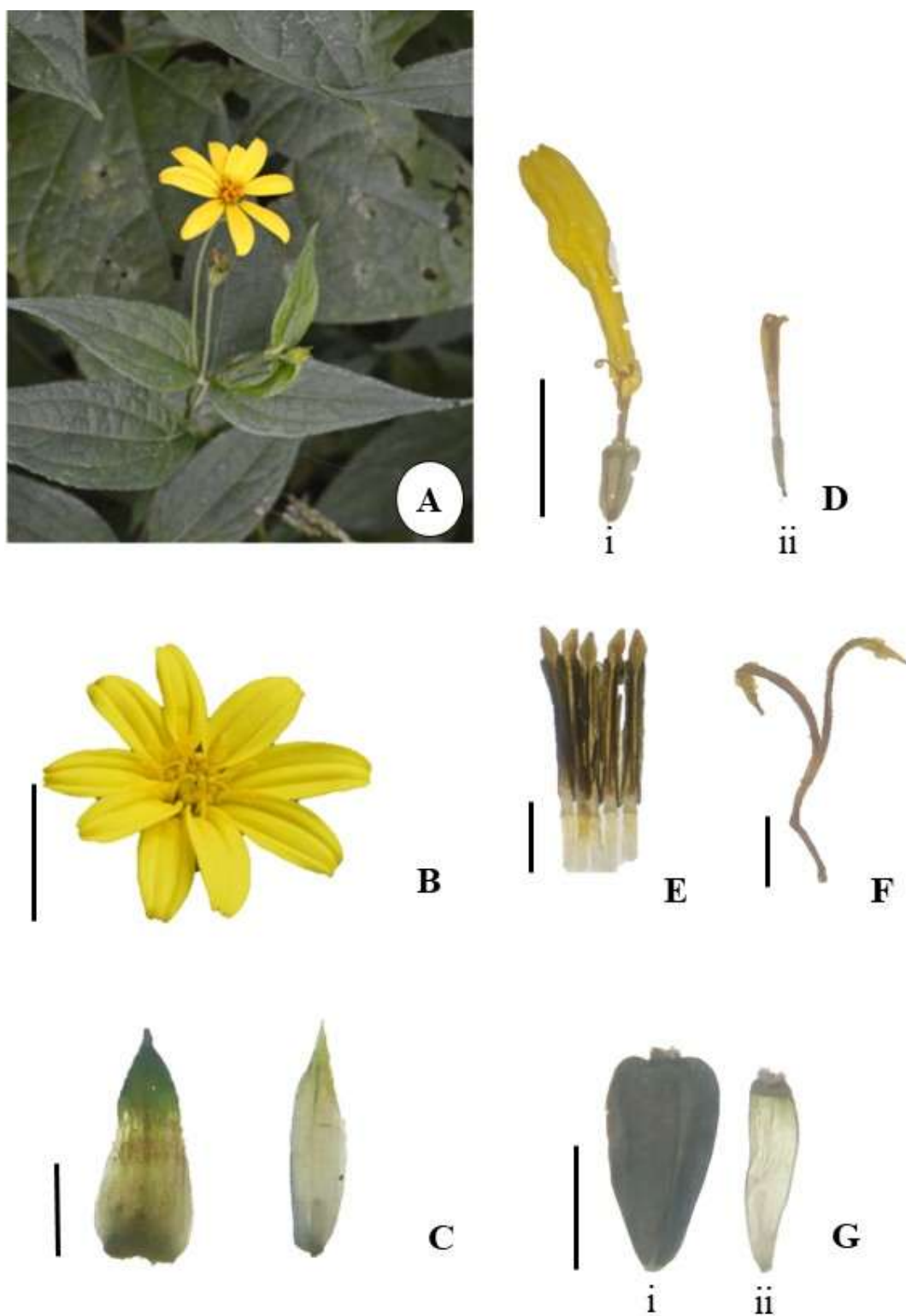


Plate 4.57 *Lipoblepharis urticifolia* (Blume) Orchard A-Habit; B- Capitulum (bar= 1 cm); C- Phyllary (bar= 3 mm); D- Floret (bar= 6 mm); E- Anthers (bar= 1 mm); F- Style (bar= 1 mm); G- Cypsela (bar= 2 mm) (i=RF, ii=DF).



Plate 4.58 *Lipochaeta lobata* (Gaudich.) DC. A-Flowering twig; B- Capitulum (bar= 1 cm); C- Phyllary (bar= 5 mm); D- Floret (bar= 5 cm); E- Anthers (bar= 1 mm); F- Style (bar= 1 mm); G- Cypsela (bar= 2 mm) (i=RF, ii=DF).

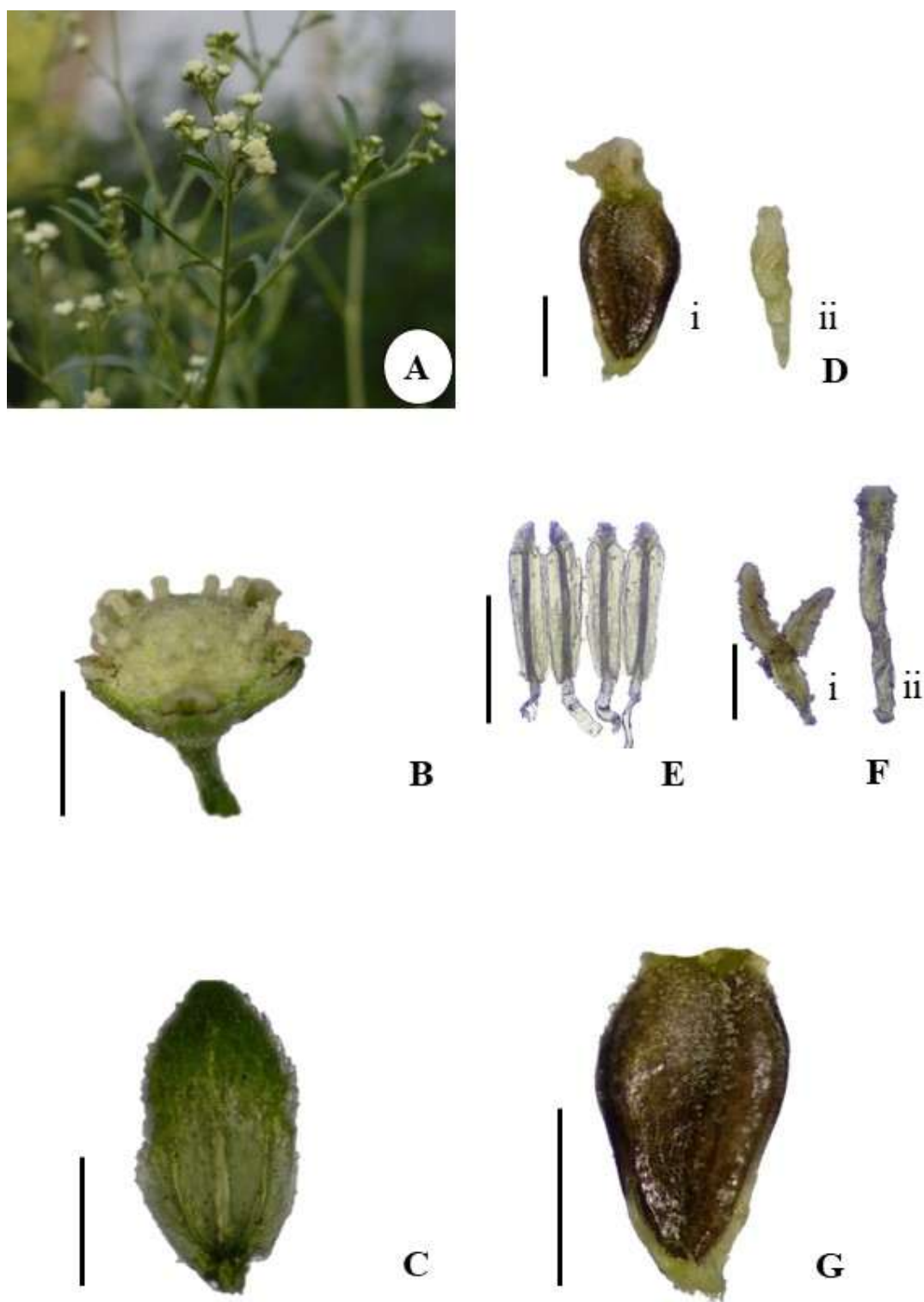


Plate 4.59 *Parthenium hysterophorus* L. **A**-Flowering twig; **B**- Capitulum (bar= 0.2 cm); **C**- Phyllary (bar= 1 mm); **D**- Floret (bar= 1 mm); **E**- Anthers (bar= 0.5 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 1 mm) (i=RF, ii=DF).

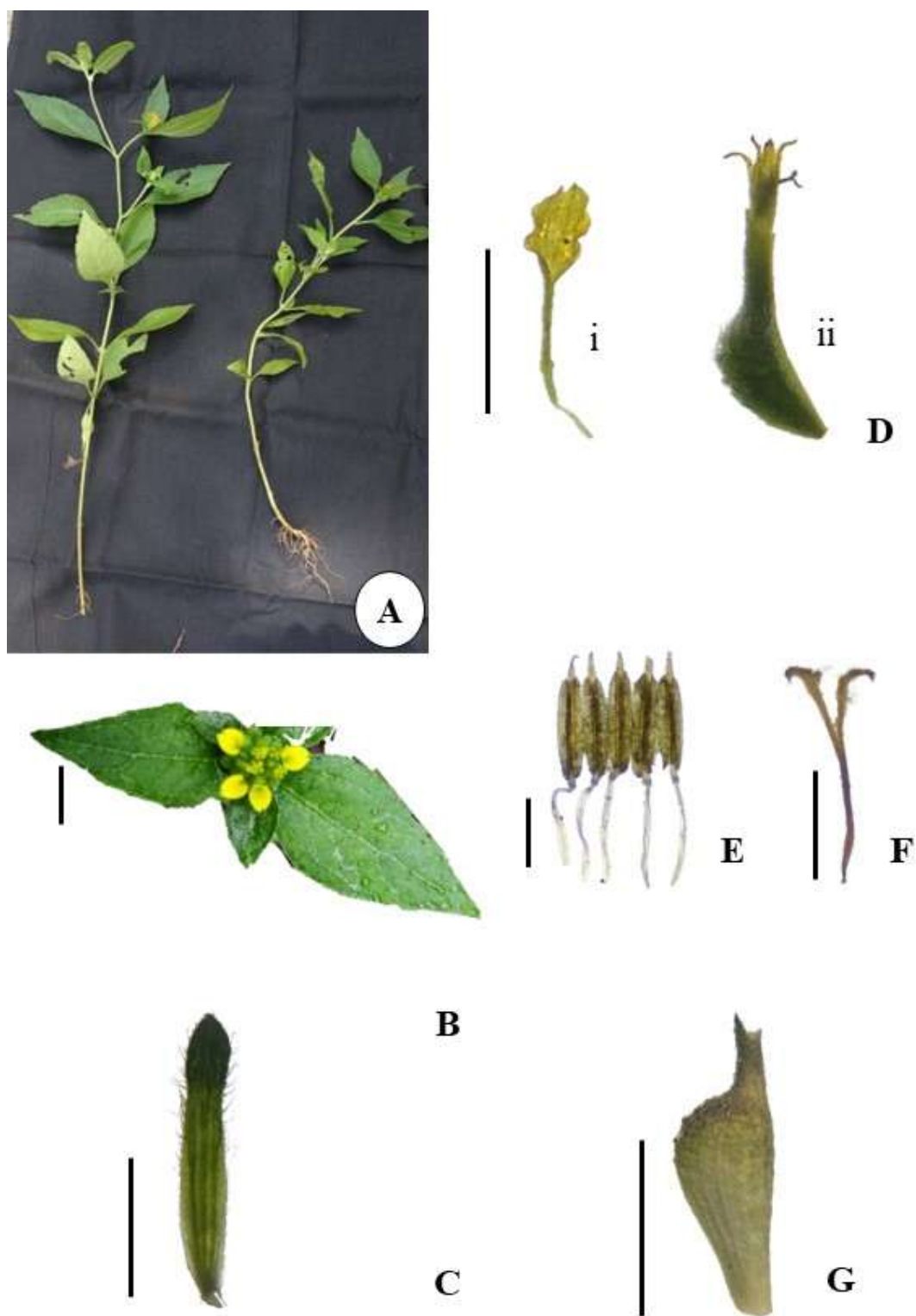


Plate 4.60 *Sclerocarpus africanus* Jacq. **A**-Habit; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 2 cm); **D**- Floret (bar= 1 cm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 4 mm) (i=RF, ii=DF).



Plate 4.61 *Sphagneticola trilobata* (L.) Pruski A-Habit; B- Capitulum (bar= 3 cm); C- Phyllary (bar= 4 mm); D- Floret (bar= 4 mm); E- Anthers (bar= 1 mm); F- Style (bar= 1 mm); G- Cypsela (bar= 1 mm) (i=RF, ii=DF).



Plate 4.62 *Synedrella nodiflora* (L.) Gaertn. **A**-Flowering twig; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 3 mm); **D**- Floret (bar= 1 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 1 mm) (i=RF, ii=DF).



Plate 4.63 *Tithonia diversifolia* (Hemsl.) A.Gray A-Habit ; B- Capitulum (bar= 5 cm); C- Phyllary (bar= 2 cm); D- Floret (bar= 1 cm); E- Anthers (bar= 2 mm); F- Style (bar= 3 mm); G- Cypsela (bar= 3 mm) (i=RF, ii=DF).

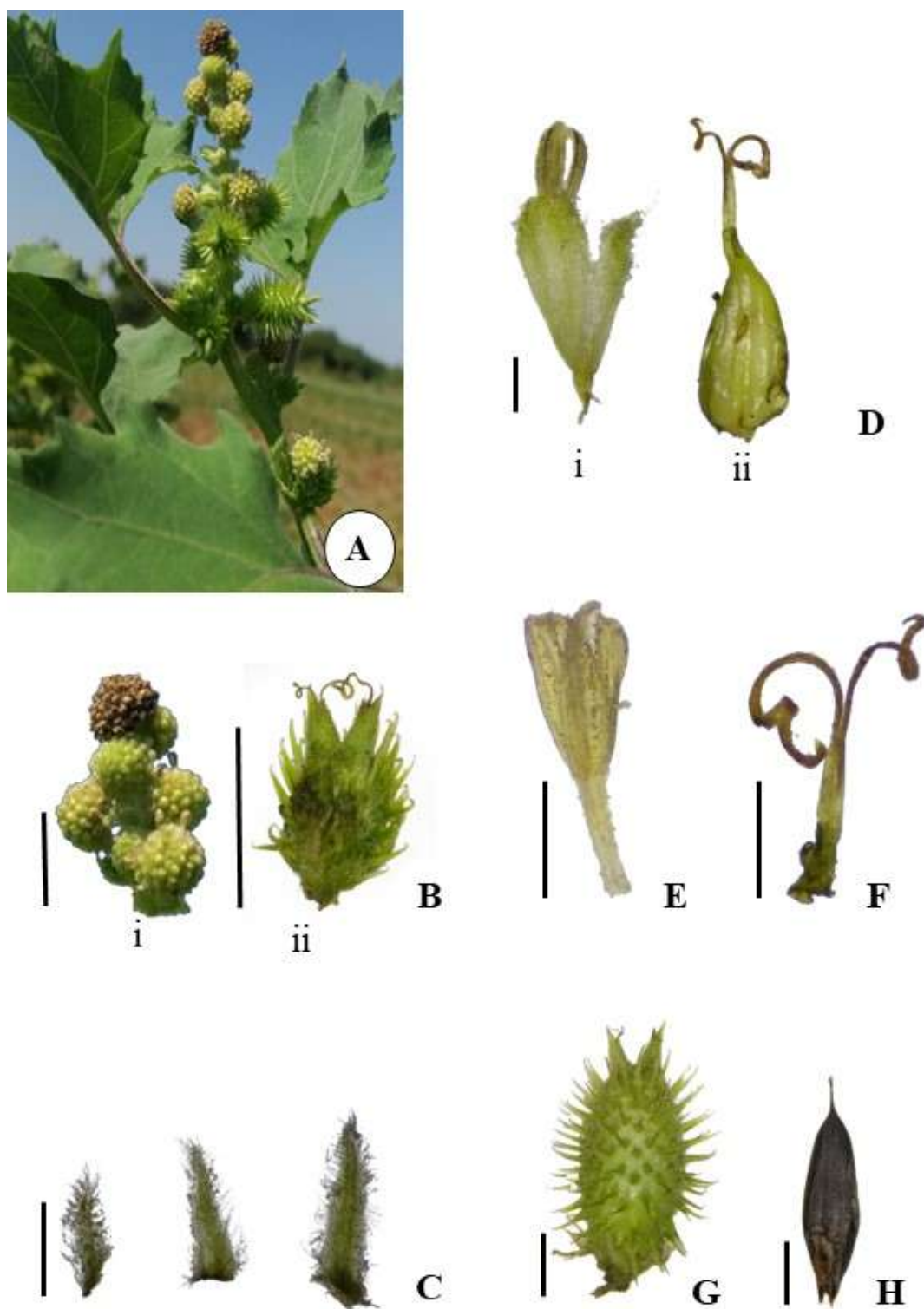


Plate 4.64 *Xanthium strumarium* L. **A**-Flowering twig; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 1 mm); **D**- Floret (bar= 1 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 1 mm); **G**- Burr (bar= 5 mm); **H**- Cypsela (bar= 5 mm). (i=Male, ii=Female).

Tribe: Millerieae Lindl.

