CHAPTER II
TAXONOMIC TREATMENT

1. Taxonomy of Vernonieae

The traditional concept of the tribe is that of Bentham (1873), based upon the earlier work of Cassini (1819, 1828), Lessing (1832), and Candolle (1836). The biggest change in Bentham's tribal concept has come with the recent revisions of the Old and New World Vernonieae by Robinson (1999a, 1999b; 2007) based on morphological studies along with the molecular work of Keeley (Keeley & Jansen, 1994; Keeley *et al.*, 2007). Combining these findings has produced a new understanding of the Vernonieae (Keeley and Robinson, 2009, Ch. 28 in The Systematics, Evolution and Biogeography of the Compositae (Funk *et al.*, 2009)). In this treatment, 20 subtribes and 125 genera