Key to the Genera

- 1a. Cypsela armed *Acanthospermum*
1b. Cypsela not armed (2)
2a. Pappus ciliate *Guizotia*
2b. Pappus setose *Tridax*

Genus: *Acanthospermum* Schrank, Pl. Rar. Hort. Monac. 2(pt. 6): t. 53 (1820).

Acanthospermum hispidum DC. in Prodr. 5: 522 (1836); Hajra *et al.*, Fl. of India 12: 361. (1995); Shah 366. (1978); Raghavan *et al.* 43. (1981); Bole & Pathak, FS 2: 6. (1988); *Acanthospermum humile* var. *hispidum* (DC.) Kuntze in Revis. Gen. Pl. 1: 303 (1891).

Plate 4.65

Erect herbs, 30-50 cm high. Stem branched, terete, hispid. Leaves simple, opposite, elliptic-obovate, 2-6 cm, serrate, obtuse, scabrid. Capitulescence solitary. Capitula radiate, 10-15 mm in diameter. Involucre uniseriate; phyllaries, ovate, obtuse apex, 2-9 mm long, pubescent. Ray floret ligulate, female, green, 4-6 mm. Disc floret tubular, bisexual (functionally male), 8 - 16 mm, yellow. Anthers apex appendiculate and base subentire, 0.5-1 mm. Style apex obtuse in ray floret and undivided in disc floret, 0.4-1 mm. Cypsela obovoid, surface covered with spiny hooks, 4-6 mm. Pappus 2 awns where one is straight and other is hook, 3-4 mm.

Common Name: Goathead.

Vernacular Name: Bakrimundi.

Specimen: JJS 104 (Dhulda).

Coordinates: 20°58'04.18" N, 73°39'14.70" E.

Origin: South America.

Associated Species: *Synedrella nodiflora* (L.) Gaertn., *Dichanthium annulatum* (Forssk.) Stapf., *Digitaria adscendens* (Kunth) Henrard.

Abundance: Abundant.

Flw-Fru: October-March.

Habitat: Aquatic areas and wastelands.

Distribution: Navsari, Dang and Valsad.

Taxonomic Note: Ray florets produce cypsela.

Genus: *Guizotia* Cass., Dict. Sci. Nat., ed. 2. [F. Cuvier] 59: 237, 247-248 (1829).

***Guizotia abyssinica* (L.f.) Cass.** in G.-F.Cuvier, Dict. Sci. Nat., ed. 2. 59: 248 (1829); Hajra *et al.*, Fl. of India 12: 395. (1995); Cooke, FBP 2: 66. (1904); Shah 384. (1978); Raghavan *et al.* 45. (1981); *Verbesina sativa* Roxb. ex Sims in Bot. Mag. 26: t. 1017 (1807); Hook.f. in Fl. Brit. India 3: 307 (1883); *Ramtilla oleifera* DC. in R.Wight, Contr. Bot. India: 18 (1834).

Plate 4.66

Erect herbs, 60-150 cm high. Stem branched, terete, hirsute. Leaves simple, opposite, auricled, lanceolate, 3-9 cm, entire, acute, glabrous. Capitulescence solitary. Capitula radiate, 3-5 cm in diameter. Involucre biseriate; phyllaries, ovate-obovate, obtuse apex, 2-9 mm long, pubescent. Ray floret ligulate, female, yellow, 12-14 mm. Disc floret tubular, bisexual, 8 - 16 mm, yellow. Anthers articulated, apex acute and base subentire, 3-4 mm. Style apex acute in ray floret and acuminate in disc floret, 1-2.5 mm. Cypsela obovoid, trigonous in ray floret and flat in disc floret, glabrous, 3-4 mm. Pappus ciliated tuft.

Common Name: Niger Blackseed

Vernacular Name: Ramtil, Karatil, Khursani

Specimen: JJS 99 (Piprol).

Coordinates: 20°30'08.67" N, 73°18'19.66" E.

Origin: Ethiopia.

Associated Species: *Themeda triandra* Forssk., *Apluda mutica* L., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Argemon mexicana* L., *Celosia argentea* L.

Abundance: Rare.

Flw-Fru: September-December.

Habitat: Roadside, wasteland and cultivated fields (escaped).

Distribution: India: Navsari, Dang and Valsad.

Taxonomic Note: Pappus is ciliated collar.

Genus: *Tridax* L., Sp. Pl. 2: 900 (1753).

***Tridax procumbens* L.** in Sp. Pl.: 900 (1753); Hook.f. in Fl. Brit. India 3: 311 (1883); Hajra *et al.*, Fl. of India 12: 418. (1995); Cooke, FBP 2: 45. (1904); Shah 397. (1978); Raghavan *et al.* 47. (1981); Bole & Pathak, FS 2: 37. (1988).

Plate 4.67

Decumbent herbs, 20-50 cm high. Stem branched, terete, pubescent. Leaves simple, opposite, ovate, 3-9 cm, serrate or lobed, acute, hispid. Capitulescence solitary. Capitula radiate, 1-2 cm in diameter. Involucre biseriate; phyllaries, ovate-oblong, obtuse apex, 2-9 mm long, pubescent. Ray floret ligulate, female, white, 7-15 mm. Disc floret tubular, bisexual, 8 - 16 mm, yellow. Anthers articulated, apex acute and base sagittate, 3-3.5 mm. Style apex acute in both florets, 0.5-1 mm. Cypsela obovoid, terete, pubescent, 1.5-2 mm. Pappus setose, 2-3 mm.

Common Name: Mexican Daisy

Vernacular Name: Pardesi Bhangro.

Specimen: JJS 130 (Gangadhara).

Coordinates: 21°08'08.22" N, 73°02'27.53" E.

Origin: Central and South America.

Associated Species: *Dichanthium annulatum* (Forssk.) Stapf., *Boerhavia diffusa* L., (Kunth) Henrard, *Euphorbia hirta* L.

Abundance: Common.

Flw-Fru: Throughout the year

Habitat: Wastelands, roadsides, grasslands and aquatic areas.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

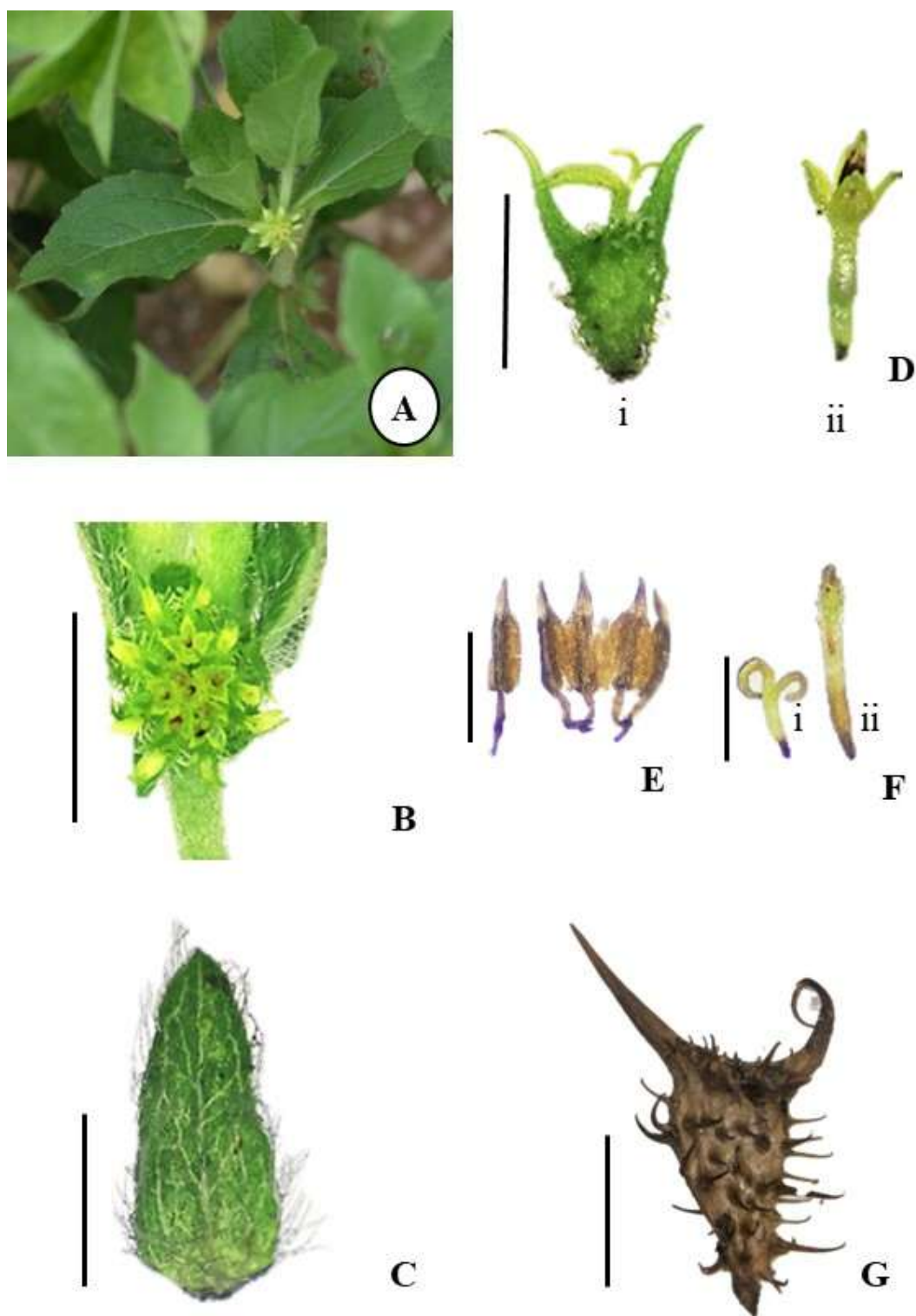


Plate 4.65 *Acanthospermum hispidum* DC. **A**- Flowering twig; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 3 mm); **E**- Anthers (bar = 0.5 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 2 mm) (i=RF, ii=DF).

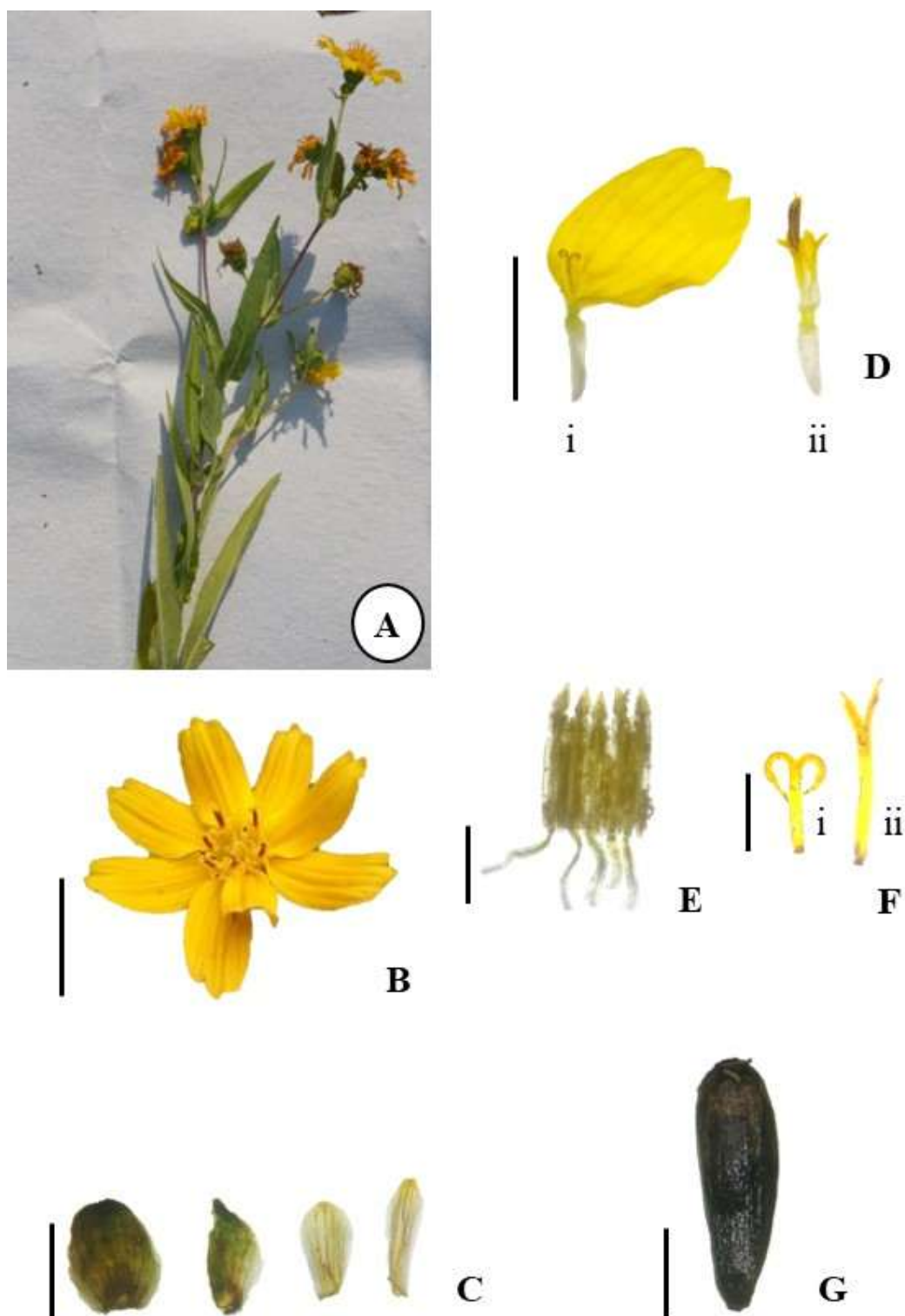


Plate 4.66 *Guizotia abyssinica* (L.f.) Cass. **A-** Flowering twig; **B-** Capitulum (bar= 3 cm); **C-** Phyllary (bar= 5 mm); **D-** Floret (bar= 5 mm); **E-** Anthers (bar = 1 mm); **F-** Style (bar= 2 mm); **G-** Cypsela (bar= 2 mm) (i=RF, ii=DF).

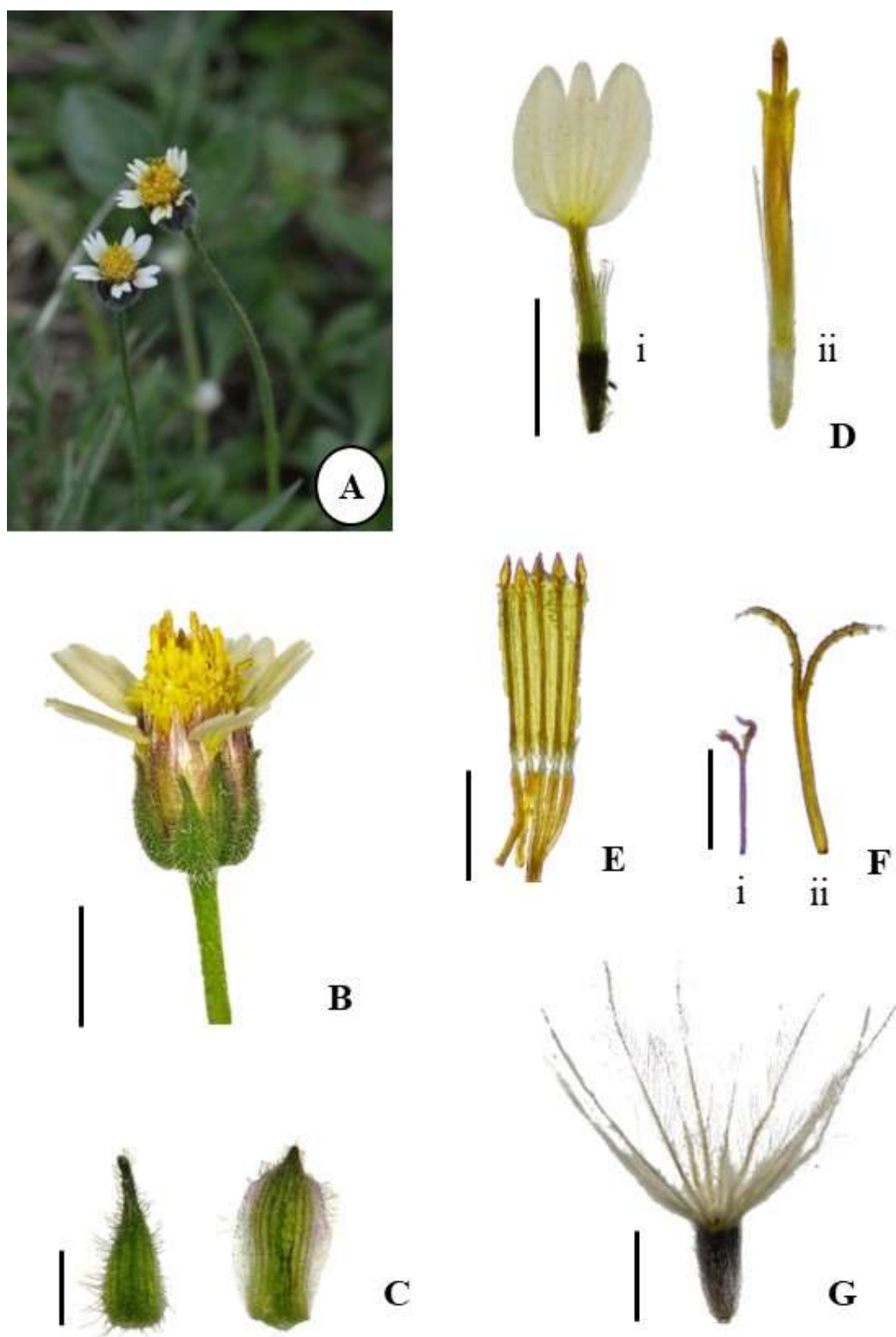


Plate 4.67 *Tridax procumbens* L. **A**- Flowering twig; **B**- Capitulum (bar= 1 cm); **C**- Phyllary (bar= 2 mm); **D**- Floret (bar= 3 mm); **E**- Anthers (bar= 1 mm); **F**- Style (bar= 1 mm); **G**- Cypsela (bar= 2 mm) (i=RF, ii=DF).

Tribe: Eupatorieae Cass.

Key to the Genera

- 1a. Plant shrub *Chromolaena*
1b. Plant herb (2)
2a. Pappus scaly *Ageratum*
2b. Pappus clubbed or clavate *Adenostemma*

Genus: *Adenostemma* J.R.Forst & G.Forst., Char. Gen. Pl., ed. 2. [89] (1776).

Adenostemma viscosum J.R.Forst. & G.Forst. in Char. Gen. Pl., ed. 2: 90 (1776); Cooke, FBP 2: 13. (1904); *Adenostemma lavenia* (L.) Kuntze in Revis. Gen. Pl. 1: 304 (1891); Hajra *et al.*, Fl. of India 12: 346. (1995); Shah 367. (1978); Raghavan *et al.* 43. (1981); *Adenostemma lavenia* var. *viscosum* (J.R.Forst. & G.Forst.) M.R.Almeida in Fl. Maharashtra 3A: 67 (2001).

Plate 4.68

Decumbent herbs, 30-60 cm. Stem branched, terete, pubescent. Leaves simple, opposite, ovate-lanceolate, 2–6 cm, serrate, acute, pubescent or glabrous. Capitulescence corymb. Capitula discoid, 15–20 mm across. Involucres biseriate; phyllaries lanceolate, 7–10 mm, apex acute. Florets tubular, bisexual, 8 - 16 mm, white. Anther apex obtuse and base subentire, 1.8 – 2.1 mm. Style apex obtuse, 1.6 – 2 mm. Cypsela obovoid, terete, 2.2 – 2.7 cm, tuberculated. Pappus clubbed or capitate.

Common Name: Sticky Daisy

Vernacular Name: Jungli Jeeru.

Specimen: JJS 101 (Kilad).

Coordinates: 20°45'18.91" N, 73°29'26.55" E.

Origin: Africa.

Associated Species: *Cyperus rotundus* L., *Brassica nigra* (L.) W.D.J.Koch, *Cyathocline purpurea* (Buch.-Ham. ex D.Don) Kuntze, *Persicaria glabra* (Willd.) M.Gómez, *Rotala* sp.

Abundance: Rare.

Flw-Fru: October-March

Habitat: Aquatic areas.

Distribution: Navsari, Dang and Valsad.

Taxonomic Note: This plant resembles to *Ageratum conyzoides* but differs in viscose leaf and clubbed pappus.

Genus: *Ageratum* L., Sp. Pl. 2: 839 (1753).

Ageratum conyzoides L. in Sp. Pl.: 839 (1753); Hook.f. in Fl. Brit. India 3: 243 (1883); Hajra *et al.*, Fl. of India 12: 348. (1995); Cooke, FBP 2: 14. (1904); Shah 367. (1978); Raghavan *et al.* 43. (1981); Bole & Pathak, FS 2: 6. (1988); *Eupatorium conyzoides* (L.) E.H.L.Krause in J.W.Sturm, Deutschl. Fl. Abbild., ed. 2. 13: 32 (1905).

Plate 4.69

Erect herbs, 30-60 cm. Stem branched, terete, pilose. Leaves simple, opposite, ovate, 6–10 cm, serrate, obtuse, pilose. Capitulescence clustered or corymb. Capitula discoid, 15–20 mm across. Involucres biseriate; phyllaries ovate-oblong, 7–10 mm, apex acute. Florets tubular, bisexual, 8 - 16 mm, white. Anther apex acute and base subentire, 1.8 – 2.1 mm. Style apex obtuse, 1.6 – 2 mm. Cypsela columnar, terete, 2.2 – 2.7 cm, glabrous. Pappus scales.

Common Name: Goat weed.

Vernacular Name: Mankad Mari, Dholi Saddi.

Specimen: JJS 18 (Dharampur).

Coordinates: 20°31'38.04" N, 73°10'39.99" E.

Origin: Mexico.

Associated Species: *Synedrella nodiflora* (L.) Gaertn., *Commelina benghalensis* L., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Trianthema portulacastrum* L., *Triumfetta rhomboidea* Jacq.

Abundance: Common.

Flw-Fru: Throughout the year.

Habitat: Roadside, forest, grassland, cultivated areas and aquatic areas.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

Genus: *Chromolaena* DC., Prodr. [A. P. de Candolle] 5: 133 (1836).

***Chromolaena odorata* (L.) R.M.King & H.Rob.** in Phytologia 20: 204 (1970); *Eupatorium odoratum* L. in Syst. Nat., ed. 10. 2: 1205 (1759); Hajra *et al.*, Fl. of India 12: 354. (1995); *Eupatorium conyzoides* Vahl in Symb. Bot. 3: 96 (1794), nom. illeg.; Hook.f. in Fl. Brit. India 3: 244 (1883).

Plate 4.70

Shrubs, 1-3 m tall. Stem branched, terete, pubescent. Leaves simple, opposite, deltoid, 6–10 cm, serrate, acute, pubescent. Capitulescence corymb. Capitula discoid, 15–20 mm across. Involucres multiseriate; phyllaries ovate-linear, 7–10 mm, apex obtuse-acute. Florets tubular, bisexual, 8 - 16 mm, white-lilac. Anther apex obtuse and base subentire, 1.8 – 2.1 mm. Style apex obtuse, 1.6 – 2 mm. Cypsela columnar, angular, 2.2 – 2.7 cm, pubescent on ribs. Pappus bristles.

Common Name: Siam Weed

Vernacular Name: Pardesi Saddi.

Specimen: JJS 5 (Rohina).

Coordinates: 20°26'13.44" N, 72°59'32.60" E.

Origin: Central and South America.

Associated Species: *Sporobolus* sp., *Commelina benghalensis* L., *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., *Eranthemum roseum* (Vahl) R.Br. ex Roem. & Schult., *Triumfetta rhomboidea* Jacq., *Canavalia gladiata* (Jacq.) DC.

Abundance: Common.

Flw-Fru: October-May.

Habitat: Roadside, cultivated areas, forests and grasslands.

Distribution: Surat, Tapi, Navsari, Dang and Valsad.

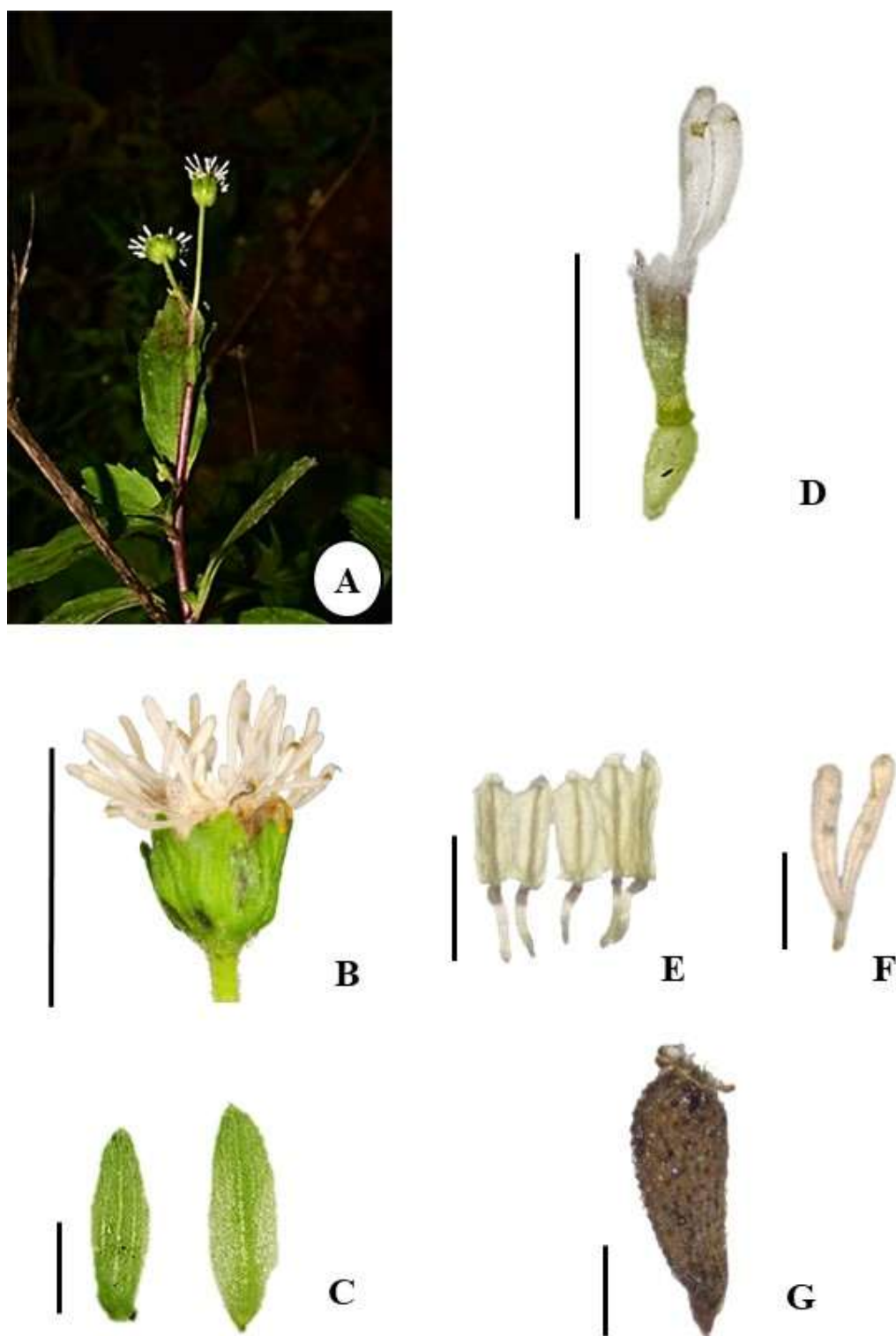


Plate 4.68 *Adenostemma viscosum* J.R.Frost. & G.Frost. **A-** Flowering twig; **B-** Capitulum (bar= 1 cm); **C-** Phyllary (bar= 2 mm); **D-** Floret (bar= 5 mm); **E-** Anthers (bar= 1 mm); **F-** Style (bar= 2 mm); **G-** Cypsela (bar= 1 mm).

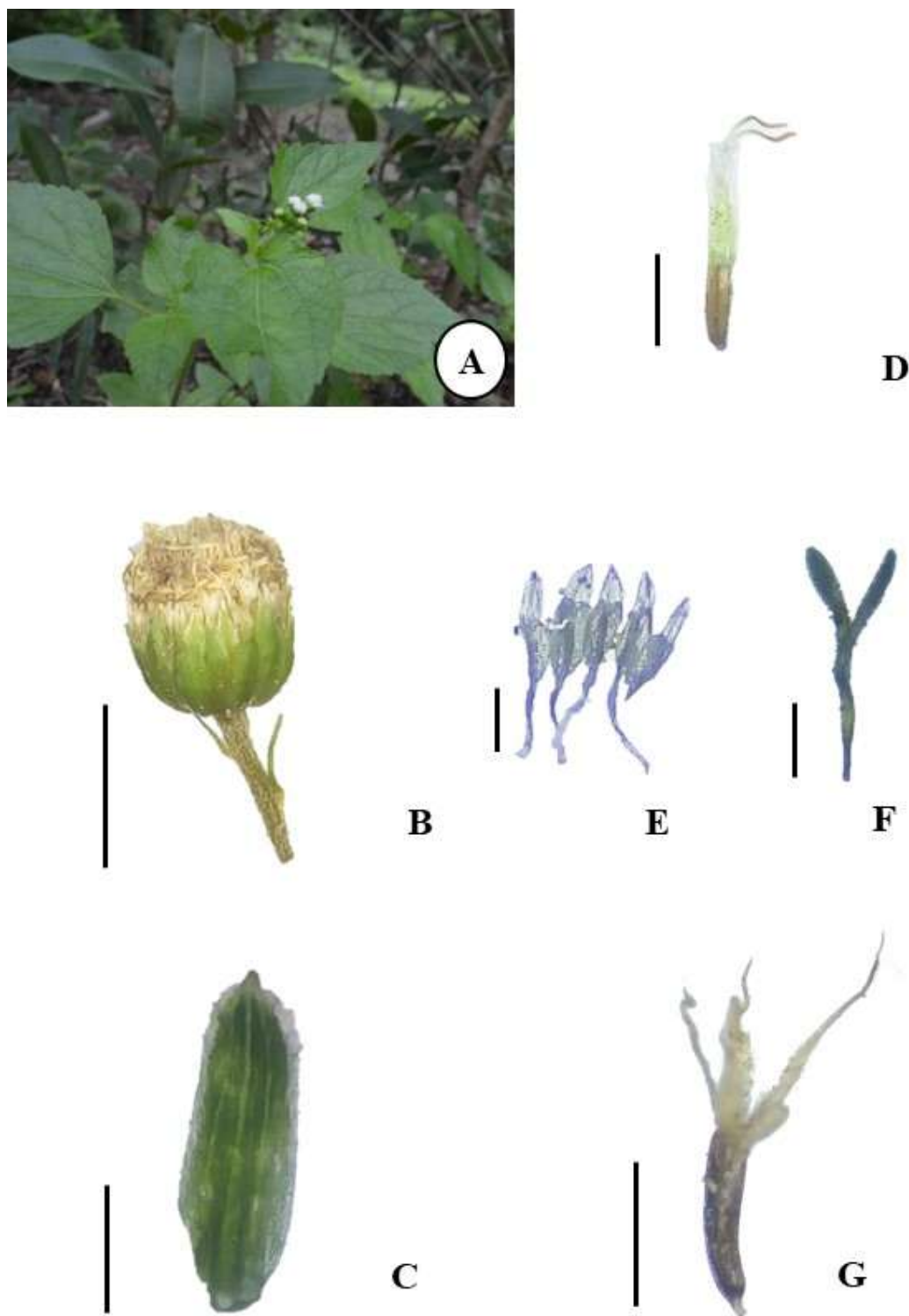


Plate 4.69 *Ageratum conyzoides* L. **A**- Flowering twig; **B**- Capitulum (bar= 0.4 cm); **C**- Phyllary (bar= 1 mm); **D**- Floret (bar= 1 mm); **E**- Anthers (bar= 0.2 mm); **F**- Style (bar= 0.5 mm); **G**- Cypsela (bar= 1 mm).

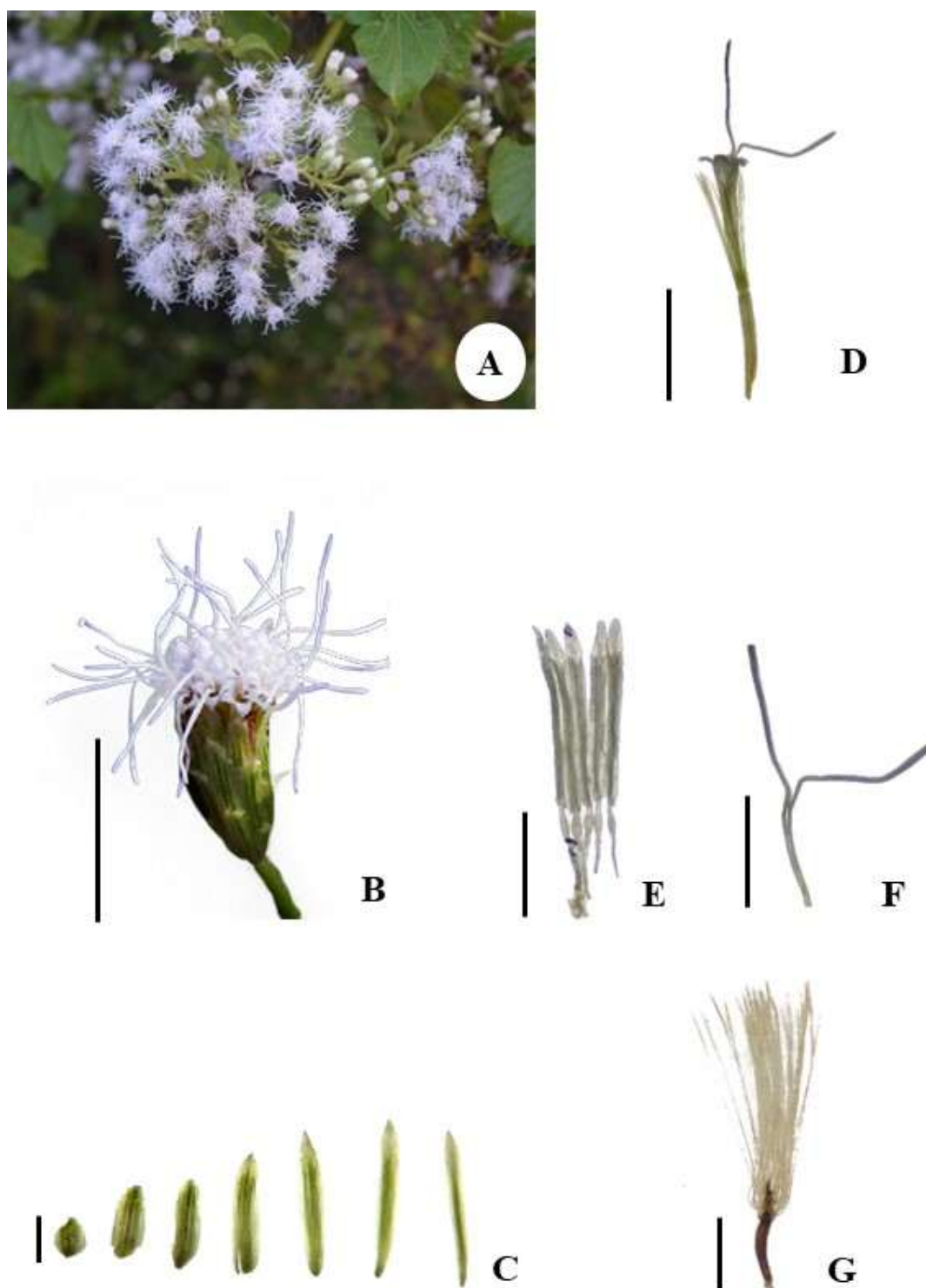


Plate 4.70 *Chromolaena odorata* (L.) R.M.King & H.Rob. **A-** Flowering twig; **B-** Capitulum (bar= 1 cm); **C-** Phyllary (bar= 2 mm); **D-** Floret (bar= 4 mm); **E-** Anthers (bar= 1 mm); **F-** Style (bar= 3 mm); **G-** Cypsela (bar= 3 mm).

4.3 Pollen Studies

4.3.1 Pollen Description

1. *Echinops echinatus* Roxb.

Isopolar, Bilateral symmetry, Oblate shape, Pollen class *magnae*, Pollen size $85.600\mu\text{m} \pm 2.562$, Aperture Tricolpate $31.428\mu\text{m} \pm 2.170$, Scabrate ornamentation, Cavea absent, Length of ornamentation $24.228\mu\text{m} \pm 2.196$, Polar axis (PA) $70.004\mu\text{m} \pm 3.456$, Equatorial diameter (ED) $101.196\mu\text{m} \pm 3.336$, PA/ED $0.692\mu\text{m} \pm 0.039$.

2. *Goniocaulon indicum* (J.G. Klein ex Willd.) C.B. Clarke

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class *mediae*, Pollen size $37.214\mu\text{m} \pm 1.694$, Aperture tricolporate $9.183\mu\text{m} \pm 0.173$, Echinate ornamentation, Cavea present, Length of ornamentation $4.682\mu\text{m} \pm 0.337$, Polar axis (PA) $36.282\mu\text{m} \pm 2.988$, Equatorial diameter (ED) $38.147\mu\text{m} \pm 2.806$, PA/ED $0.957\mu\text{m} \pm 0.117$, Density of spines $37.327\mu\text{m} \pm 1.278$.

3. *Oligochaeta divaricate* (DC.) K. Koch

Isopolar, Bilateral symmetry, Sub-prolate shape, Pollen class *mediae*, Pollen size $27.038\mu\text{m} \pm 0.455$, Aperture tricolporate $4.307\mu\text{m} \pm 0.052$, Psilate ornamentation, Cavea absent, Polar axis (PA) $29.493\mu\text{m} \pm 0.364$, Equatorial diameter (ED) $24.582\mu\text{m} \pm 0.862$, PA/ED $1.201\mu\text{m} \pm 0.044$.

4. *Tricholepis glaberrima* DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class *mediae*, Pollen size $38.118\mu\text{m} \pm 1.492$, Aperture tricolporate $9.201\mu\text{m} \pm 0.607$, Echinate ornamentation, Cavea absent, Length of ornamentation $5.278\mu\text{m} \pm 0.739$, Polar axis (PA) $37.838\mu\text{m} \pm 1.573$, Equatorial diameter (ED) $38.398\mu\text{m} \pm 1.738$, PA/ED $0.986\mu\text{m} \pm 0.036$, Density of spines $39.846\mu\text{m} \pm 2.063$.

5. *Launeae procumbens* (Roxb.) Ramayya & Rajagopal

Isopolar, Radial symmetry, Sub-oblate shape, Pollen class *mediae*, Pollen size $32.067\mu\text{m} \pm 0.619$, Aperture triporate $7.465\mu\text{m} \pm 0.155$, Lophate ornamentation, Cavea absent, Length of ornamentation $5.513\mu\text{m} \pm 0.498$, Polar axis (PA) $28.451\mu\text{m} \pm 0.887$, Equatorial diameter (ED)

35.682 $\mu\text{m} \pm 0.589$, PA/ED 0.797 $\mu\text{m} \pm 0.023$, Density of spines 53.2 $\mu\text{m} \pm 0.193$, Density of Lacunae 7 $\mu\text{m} \pm 0.458$.

6. *Launaea sarmentosa* (Willd.) Kuntze

Isopolar, Radial symmetry, Spheroidal shape, Pollen class mediae, Pollen size 26.875 $\mu\text{m} \pm 1.218$, Aperture triporate 6.370 $\mu\text{m} \pm 0.209$, Lophate ornamentation, Cavea absent, Length of ornamentation 6.269 $\mu\text{m} \pm 0.524$, Polar axis (PA) 26.970 $\mu\text{m} \pm 1.214$, Equatorial diameter (ED) 26.779 $\mu\text{m} \pm 1.573$, PA/ED 1.009 $\mu\text{m} \pm 0.054$, Density of spines 52.5 $\mu\text{m} \pm 0.024$, Density of Lacunae 6 $\mu\text{m} \pm 0.471$.

7. *Sonchus asper* (L.) Hill

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size 23.475 $\mu\text{m} \pm 0.880$, Aperture triporate 5.207 $\mu\text{m} \pm 0.024$, Lophate ornamentation, Cavea absent, Length of ornamentation 3.873 $\mu\text{m} \pm 0.113$, Polar axis (PA) 23.932 $\mu\text{m} \pm 1.062$, Equatorial diameter (ED) 23.018 $\mu\text{m} \pm 0.964$, PA/ED 1.040 $\mu\text{m} \pm 0.044$, Density of spines 51.7 $\mu\text{m} \pm 0.034$, Density of Lacunae 6.7 $\mu\text{m} \pm 0.483$.

8. *Sonchus oleraceus* L.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size 32.97 $\mu\text{m} \pm 4.436$, Aperture triporate 4.52 $\mu\text{m} \pm 0.348$, Lophate ornamentation, Cavea absent, Length of ornamentation 5.61 $\mu\text{m} \pm 0.731$, Polar axis (PA) 32.12 $\mu\text{m} \pm 4.651$, Equatorial diameter (ED) 33.81 $\mu\text{m} \pm 4.457$, PA/ED 0.95 $\mu\text{m} \pm 0.060$, Density of spines 52.1 $\mu\text{m} \pm 0.012$, Density of Lacunae 8.4 $\mu\text{m} \pm 0.516$.

9. *Acilepis divergens* (DC.) H.Rob. & Skvarla

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size 35.65 $\mu\text{m} \pm 0.75$, Aperture triporate 5.74 $\mu\text{m} \pm 0.45$, Lophate ornamentation, Cavea absent, Length of ornamentation 7.75 $\mu\text{m} \pm 0.74$, Polar axis (PA) 35.59 $\mu\text{m} \pm 1.32$, Equatorial diameter (ED) 35.71 $\mu\text{m} \pm 0.43$, PA/ED 0.997 $\mu\text{m} \pm 0.035$, Density of spines 75.40 $\mu\text{m} \pm 2.59$, Density of Lacunae 13.07 $\mu\text{m} \pm 2.10$.

10. *Baccharoides anthelmentica* (L.) Moench

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class mediae, Pollen size 47.61 $\mu\text{m} \pm 2.83$, Aperture triporate 7.46 $\mu\text{m} \pm 0.92$, Echinate ornamentation, Cavea absent, Length of

ornamentation $9.94\mu\text{m} \pm 0.74$, Polar axis (PA) $47.99\mu\text{m} \pm 3.66$, Equatorial diameter (ED) $47.24\mu\text{m} \pm 4.14$, PA/ED $1.02\mu\text{m} \pm 0.12$, Density of spines $79.6\mu\text{m} \pm 3.134$, Density of Lacunae $7.1\mu\text{m} \pm 0.994$.

11. *Centratherum punctatum* Cass.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $39.790\mu\text{m} \pm 0.740$, Aperture tricolpate $6.9\mu\text{m} \pm 0.524$, Lophate ornamentation, Cavea absent, Length of ornamentation $8.856\mu\text{m} \pm 0.822$, Polar axis (PA) $39.331\mu\text{m} \pm 1.343$, Equatorial diameter (ED) $40.294\mu\text{m} \pm 0.540$, PA/ED $0.977\mu\text{m} \pm 0.034$, Density of spines $81.3\mu\text{m} \pm 2.11$, Density of Lacunae $22.7\mu\text{m} \pm 1.251$

12. *Cyanthellium cinereum* (L.) H. Rob.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $32.110\mu\text{m} \pm 1.294$, Aperture tricolporate $6.620\mu\text{m} \pm 0.685$, Lophate ornamentation, Cavea absent, Length of ornamentation $3.358\mu\text{m} \pm 0.501$, Polar axis (PA) $31.591\mu\text{m} \pm 0.519$, Equatorial diameter (ED) $32.629\mu\text{m} \pm 2.170$, PA/ED $0.971\mu\text{m} \pm 0.052$, Density of spines $48.700\mu\text{m} \pm 2.213$, Density of Lacunae $6.500\mu\text{m} \pm 1.08$.

13. *Elephantopus scaber* L.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $45.660\mu\text{m} \pm 0.941$, Aperture triporate $6.472\mu\text{m} \pm 0.338$, Lophate ornamentation, Cavea absent, Length of ornamentation $5.399\mu\text{m} \pm 0.298$, Polar axis (PA) $44.692\mu\text{m} \pm 0.835$, Equatorial diameter (ED) $46.629\mu\text{m} \pm 1.358$, PA/ED $0.959\mu\text{m} \pm 0.025$, Density of spines $66.400\mu\text{m} \pm 2.675$, Density of Lacunae $7\mu\text{m} \pm 0.567$

14. *Phyllocephalum microcephalum* (Dalzell) H. Rob.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class magnae, Pollen size $59.443\mu\text{m} \pm 0.755$, Aperture triporate $7.452\mu\text{m} \pm 0.096$, Lophate ornamentation, Cavea absent, Length of ornamentation $6.523\mu\text{m} \pm 0.114$, Polar axis (PA) $58.500\mu\text{m} \pm 1.04$, Equatorial diameter (ED) $60.387\mu\text{m} \pm 0.800$, PA/ED $0.969\mu\text{m} \pm 0.017$, Density of spines $56.4\mu\text{m} \pm 1.955$, Density of Lacunae $6.2\mu\text{m} \pm 0.788$.

15. *Crassocephalum crepidioides* (Benth.) S. Moore

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class mediae, Pollen size $27.210\mu\text{m} \pm 0.738$, Aperture tricolporate $4.905\mu\text{m} \pm 0.514$, Echinate ornamentation, Cavea present, Length of ornamentation $2.787\mu\text{m} \pm 0.218$, Polar axis (PA) $28.292\mu\text{m} \pm 0.560$, Equatorial diameter (ED) $26.129\mu\text{m} \pm 1.123$, PA/ED $1.084\mu\text{m} \pm 0.040$, Density of spines $55.224\mu\text{m} \pm 1.965$.

16. *Emilia sonchifolia* (L.) DC.

Isopolar, Radial symmetry, Spheroidal shape, Pollen class mediae, Pollen size $25.606\mu\text{m} \pm 1.056$, Aperture tricolporate $3.121\mu\text{m} \pm 0.204$, Echinate ornamentation, Cavea present, Length of ornamentation $2.698\mu\text{m} \pm 1.202$, Polar axis (PA) $25.697\mu\text{m} \pm 1.331$, Equatorial diameter (ED) $25.515\mu\text{m} \pm 1.481$, PA/ED $1.010\mu\text{m} \pm 0.072$, Density of spines $35.845\mu\text{m} \pm 0.983$.

17. *Senecio bombayensis* N.P. Balakr

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $26.472\mu\text{m} \pm 1.959$, Aperture tricolporate $4.074\mu\text{m} \pm 0.869$, Echinate ornamentation, Cavea present, Length of ornamentation $4.786\mu\text{m} \pm 0.970$, Polar axis (PA) $25.542\mu\text{m} \pm 2.334$, Equatorial diameter (ED) $27.401\mu\text{m} \pm 2.515$, PA/ED $0.936\mu\text{m} \pm 0.093$, Density of spines $37.306\mu\text{m} \pm 6.870$.

18. *Gamochaeta pensylvanica* (Willd.) Cabrera

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $19.247\mu\text{m} \pm 0.211$, Aperture tricolporate $2.139\mu\text{m} \pm 0.078$, Echinate ornamentation, Cavea present, Length of ornamentation $2.149\mu\text{m} \pm 0.050$, Polar axis (PA) $18.590\mu\text{m} \pm 0.177$, Equatorial diameter (ED) $19.905\mu\text{m} \pm 0.284$, PA/ED $0.934\mu\text{m} \pm 0.010$, Density of spines $43.674\mu\text{m} \pm 3.695$.

19. *Gamochaeta purpurea* (L.) Cabrera

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $18.315\mu\text{m} \pm 0.694$, Aperture tricolporate $3.218\mu\text{m} \pm 0.057$, Echinate ornamentation, Cavea present, Length of ornamentation $2.277\mu\text{m} \pm 0.295$, Polar axis (PA) $17.408\mu\text{m} \pm 0.720$, Equatorial diameter (ED) $19.222\mu\text{m} \pm 1.339$, PA/ED $0.910\mu\text{m} \pm 0.080$, Density of spines $40.979\mu\text{m} \pm 0.769$.

20. *Helichrysum indicum* (L.) Grierson

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $19.881\mu\text{m} \pm 0.594$, Aperture tricolporate $2.751\mu\text{m} \pm 0.183$, Echinate ornamentation, Cavea present, Length of ornamentation $1.461\mu\text{m} \pm 0.199$, Polar axis (PA) $18.786\mu\text{m} \pm 0.630$, Equatorial diameter (ED) $20.976\mu\text{m} \pm 0.890$, PA/ED $0.897\mu\text{m} \pm 0.042$, Density of spines $50.751\mu\text{m} \pm 2.054$.

21. *Cyathocline purpurea* (Buch.-Ham. Ex D. Don) Kuntze

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size $16.083\mu\text{m} \pm 0.718$, Aperture tricolporate $4.510\mu\text{m} \pm 0.389$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.078\mu\text{m} \pm 0.129$, Polar axis (PA) $16.568\mu\text{m} \pm 0.913$, Equatorial diameter (ED) $15.599\mu\text{m} \pm 0.902$, PA/ED $1.065\mu\text{m} \pm 0.074$, Density of spines $26.524\mu\text{m} \pm 1.930$.

22. *Erigeron bonariensis* L.

Isopolar, Radial symmetry, Sub-oblate shape, Pollen class minutae, Pollen size $19.658\mu\text{m} \pm 2.304$, Aperture tricolporate $4.280\mu\text{m} \pm 0.337$, Echinate ornamentation, Cavea present, Length of ornamentation $2.838\mu\text{m} \pm 0.203$, Polar axis (PA) $18.050\mu\text{m} \pm 2.518$, Equatorial diameter (ED) $21.265\mu\text{m} \pm 2.566$, PA/ED $0.852\mu\text{m} \pm 0.097$, Density of spines $41.324\mu\text{m} \pm 0.977$.

23. *Eschenbanchia stricta* (Willd.) Raizada

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size $24.727\mu\text{m} \pm 0.632$, Aperture tricolporate $4.938\mu\text{m} \pm 0.072$, Echinate ornamentation, Cavea absent, Length of ornamentation $3.177\mu\text{m} \pm 0.068$, Polar axis (PA) $25.546\mu\text{m} \pm 0.786$, Equatorial diameter (ED) $23.908\mu\text{m} \pm 0.794$, PA/ED $1.069\mu\text{m} \pm 0.040$, Density of spines $34.927\mu\text{m} \pm 1.343$.

24. *Grangea maderaspatana* (L.) Poir.

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size $24.478\mu\text{m} \pm 0.616$, Aperture tricolporate $3.014\mu\text{m} \pm 0.254$, Echinate ornamentation, Cavea present, Length of ornamentation $4.793\mu\text{m} \pm 0.560$, Polar axis (PA) $24.563\mu\text{m} \pm 0.914$, Equatorial diameter (ED) $24.392\mu\text{m} \pm 0.845$, PA/ED $1.008\mu\text{m} \pm 0.051$, Density of spines $32.018\mu\text{m} \pm 3.663$.

25. *Thespis thakeri* J.J. Sharma & Nagar

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size $17.203\mu\text{m} \pm 0.793$, Aperture tricolporate $2.438\mu\text{m} \pm 0.136$, Echinate ornamentation, Cavea present, Length of ornamentation $2.369\mu\text{m} \pm 0.189$, Polar axis (PA) $18.251\mu\text{m} \pm 0.870$, Equatorial diameter (ED) $16.156\mu\text{m} \pm 0.920$, PA/ED $1.131\mu\text{m} \pm 0.053$, Density of spines $33\mu\text{m} \pm 1.078$.

26. *Blumea axillaris* (Lam.) DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $22.898\mu\text{m} \pm 0.788$, Aperture tricolporate $5.103\mu\text{m} \pm 0.225$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.407\mu\text{m} \pm 0.502$, Polar axis (PA) $22.353\mu\text{m} \pm 0.884$, Equatorial diameter (ED) $23.443\mu\text{m} \pm 0.713$, PA/ED $0.953\mu\text{m} \pm 0.014$, Density of spines $28.667\mu\text{m} \pm 1.154$.

27. *Blumea belangeriana* DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $22.08\mu\text{m} \pm 1.98$, Aperture tricolporate $3.62\mu\text{m} \pm 0.17$, Echinate ornamentation, Cavea absent, Length of ornamentation $5.27\mu\text{m} \pm 0.16$, Polar axis (PA) $21.38\mu\text{m} \pm 2.04$, Equatorial diameter (ED) $22.78\mu\text{m} \pm 2.03$, PA/ED $0.94\mu\text{m} \pm 0.04$, Density of spines $24.73\mu\text{m} \pm 1.30$.

28. *Blumea eriantha* DC.

Isopolar, Radial symmetry, Oblate shape, Pollen class minutae, Pollen size $20.71\mu\text{m} \pm 4.69$, Aperture tricolporate $6.46\mu\text{m} \pm 0.24$, Echinate ornamentation, Cavea absent, Length of ornamentation $6.10\mu\text{m} \pm 0.60$, Polar axis (PA) $17.26\mu\text{m} \pm 9.32$, Equatorial diameter (ED) $24.16\mu\text{m} \pm 0.61$, PA/ED $0.71\mu\text{m} \pm 0.38$, Density of spines $25.17\mu\text{m} \pm 2.78$.

29. *Blumea malcolmii* Hook.f.

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class mediae, Pollen size $30.135\mu\text{m} \pm 0.789$, Aperture tricolporate $5.736\mu\text{m} \pm 0.141$, Echinate ornamentation, Cavea present, Length of ornamentation $4.447\mu\text{m} \pm 0.361$, Polar axis (PA) $30.844\mu\text{m} \pm 1.346$, Equatorial diameter (ED) $29.426\mu\text{m} \pm 0.713$, PA/ED $1.049\mu\text{m} \pm 0.051$, Density of spines $38.073\mu\text{m} \pm 2.722$.

30. *Blumea membranacea* DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $25.99\mu\text{m} \pm 0.68$, Aperture tricolporate $5.35\mu\text{m} \pm 0.13$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.76\mu\text{m} \pm 0.23$, Polar axis (PA) $25.42\mu\text{m} \pm 0.64$, Equatorial diameter (ED) $26.56\mu\text{m} \pm 0.85$, PA/ED $0.96\mu\text{m} \pm 0.02$, Density of spines $32.47\mu\text{m} \pm 3.35$.

31. *Blumea obliqua* (L.) Druce

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $21.647\mu\text{m} \pm 0.964$, Aperture tricolporate $4.561\mu\text{m} \pm 0.353$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.760\mu\text{m} \pm 0.514$, Polar axis (PA) $20.774\mu\text{m} \pm 0.980$, Equatorial diameter (ED) $22.520\mu\text{m} \pm 1.122$, PA/ED $0.923\mu\text{m} \pm 0.035$, Density of spines $24.766\mu\text{m} \pm 1.012$.

32. *Blumea oxyodonta* DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $31.725\mu\text{m} \pm 5.096$, Aperture tricolporate $5.694\mu\text{m} \pm 0.355$, Echinate ornamentation, Cavea absent, Length of ornamentation $7.167\mu\text{m} \pm 0.248$, Polar axis (PA) $31.154\mu\text{m} \pm 5.214$, Equatorial diameter (ED) $32.296\mu\text{m} \pm 5.875$, PA/ED $0.978\mu\text{m} \pm 0.154$, Density of spines $20.801\mu\text{m} \pm 1.534$.

33. *Blumea sinuate* (Lour.) Merr.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $23.081\mu\text{m} \pm 0.632$, Aperture tricolporate $3.682\mu\text{m} \pm 0.243$, Echinate ornamentation, Cavea absent, Length of ornamentation $3.142\mu\text{m} \pm 0.045$, Polar axis (PA) $22.227\mu\text{m} \pm 0.536$, Equatorial diameter (ED) $23.936\mu\text{m} \pm 0.937$, PA/ED $0.930\mu\text{m} \pm 0.033$, Density of spines $25.201\mu\text{m} \pm 0.460$.

34. *Blumea virens* DC.

Isopolar, Bilateral symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $23.60\mu\text{m} \pm 0.46$, Aperture tricolporate $6.10\mu\text{m} \pm 0.10$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.61\mu\text{m} \pm 0.20$, Polar axis (PA) $23.10\mu\text{m} \pm 0.78$, Equatorial diameter (ED) $24.09\mu\text{m} \pm 0.79$, PA/ED $0.96\mu\text{m} \pm 0.05$, Density of spines $33\mu\text{m} \pm 3.33$.

35. *Caesulia axillaris* Roxb.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $26.73\mu\text{m} \pm 0.08$, Aperture tricolporate $4.34\mu\text{m} \pm 0.41$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.90\mu\text{m} \pm 0.18$, Polar axis (PA) $26.34\mu\text{m} \pm 0.14$, Equatorial diameter (ED) $27.12\mu\text{m} \pm 0.06$, PA/ED $0.97\mu\text{m} \pm 0.01$, Density of spines $29.34\mu\text{m} \pm 1.39$.

36. *Blumea bovei* (DC.) Vatke

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $25.434\mu\text{m} \pm 2.062$, Aperture tricolporate $5.154\mu\text{m} \pm 0.370$, Echinate ornamentation, Cavea absent, Length of ornamentation $6.545\mu\text{m} \pm 0.209$, Polar axis (PA) $24.586\mu\text{m} \pm 3.321$, Equatorial diameter (ED) $26.283\mu\text{m} \pm 2.855$, PA/ED $0.947\mu\text{m} \pm 0.175$, Density of spines $26.767\mu\text{m} \pm 1.033$.

37. *Pluchea ovalis* (Pers.) DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $22.909\mu\text{m} \pm 0.345$, Aperture tricolporate $5.321\mu\text{m} \pm 0.544$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.864\mu\text{m} \pm 0.129$, Polar axis (PA) $22.862\mu\text{m} \pm 0.456$, Equatorial diameter (ED) $22.956\mu\text{m} \pm 0.399$, PA/ED $0.996\mu\text{m} \pm 0.022$, Density of spines $29.286\mu\text{m} \pm 2.573$.

38. *Pluchea wallichiana* DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $25.630\mu\text{m} \pm 0.492$, Aperture tricolporate $5.623\mu\text{m} \pm 0.0855$, Echinate ornamentation, Cavea absent, Length of ornamentation $2.806\mu\text{m} \pm 0.078$, Polar axis (PA) $24.993\mu\text{m} \pm 0.561$, Equatorial diameter (ED) $26.267\mu\text{m} \pm 0.496$, PA/ED $0.952\mu\text{m} \pm 0.014$, Density of spines $38.889\mu\text{m} \pm 1.563$.

39. *Pseudoconyza viscosa* (Mill.) D'Arcy

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $23.039\mu\text{m} \pm 1.507$, Aperture tricolporate $6.794\mu\text{m} \pm 0.401$, Echinate ornamentation, Cavea absent, Length of ornamentation $3.956\mu\text{m} \pm 0.430$, Polar axis (PA) $21.876\mu\text{m} \pm 1.405$, Equatorial diameter (ED) $24.202\mu\text{m} \pm 1.974$, PA/ED $0.907\mu\text{m} \pm 0.067$, Density of spines $35.896\mu\text{m} \pm 1.449$.

40. *Pulicaria angustifolia* DC.

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size $24.232\mu\text{m} \pm 0.996$, Aperture tricolporate $3.444\mu\text{m} \pm 0.156$, Echinate ornamentation, Cavea absent, Length of ornamentation $3.922\mu\text{m} \pm 0.495$, Polar axis (PA) $24.471\mu\text{m} \pm 1.415$, Equatorial diameter (ED) $23.993\mu\text{m} \pm 1.120$, PA/ED $1.021\mu\text{m} \pm 0.066$, Density of spines $30.172\mu\text{m} \pm 1.704$.

41. *Sphaeranthus indicus* L.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $22.787\mu\text{m} \pm 0.383$, Aperture tricolporate $4.328\mu\text{m} \pm 0.121$, Echinate ornamentation, Cavea absent, Length of ornamentation $5.662\mu\text{m} \pm 0.316$, Polar axis (PA) $22.752\mu\text{m} \pm 0.597$, Equatorial diameter (ED) $22.822\mu\text{m} \pm 0.287$, PA/ED $0.997\mu\text{m} \pm 0.023$, Density of spines $26.625\mu\text{m} \pm 1.352$.

42. *Vicoa cernua* Dalzell

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size $21.966\mu\text{m} \pm 1.150$, Aperture tricolporate $5.211\mu\text{m} \pm 0.334$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.820\mu\text{m} \pm 0.154$, Polar axis (PA) $22.358\mu\text{m} \pm 1.253$, Equatorial diameter (ED) $21.574\mu\text{m} \pm 1.314$, PA/ED $1.038\mu\text{m} \pm 0.058$, Density of spines $34.031\mu\text{m} \pm 1.938$.

43. *Vicoa indica* (L.) DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $19.617\mu\text{m} \pm 0.884$, Aperture tricolporate $4.311\mu\text{m} \pm 0.513$, Echinate ornamentation, Cavea absent, Length of ornamentation $3.465\mu\text{m} \pm 0.815$, Polar axis (PA) $19.534\mu\text{m} \pm 0.710$, Equatorial diameter (ED) $19.700\mu\text{m} \pm 1.531$, PA/ED $0.997\mu\text{m} \pm 0.087$, Density of spines $30.841\mu\text{m} \pm 2.779$.

44. *Bidens bipinnata* L.

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class mediae, Pollen size $29.18\mu\text{m} \pm 0.88$, Aperture tricolporate $4.95\mu\text{m} \pm 0.43$, Echinate ornamentation, Cavea present, Length of ornamentation $6.14\mu\text{m} \pm 0.44$, Polar axis (PA) $29.54\mu\text{m} \pm 1.28$, Equatorial diameter (ED) $28.82\mu\text{m} \pm 0.98$, PA/ED $1.03\mu\text{m} \pm 0.05$, Density of spines $43.43\mu\text{m} \pm 1.32$.

45. *Bidens biternate* (Lour.) Merr. & Shreff

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $30.530\mu\text{m} \pm 1.679$, Aperture tricolporate $2.798\mu\text{m} \pm 0.211$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.044\mu\text{m} \pm 0.271$, Polar axis (PA) $29.409\mu\text{m} \pm 1.951$, Equatorial diameter (ED) $31.651\mu\text{m} \pm 1.904$, PA/ED $0.930\mu\text{m} \pm 0.055$, Density of spines $34\mu\text{m} \pm 1.087$.

46. *Cosmos caudatus* Kunth

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $33.478\mu\text{m} \pm 1.741$, Aperture tricolporate $5.536\mu\text{m} \pm 0.261$, Echinate ornamentation, Cavea present, Length of ornamentation $6.623\mu\text{m} \pm 0.690$, Polar axis (PA) $33.291\mu\text{m} \pm 1.071$, Equatorial diameter (ED) $33.664\mu\text{m} \pm 3.017$, PA/ED $0.996\mu\text{m} \pm 0.089$, Density of spines $43.493\mu\text{m} \pm 1.753$.

47. *Cosmos sulphureus* Cav.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $27.340\mu\text{m} \pm 0.399$, Aperture tricolporate $3.445\mu\text{m} \pm 0.232$, Echinate ornamentation, Cavea absent, Length of ornamentation $5.788\mu\text{m} \pm 0.161$, Polar axis (PA) $27.201\mu\text{m} \pm 0.422$, Equatorial diameter (ED) $27.479\mu\text{m} \pm 0.578$, PA/ED $0.990\mu\text{m} \pm 0.022$, Density of spines $28.288\mu\text{m} \pm 2.351$.

48. *Glossocardia bosvallia* (L.f.) DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $28.864\mu\text{m} \pm 0.604$, Aperture tricolpate $3.684\mu\text{m} \pm 0.336$, Echinate ornamentation, Cavea present, Length of ornamentation $5.552\mu\text{m} \pm 0.564$, Polar axis (PA) $28.568\mu\text{m} \pm 0.599$, Equatorial diameter (ED) $29.160\mu\text{m} \pm 0.915$, PA/ED $0.980\mu\text{m} \pm 0.032$, Density of spines $27.288\mu\text{m} \pm 1.538$.

49. *Acmella ciliata* (Kunth) Cass.

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size $22.804\mu\text{m} \pm 1.386$, Aperture tricolpate $4.488\mu\text{m} \pm 0.147$, Echinate ornamentation, Cavea absent, Length of ornamentation $3.302\mu\text{m} \pm 0.159$, Polar axis (PA) $23.181\mu\text{m} \pm 1.586$, Equatorial diameter (ED) $22.427\mu\text{m} \pm 1.688$, PA/ED $1.037\mu\text{m} \pm 0.08$, Density of spines $37.814\mu\text{m} \pm 3.195$.

50. *Acmella oleracea* (L.) R.K. Jansen

Isopolar, Radial symmetry, Spheroidal shape, Pollen class minutae, Pollen size $24\mu\text{m} \pm 0.72$, Aperture tricolporate $4.56\mu\text{m} \pm 0.42$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.52\mu\text{m} \pm 0.18$, Polar axis (PA) $24.04\mu\text{m} \pm 0.70$, Equatorial diameter (ED) $23.97\mu\text{m} \pm 1.02$, PA/ED $1.00\mu\text{m} \pm 0.04$, Density of spines $36.22\mu\text{m} \pm 2.77$.

51. *Acmella paniculata* (Wall.ex. DC) R.K. Jansen

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class mediae, Pollen size $27.935\mu\text{m} \pm 4.086$, Aperture tricolpate $2.527\mu\text{m} \pm 0.06$, Echinate ornamentation, Cavea absent, Length of ornamentation $4.893\mu\text{m} \pm 0.351$, Polar axis (PA) $29.527\mu\text{m} \pm 8.082$, Equatorial diameter (ED) $26.343\mu\text{m} \pm 0.990$, PA/ED $1.122\mu\text{m} \pm 0.308$, Density of spines $30\mu\text{m} \pm 1.989$.

52. *Acmella radicans* (Jacq.) R.K. Jansen

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $30.96\mu\text{m} \pm 2.32$, Aperture tricolporate $6.39\mu\text{m} \pm 0.04$, Echinate ornamentation, Cavea absent, Length of ornamentation $6.43\mu\text{m} \pm 0.14$, Polar axis (PA) $30.60\mu\text{m} \pm 1.46$, Equatorial diameter (ED) $31.32\mu\text{m} \pm 3.88$, PA/ED $0.99\mu\text{m} \pm 0.13$, Density of spines $57.03\mu\text{m} \pm 3.37$.

53. *Acmella uliginosa* (Sw.) Cass.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $25\mu\text{m} \pm 1.66$, Aperture tricolpate $3.44\mu\text{m} \pm 0.15$, Echinate ornamentation, Cavea present, Length of ornamentation $5.70\mu\text{m} \pm 0.88$, Polar axis (PA) $24.54\mu\text{m} \pm 1.68$, Equatorial diameter (ED) $25.46\mu\text{m} \pm 1.92$, PA/ED $0.97\mu\text{m} \pm 0.05$, Density of spines $37.46\mu\text{m} \pm 2.47$.

54. *Blainvillea acmella* (L.) Philipson

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $28.17\mu\text{m} \pm 0.90$, Aperture tricolporate $4.25\mu\text{m} \pm 0.48$, Echinate ornamentation, Cavea present, Length of ornamentation $7.14\mu\text{m} \pm 1.14$, Polar axis (PA) $27.42\mu\text{m} \pm 0.87$, Equatorial diameter (ED) $28.91\mu\text{m} \pm 1.29$, PA/ED $0.95\mu\text{m} \pm 0.04$, Density of spines $35.80\mu\text{m} \pm 0.59$.

55. *Eclipta prostrata* (L.) L.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $22.149\mu\text{m} \pm 0.780$, Aperture tricolporate $4.212\mu\text{m} \pm 0.061$, Echinate ornamentation, Cavea present, Length of ornamentation $4.669\mu\text{m} \pm 0.292$, Polar axis (PA) $21.749\mu\text{m} \pm 0.809$,

Equatorial diameter (ED) $22.549\mu\text{m} \pm 0.892$, PA/ED $0.965\mu\text{m} \pm 0.029$, Density of spines $27.418\mu\text{m} \pm 1.222$.

56. *Lagascea mollis* Cav.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $23.366\mu\text{m} \pm 0.338$, Aperture tricolpate $3.050\mu\text{m} \pm 0.226$, Echinate ornamentation, Cavea absent, Length of ornamentation $3.891\mu\text{m} \pm 0.338$, Polar axis (PA) $23.238\mu\text{m} \pm 0.641$, Equatorial diameter (ED) $23.495\mu\text{m} \pm 0.328$, PA/ED $0.989\mu\text{m} \pm 0.032$, Density of spines $39.548\mu\text{m} \pm 1.266$.

57. *Lipoblepharis urticifolia* (Blume) Orchard

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $32.758\mu\text{m} \pm 1.893$, Aperture tricolpate $4.812\mu\text{m} \pm 0.203$, Echinate ornamentation, Cavea present, Length of ornamentation $6.003\mu\text{m} \pm 0.329$, Polar axis (PA) $31.855\mu\text{m} \pm 1.666$, Equatorial diameter (ED) $33.660\mu\text{m} \pm 2.373$, PA/ED $0.948\mu\text{m} \pm 0.044$, Density of spines $29.980\mu\text{m} \pm 2.502$.

58. *Lipochaeta lobata* (Gaudich.) DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $26.540\mu\text{m} \pm 0.581$, Aperture tricolporate $4.468\mu\text{m} \pm 0.198$, Echinate ornamentation, Cavea present, Length of ornamentation $7.619\mu\text{m} \pm 0.325$, Polar axis (PA) $25.098\mu\text{m} \pm 0.652$, Equatorial diameter (ED) $27.982\mu\text{m} \pm 0.698$, PA/ED $0.897\mu\text{m} \pm 0.023$, Density of spines $44.756\mu\text{m} \pm 2.461$.

59. *Parthenium hysterophorus* L.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $17.307\mu\text{m} \pm 0.467$, Aperture tricolpate $4.420\mu\text{m} \pm 0.172$, Echinate ornamentation, Cavea absent, Length of ornamentation $2.394\mu\text{m} \pm 0.185$, Polar axis (PA) $17.184\mu\text{m} \pm 0.670$, Equatorial diameter (ED) $17.429\mu\text{m} \pm 0.372$, PA/ED $0.986\mu\text{m} \pm 0.032$, Density of spines $23.351\mu\text{m} \pm 1.142$.

60. *Sclerocarpus africanus* Jacq.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $29.064\mu\text{m} \pm 0.977$, Aperture tricolporate $4.655\mu\text{m} \pm 0.409$, Echinate ornamentation, Cavea absent, Length of ornamentation $5.470\mu\text{m} \pm 0.946$, Polar axis (PA) $28.335\mu\text{m} \pm 1.053$,

Equatorial diameter (ED) $29.793\mu\text{m} \pm 1.042$, PA/ED $0.951\mu\text{m} \pm 0.024$, Density of spines $57.502\mu\text{m} \pm 3.836$.

61. *Sphangneticola trilobata* (L.) Pruski

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $24.356\mu\text{m} \pm 0.440$, Aperture tricolporate $3.521\mu\text{m} \pm 0.186$, Echinate ornamentation, Cavea present, Length of ornamentation $4.064\mu\text{m} \pm 0.205$, Polar axis (PA) $23.235\mu\text{m} \pm 0.497$, Equatorial diameter (ED) $25.476\mu\text{m} \pm 0.497$, PA/ED $0.912\mu\text{m} \pm 0.017$, Density of spines $34.468\mu\text{m} \pm 2.384$.

62. *Synedrella nodiflora* (L.) Gaertn.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $27.504\mu\text{m} \pm 0.784$, Aperture tricolpate $4.267\mu\text{m} \pm 0.095$, Echinate ornamentation, Cavea present, Length of ornamentation $4.504\mu\text{m} \pm 0.155$, Polar axis (PA) $27.077\mu\text{m} \pm 0.900$, Equatorial diameter (ED) $27.931\mu\text{m} \pm 0.717$, PA/ED $0.969\mu\text{m} \pm 0.016$, Density of spines $47.425\mu\text{m} \pm 3.664$.

63. *Tithonia diversifolia* (Hemsl.) A.Gray

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $35.053\mu\text{m} \pm 0.991$, Aperture tricolpate $7.242\mu\text{m} \pm 0.436$, Echinate ornamentation, Cavea absent, Length of ornamentation $8.507\mu\text{m} \pm 0.610$, Polar axis (PA) $34.621\mu\text{m} \pm 0.412$, Equatorial diameter (ED) $35.485\mu\text{m} \pm 1.750$, PA/ED $0.978\mu\text{m} \pm 0.043$, Density of spines $41.943\mu\text{m} \pm 1.6$.

64. *Xanthium strumarium* L.

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class minutae, Pollen size $22.632\mu\text{m} \pm 1.01$, Aperture triporate $4.394\mu\text{m} \pm 0.240$, Scabrate ornamentation, Cavea absent, Length of ornamentation $0.602\mu\text{m} \pm 0.093$, Polar axis (PA) $23.596\mu\text{m} \pm 1.522$, Equatorial diameter (ED) $21.669\mu\text{m} \pm 1.541$, PA/ED $1.095\mu\text{m} \pm 0.119$, Density of spines $67.958\mu\text{m} \pm 4.686$.

65. *Acanthospermum hispidum* DC.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $22.17\mu\text{m} \pm 0.765$, Aperture tricolporate $3.53\mu\text{m} \pm 0.446$, Echinate ornamentation, Cavea

absent, Length of ornamentation $3.82\mu\text{m} \pm 0.544$, Polar axis (PA) $21.41\mu\text{m} \pm 0.89$, Equatorial diameter (ED) $22.93\mu\text{m} \pm 0.735$, PA/ED $0.934\mu\text{m} \pm 0.025$, Density of spines $29.70\mu\text{m} \pm 3.54$.

66. *Guizotia abyssinica* (L.f.) Cass.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $30.605\mu\text{m} \pm 1.025$, Aperture tricolporate $4.908\mu\text{m} \pm 0.502$, Echinate ornamentation, Cavea absent, Length of ornamentation $7.168\mu\text{m} \pm 0.198$, Polar axis (PA) $30.274\mu\text{m} \pm 1.838$, Equatorial diameter (ED) $30.935\mu\text{m} \pm 0.993$, PA/ED $0.980\mu\text{m} \pm 0.067$, Density of spines $43.756\mu\text{m} \pm 1.546$.

67. *Tridax procumbens* L.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $25.486\mu\text{m} \pm 0.871$, Aperture tricolporate $5.095\mu\text{m} \pm 0.220$, Echinate ornamentation, Cavea absent, Length of ornamentation $3.890\mu\text{m} \pm 0.528$, Polar axis (PA) $25.135\mu\text{m} \pm 1.034$, Equatorial diameter (ED) $25.837\mu\text{m} \pm 1.174$, PA/ED $0.974\mu\text{m} \pm 0.051$, Density of spines $45.337\mu\text{m} \pm 2.026$.

68. *Adenostema visocsa* J.R.Frost. & G.Frost.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class mediae, Pollen size $25.663\mu\text{m} \pm 0.559$, Aperture tricolporate $5.667\mu\text{m} \pm 0.315$, Echinate ornamentation, Cavea present, Length of ornamentation $2.661\mu\text{m} \pm 0.068$, Polar axis (PA) $24.495\mu\text{m} \pm 0.438$, Equatorial diameter (ED) $26.83\mu\text{m} \pm 0.862$, PA/ED $0.914\mu\text{m} \pm 0.026$, Density of spines $36\mu\text{m} \pm 1.383$.

69. *Ageratum conyzoides* L.

Isopolar, Radial symmetry, Oblate-spheroidal shape, Pollen class minutae, Pollen size $21.853\mu\text{m} \pm 0.613$, Aperture tricolporate $3.356\mu\text{m} \pm 0.198$, Echinate ornamentation, Cavea present, Length of ornamentation $2.713\mu\text{m} \pm 0.084$, Polar axis (PA) $21.446\mu\text{m} \pm 0.633$, Equatorial diameter (ED) $22.261\mu\text{m} \pm 0.642$, PA/ED $0.964\mu\text{m} \pm 0.015$, Density of spines $50\mu\text{m} \pm 1.533$.

70. *Chromolaena odorata* (L.) R.M.King & H.Rob.

Isopolar, Radial symmetry, Prolate-spheroidal shape, Pollen class mediae, Pollen size $29.07\mu\text{m} \pm 1.21$, Aperture tricolporate $3.46\mu\text{m} \pm 0.09$, Echinate ornamentation, Cavea present, Length

of ornamentation $6.46\mu\text{m} \pm 0.34$, Polar axis (PA) $29.47\mu\text{m} \pm 1.57$, Equatorial diameter (ED) $28.67\mu\text{m} \pm 1.22$, PA/ED $1.03\mu\text{m} \pm 0.05$, Density of spines $38.83\mu\text{m} \pm 3.03$.

4.3.2 Discussion

From analysis of above data, 27 pollen types were designated from the different combinations of characters. The key to the pollen types are as follows.

Key to the types of Pollens

- 1a. Symmetry bilateral (2)
- 1b. Symmetry radial (3)
- 2a. Surface scabrate Type 1
- 2b. Surface Psilate Type 2
- 3a. Surface scabrate Type 3
- 3b. Surface not scabrate (4)
- 4a. Ornamentation Lophate (5)
- 4b. Ornamentation Echinata (11)
- 5a. Pollen minutae Type 4
- 5b. Pollen not minutae (6)
- 6a. Shape sub-oblate Type 5
- 6b. Shape not sub-oblate (7)
- 7a. Shape spheroidal Type 6
- 7b. Shape not spheroidal (8)
- 8a. Aperture porate (9)
- 8b. Aperture not porate (11)
- 9a. Pollen mediae (10)
- 9b. Pollen magnae Type 7
- 10a. Shape Oblate-spheroidal Type 8
- 10b. Shape Prolate-spheroidal Type 9
- 11a. Aperture colpate Type 10
- 11b. Aperture colpate Type 11
- 12a. Shape oblate Type 12
- 12b. Shape not oblate (13)
- 13a. Shape spheroidal (14)
- 13b. Shape not spheroidal (15)
- 14a. Pollen minutae, aperture colpate Type 13

14b. Pollen mediae, aperture colpate	Type 14
15a. Shape sub-oblate	Type 15
15b. Shape not sub-oblate	(16)
16a. Shape prolate-spheroidal	(17)
16b. Shape oblate-spheroidal	(21)
17a. Aperture colpate	(18)
17b. Aperture colpate	(19)
18a. Pollen minutae	Type 16
18b. Pollen mediae	Type 17
19a. Cavea absent	Type 18
19b. Cavea present	(20)
20a. Pollen minutae	Type 19
20b. Pollen mediae	Type 20
21a. Aperture colpate	(22)
21b. Aperture colpate	(24)
22a. Cavea present	Type 21
22b. Cavea absent	(23)
23a. Pollen minutae	Type 22
23b. Pollen mediae	Type 23
24a. Pollen minutae	(25)
24b. Pollen mediae	(26)
25a. Cavea present	Type 24
25b. Cavea absent	Type 25
26a. Cavea present	Type 26
26b. Cavea absent	Type 27

Pollen Types Description

Type 1: Bilateral, Oblate, Colpate, Scabrate, Cavea Absent, Magnae

Species: *Echinops echinatus*

Type 2: Bilateral, Sub-prolate, Colporate, Psilate, Cavea Absent, Mediae

Species: *Oligochaeta divaricata*

Type 3: Radial, Prolate-spheroidal, Porate, Scabrate, Cavea Absent, Minutae

Species: *Xanthium strumarium*

Type 4: Radial, Prolate-spheroidal, Porate, Lophate, Caves Absent, Minutae

Species: *Sonchus asper*

Type 5: Radial, Sub-oblate, Porate, Lophate, Cavea Absent, Mediae

Species: *Launaea procumbens*

Type 6: Radial, Spheroidal, Porate, Lophate, Cavea Absent, Mediae

Species: *Launaea sarmentosa*

Type 7: Radial, Oblate-spheroidal, Porate, Lophate, Cavea Absent, Magnae

Species: *Phyllocephalum microcephalum*

Type 8: Radial, Oblate-spheroidal, Porate, Lophate, Cavea Absent, Mediae

Species: *Sonchus oleraceus*, *Acilepis divergens*, *Elephantopus scaber*

Type 9: Radial, Prolate-spheroidal, Porate, Lophate, Absent, Mediae

Species: *Baccharoides anthelmintica*

Type 10: Radial, Oblate-spheroidal, Colpate, Lophate, Cavea Absent, Mediae

Species: *Centratherum punctatum*

Type 11: Radial, Oblate-spheroidal, Colporate, Lophate, Cavea Absent, Mediae

Species: *Cyanthillium cinereum*

Type 12: Radial, Oblate, Colporate, Echinata, Cavea Absent, Minutae

Species: *Blumea eriantha*

Type 13: Radial, Spheroidal, Colpate, Echinata, Cavea Absent, Minutae

Species: *Acmella oleracea*

Type 14: Radial, Spheroidal, Colporate, Echinata, Cavea Present, Mediae

Species: *Emilia sonchifolia*

Type 15: Radial, Sub-oblate, Colporate, Echinata, Cavea Present, Minutae

Species: *Erigeron bonariensis*

Type 16: Radial, Prolate-spheroidal, Colpate, Echinata, Cavea Absent, Minutae

Species: *Eschenbachia stricta*, *Acmella ciliata*

Type 17: Radial, Prolate-spheroidal, Colpate, Echinata, Cavea Absent, Mediae

Species: *Blumea malcolmii*, *Acmella paniculate*

Type 18: Radial, Prolate-spheroidal, Colporate, Echinata, Cavea Absent, Minutae

Species: *Cyathocline purpurea*, *Pulicaria angustifolia*, *Vicoa cernua*

Type 19: Radial, Prolate-spheroidal, Colporate, Echinata, Cavea Present, Minutae

Species: *Grangea maderaspatana*, *Thespis thakeri*

Type 20: Radial, Prolate-spheroidal, Colporate, Echinata, Cavea Present, Mediae

Species: *Bidens bipinnata*, *Chromolaena odorata*, *Crassocephalum crepidioides*

Type 21: Radial, Oblate-spheroidal, Colpate, Echinata, Cavea Present, Mediae

Species: *Glossocardia bosvallia*, *Acmella uliginosa*, *Lipoblepharis urticifolia*, *Synedrella nodiflora*

Type 22: Radial, Oblate-spheroidal, Colpate, Echinata, Cavea Absent, Minutae

Species: *Lagascea mollis*, *Parthenium hysterophorus*

Type 23: Radial, Oblate-spheroidal, Colpate, Echinata, Cavea Absent, Mediae

Species: *Tithonia diversifolia*

Type 24: Radial, Oblate-spheroidal, Colporate, Echinata, Cavea Present, Minutae

Species: *Gamochaeta pensylvanica*, *Gamochaeta purpurea*, *Eclipta prostrata*, *Sphagneticola trilobata*, *Ageratum conyzoides*

Type 25: Radial, Oblate-spheroidal, Colporate, Echinata, Cavea Absent, Minutae

Species: *Helichrysum indicum*, *Blumea axillaris*, *Blumea belangeriana*, *Blumea obliqua*, *Blumea sinuata*, *Blumea virens*, *Pluchea ovalis*, *Pseudoconyza viscosa*, *Sphaeranthus indicus*, *Vicoa indica*, *Acanthospermum hispidum*

Type 26: Radial, Oblate-spheroidal, Colporate, Echinata, Cavea Present, Mediae

Species: *Goniocaulon indicum*, *Blumea bovei*, *Cosmos caudatus*, *Blainvillea acmella*, *Lipochaeta lobata*, *Adenostemma viscosum*, *Senecio bombayensis*

Type 27: Radial, Oblate-spheroidal, Colporate, Echinata, Cavea Absent, Mediae

Species: *Tricholepis glaberrima*, *Blumea membranacea*, *Blumea oxyodonta*, *Caesulia axillaris*, *Pluchea wallichiana*, *Bidens biternate*, *Cosmos sulphureus*, *Acmella radicans*, *Sclerocarpus africanus*, *Guizotia abyssinica*, *Tridax procumbens*

Statistical Analysis of Pollens

To check the significant differences between the means of quantitative data, normality test was performed and it was found that data is not normally distributed. Hence, non-parametric test, Kruskal Wallis test, was performed and the results are given below.

- H_0 : There is no significant difference between the mean value of parameters with respect to species.
- H_1 : There is significant difference between the mean value of parameters with respect to species.

Table 4.2 Statistical Analysis of Pollen Measurements

No.	Parameters	P-value	Inference
1.	Size of pollen	<0.05	H_0 rejected
2.	Length of Ornamentation	<0.05	H_0 rejected
3.	Polar Axis (PA)	<0.05	H_0 rejected
4.	Equator Diameter (ED)	<0.05	H_0 rejected
5.	PA/ED	<0.05	H_0 rejected
6.	Width of Aperture	<0.05	H_0 rejected

From above table, it was found that there is the significant difference between the means of the different parameters.

Hence, the both quantitative and qualitative data can be used for systematic classification and cladistic analysis.

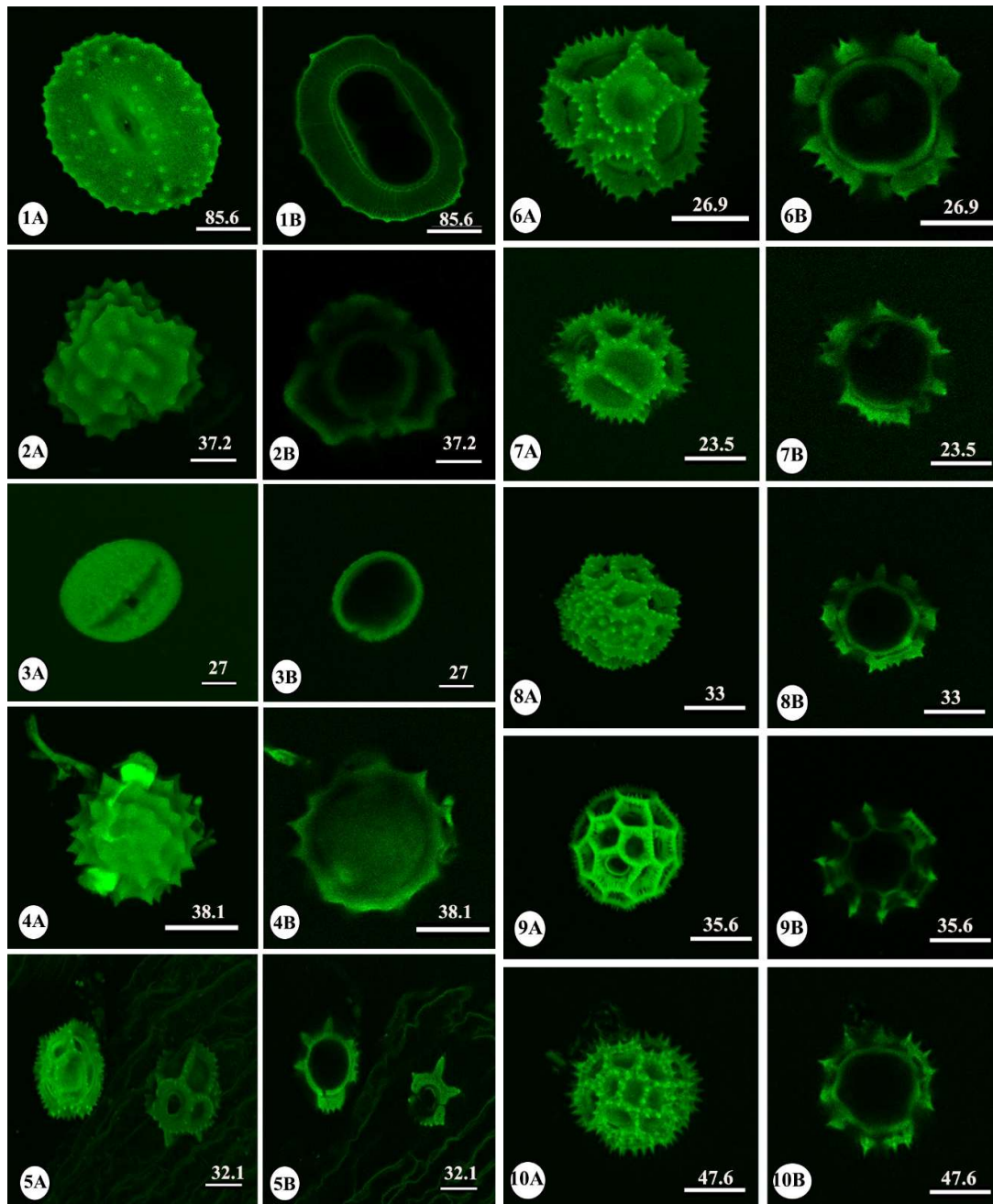


Plate 4.71 Pollen Plate 1: 1. *Echinops echinatus*; 2. *Goniocaulon indicum*; 3. *Oligochaeta divaricate*; 4. *Tricholepis glaberrima*; 5. *Launaea procumbens*; 6. *Launaea sarmentosa*; 7. *Sonchus asper*; 8. *Sonchus oleraceus*; 9. *Acilepis divergens*; 10. *Baccharoides anthelmintica*.

(A. Surface View; B. Optical Section)

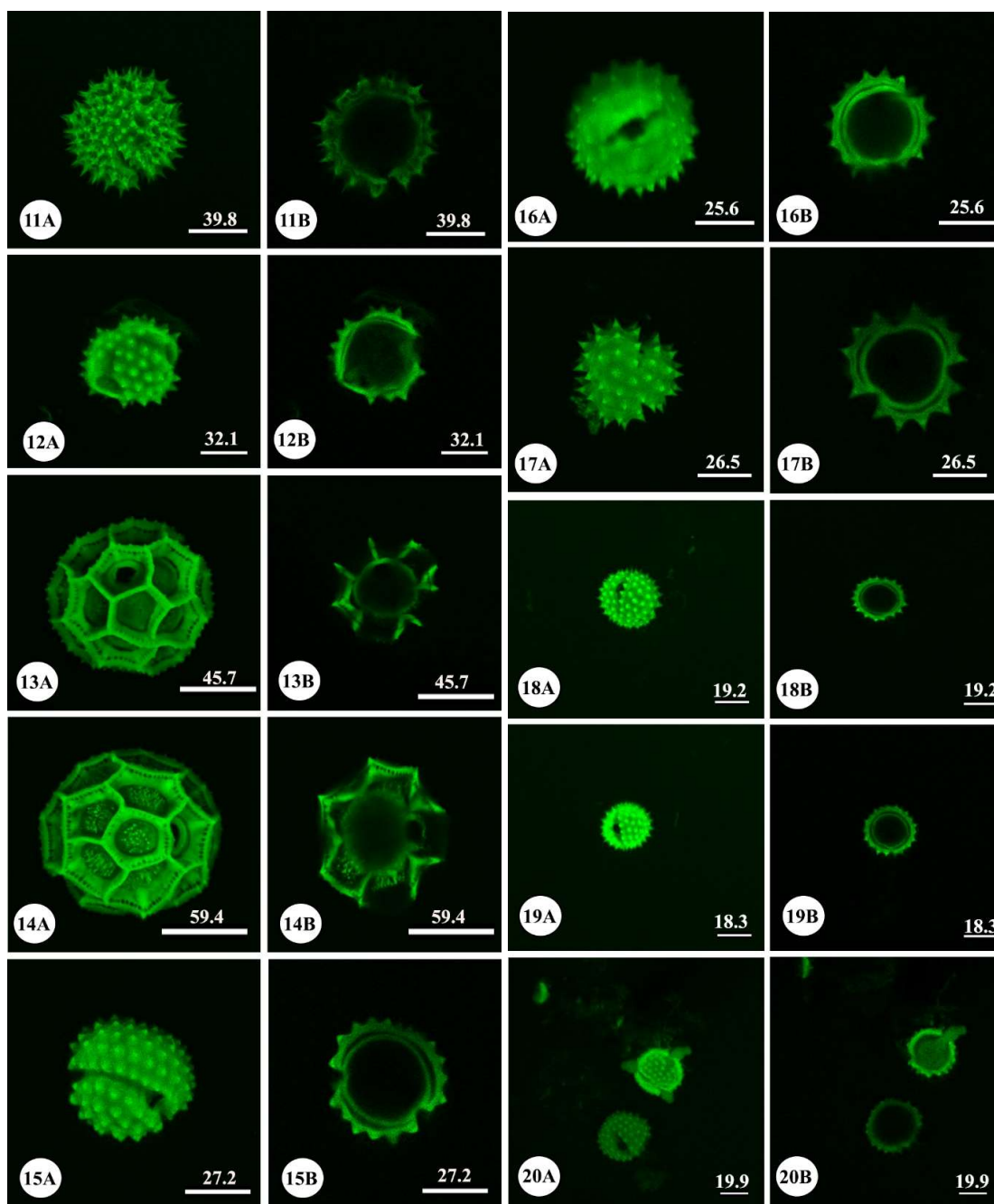


Plate 4.72 Pollen Plate 2: 11. *Centratherum punctatum*; 12. *Cyanthillium cinereum*; 13. *Elephantopus scaber*; 14. *Phyllocephalum microcephalum*; 15. *Crassocephalum crepidioides*; 16. *Emilia sonchifolia*; 17. *Senecio bombayensis*; 18. *Gamochaeta pensylvanica*; 19. *Gamochaeta purpurea*; 20. *Helichrysum indicum*.

(A. Surface View; B. Optical Section)

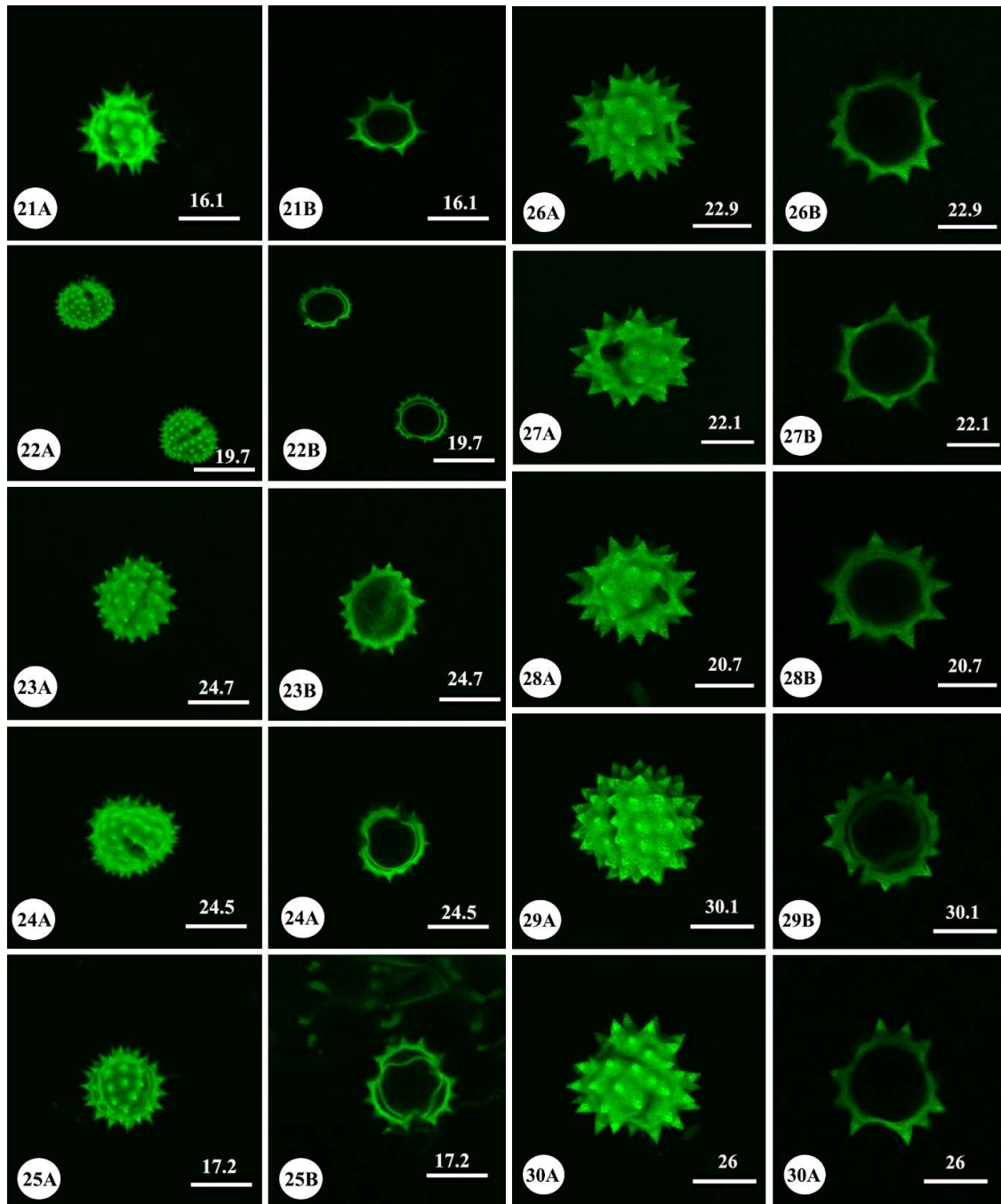


Plate 4.73 Pollen Plate 3: 21. *Cyathocline purpurea*; 22. *Erigeron bonariensis*; 23. *Eschenbachia stricta*; 24. *Grangea maderaspatana*; 25. *Thespis thakeri*; 26. *Blumea axillaris*; 27. *Blumea belangeriana*; 28. *Blumea eriantha*; 29. *Blumea malcolmii*; 30. *Blumea membranacea*.

A. Surface View; B. Optical Section

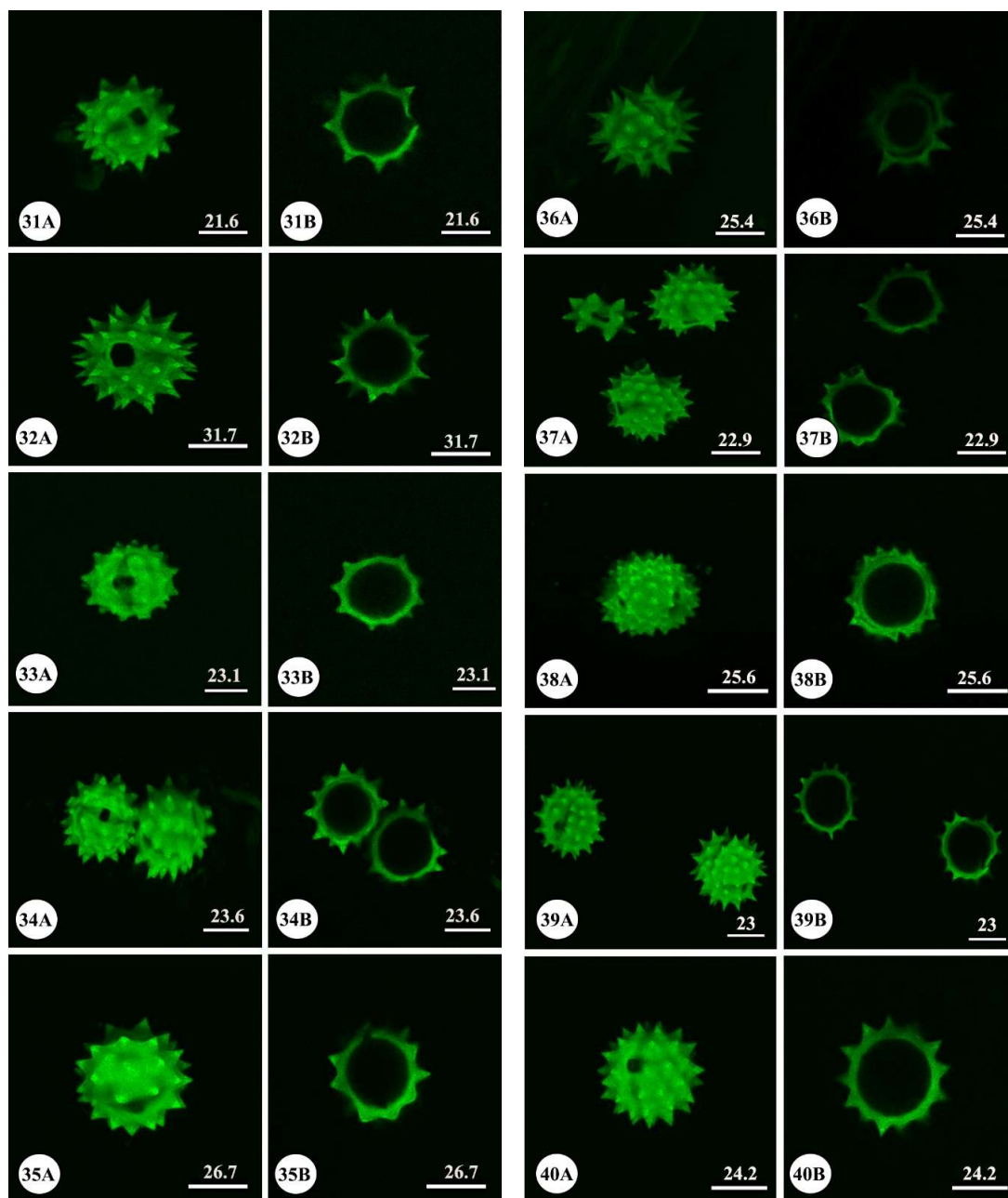


Plate 4.74 Pollen Plate 4: 31. *Blumea obliqua*; 32. *Blumea oxyodonta*; 33. *Blumea sinuate*; 34. *Blumea virens*; 35. *Caesulia axillaris*; 36. *Blumea bovei*; 37. *Pluchea ovalis*; 38. *Pluchea wallichiana*; 39. *Pseudoconyza viscosa*; 40. *Pulicaria angustifolia*.

(A. Surface View; B. Optical Section)

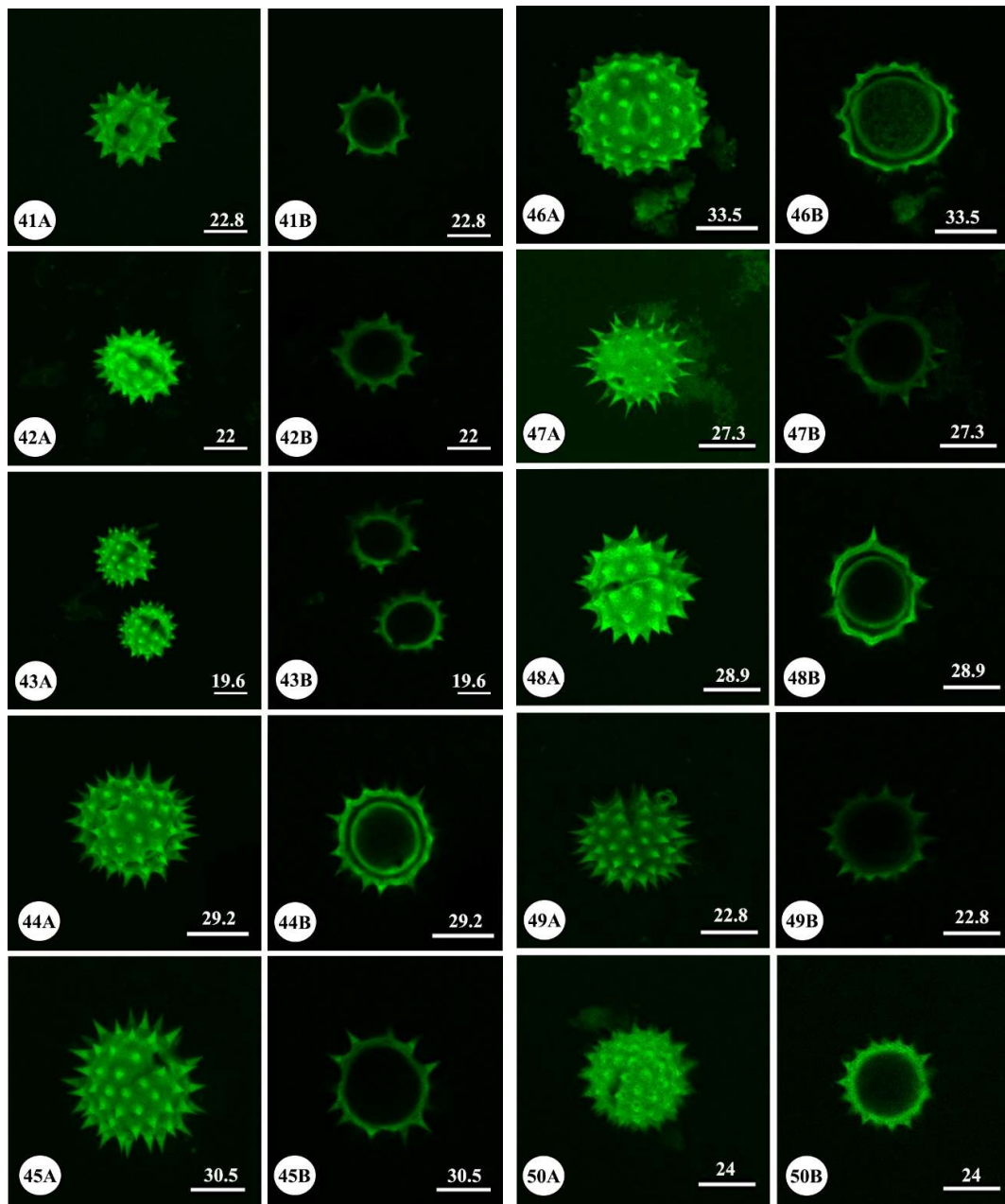


Plate 4.75 Pollen Plate 5: 41. *Sphaeranthus indicus*; 42. *Vicoa cernua*; 43. *Vicoa indica*; 44. *Bidens bipinnata*; 45. *Bidens biternate*; 46. *Cosmos caudatus*; 47. *Cosmos sulphureus*; 48. *Glossocardia bosvallia*; 49. *Acemella ciliata*; 50. *Acemella oleracea*.

(A. Surface View; B. Optical Section)

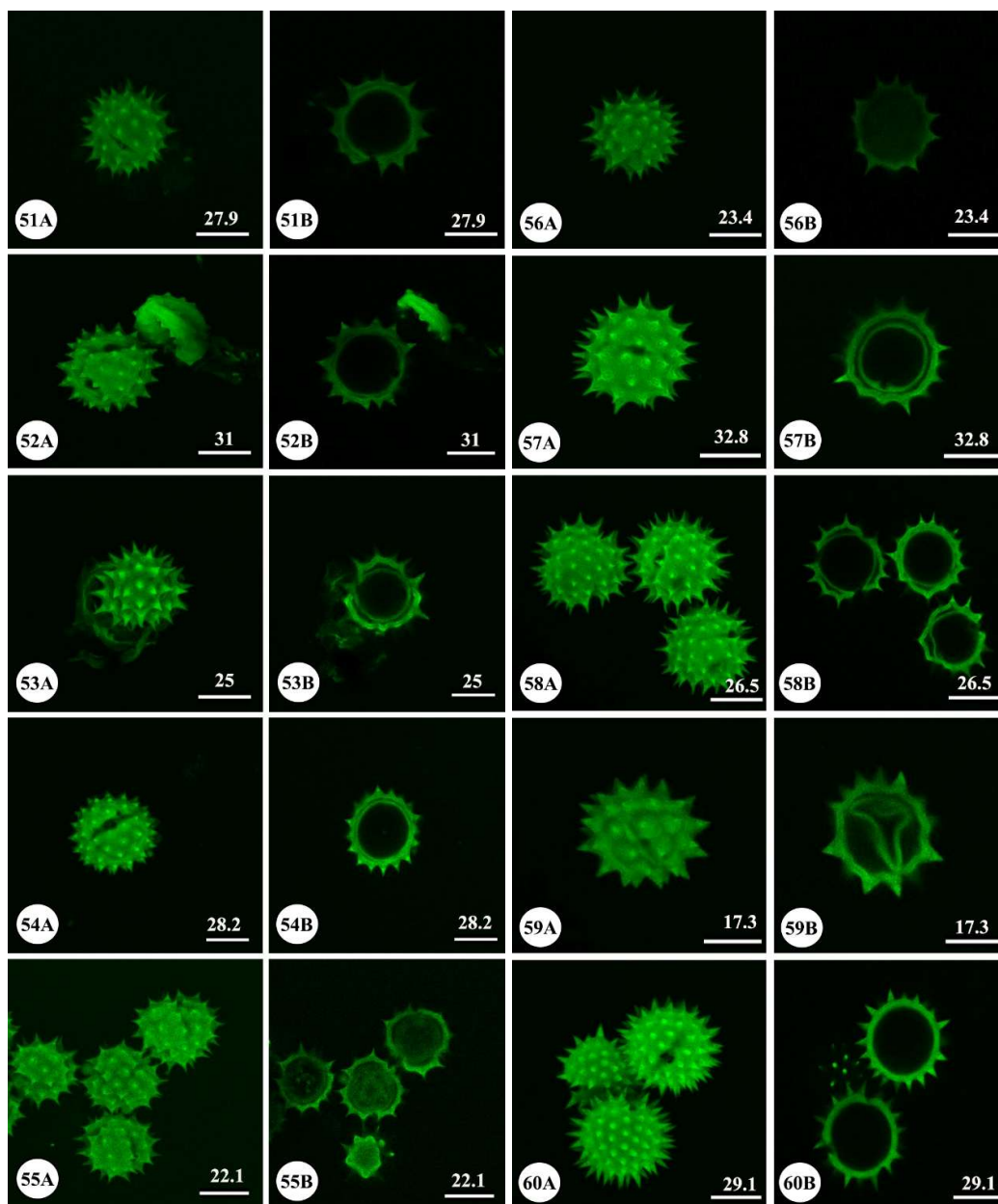


Plate 4.76 Pollen Plate 6: 51. *Acmeella paniculata*; 52. *Acmeella radicans*; 53. *Acmeella uliginosa*; 54. *Blainvillea acmella*; 55. *Eclipta prostrata*; 56. *Lagascea mollis*; 57. *Lipoblepharis urticifolia*; 58. *Lipochaeta lobata*; 59. *Parthenium hysterophorus*; 60. *Sclerocarpus africanus*.

(A. Surface View; B. Optical Section)

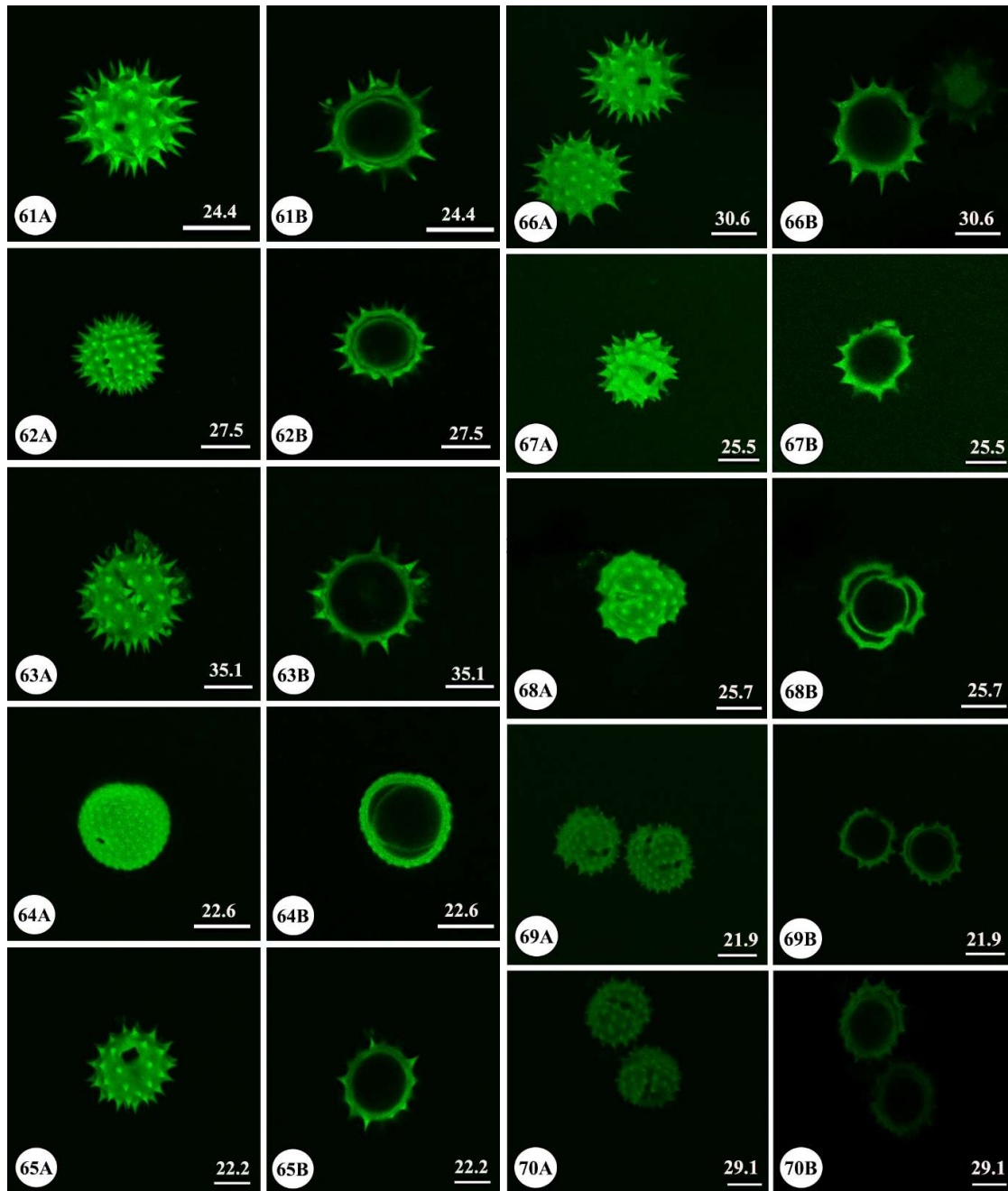


Plate 4.77 Pollen Plate 7: 61. *Sphagneticola trilobata*; 62. *Synedrella nodiflora*; 63. *Tithonia diversifolia*; 64. *Xanthium strumarium*; 65. *Acanthospermum hispidum*; 66. *Guizotia abyssinica*; 67. *Tridax procumbens*; 68. *Adenostemma viscosum*; 69. *Ageratum conyzoides*; 70. *Chromolaena odorata*.

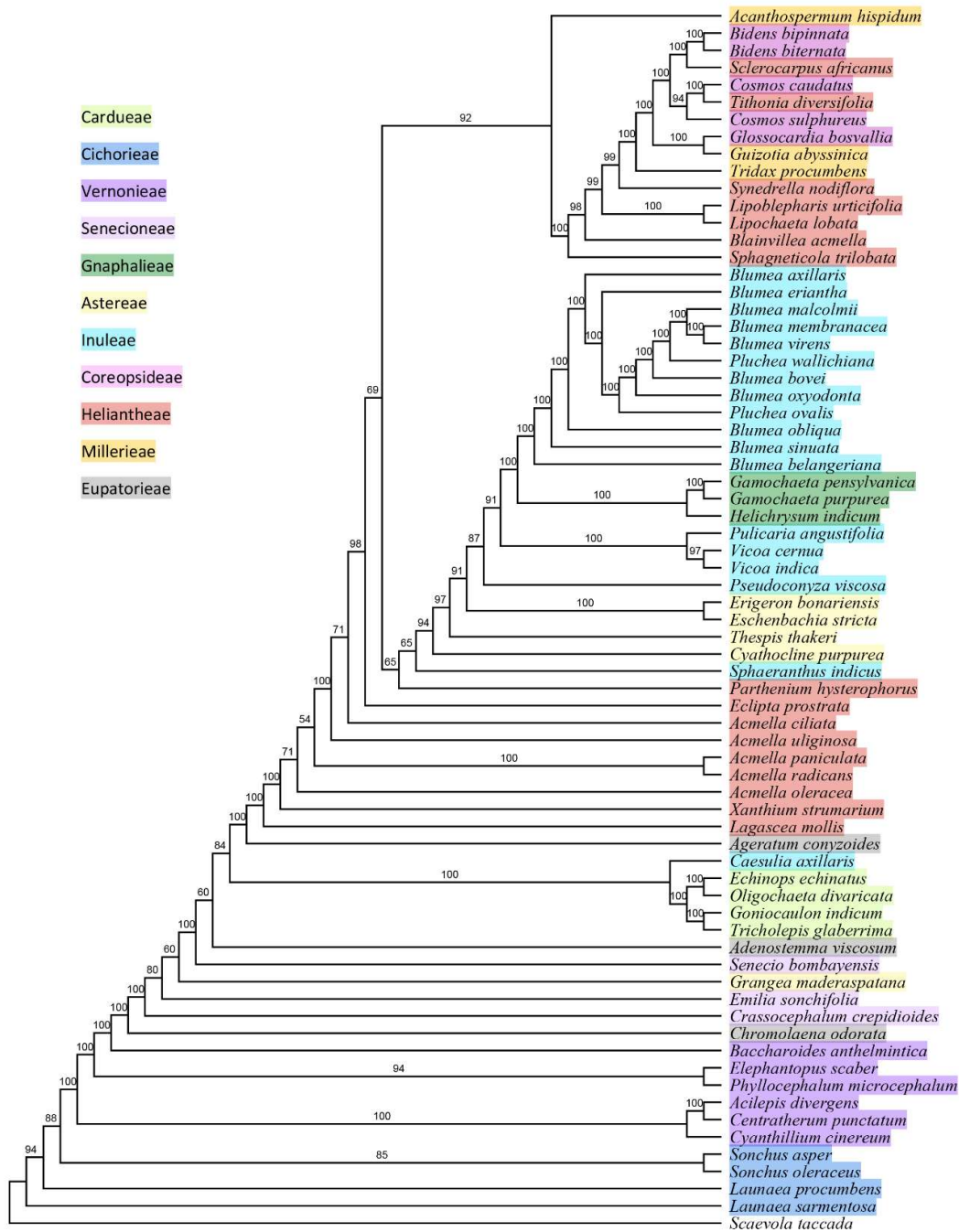
(A. Surface View; B. Optical Section)

4.4 Cladistic Analysis

In cladistic analysis, the relationship between 70 species is analysed which is shown in Figure 4.5.

Figure 4.5 Cladogram prepared by Maximum Parsimony (MP) method

Majority-rule consensus tree



The morphological and palynological dataset analyzed consisted of 56 characters, with 53 of them being parsimony-informative. From this dataset, the Maximum Parsimony (MP) analysis yielded 702 most parsimonious trees, with 79,996 rearrangements tried. The final 50% majority-rule consensus tree (illustrated in the cladogram) was constructed with bootstrap values assigned to the nodes, providing insights into the evolutionary relationships within the Asteraceae family.

Cardueae Tribe Monophyly:

The analysis clearly shows that the Cardueae tribe forms a monophyletic group with a bootstrap value of 100%. This strong support highlights the robust evolutionary relationship among its members. Interestingly, *Caesulia axillaris* is placed within this clade, suggesting an unexpected evolutionary affinity with the Cardueae tribe. The tree further shows that species like *Echinops* and *Oligochaeta* cluster together, while *Tricholepis* and *Goniocaulon* group together. The latter pairing can be attributed to their similar pollen morphology, supporting their close phylogenetic relationship.

Paraphyly in Cichorioideae:

Members of the Cichorioideae subfamily display paraphyly, which suggests they share a common ancestor but are not all descended from a single clade within the tree. Among the Cichorioideae, species like *Acilepis*, *Centratherum* and *Cyanthillium* show strong monophyly with a bootstrap value of 100%, reinforcing their close genetic relationships. In contrast, *Elephantopus* and *Phyllocephalum* also form a monophyletic group, though with slightly lower support (BS = 94%). This solidifies their placement within the subfamily but also leaves room for further investigation into their evolutionary history.

Astereae Tribe:

The Astereae tribe displays mixed patterns of evolutionary relationships. Notably, *Grangea* exhibits polyphyly, which suggests that it might not be a single evolutionary lineage. This could imply the need for reclassification or further study to resolve its placement. On the other hand, species like *Thespis* and *Cyathocline* exhibit paraphyly, suggesting they are related but not fully resolved into a monophyletic group. Interestingly, *Erigeron* and *Eschenbachia* show monophyly, indicating that these species are closely related and possibly should be merged into one genus, as both were previously classified within *Conyza*. However, *Cyathocline*, although molecularly related to *Blumea* based on *ndhF* phylogeny (where it was

classified as *Blumea stricta*), still cannot be clearly separated based on morphology alone, suggesting the need for further molecular and morphological studies to fully resolve this relationship.

Gnaphalieae Tribe and Inuleae Relationship:

The Gnaphalieae tribe is confirmed as monophyletic with strong bootstrap support (BS = 100%), indicating a well-resolved evolutionary grouping. However, it is nested within the Inuleae tribe, suggesting that it might be more appropriate to treat it as a subtribe of Inuleae. This supports the idea that Gnaphalieae may not be distinct enough to stand alone as a tribe based on the available data.

Meanwhile, *Sphaeranthus* and *Caesulia* show polyphyly within the Inuleae clade, which indicates that they likely evolved from different ancestors, and may require further taxonomic revision to clarify their exact relationships within the Inuleae.

Heliantheae Alliance and Eupatoreae Tribe:

The cladogram indicates that members of the Heliantheae alliance are polyphyletic, meaning that the traditional classification of this tribe does not reflect their evolutionary relationships. Specifically, species like *Sclerocarpus* form a monophyletic group with *Bidens*, and *Tithonia* is monophyletic with *Cosmos*, which supports their close evolutionary affinities. This implies that the Heliantheae tribe, as currently defined, is likely polyphyletic and may require redefinition to better reflect the true evolutionary history of its members.

In the case of Eupatoreae, the analysis places this tribe near more primitive groups, contrary to previous findings by Funk *et al.* (2005), where Eupatoreae was considered one of the most advanced tribes. The polyphyly observed within this tribe suggests the need for a re-evaluation of its classification, as its members appear to be spread across different clades.

Millerieae and Coreopsideae Tribes:

The Millerieae tribe also exhibits polyphyly, with members like *Guizotia* forming a monophyletic group with *Glossocardia* from the Coreopsideae tribe. This unexpected grouping, supported by a bootstrap value of 100%, challenges the traditional boundaries of these tribes and suggests that *Guizotia* may be more closely related to Coreopsideae than previously thought. Additionally, the strong monophyletic relationship between *Sclerocarpus* and *Bidens* further emphasizes the close evolutionary ties within the Heliantheae alliance.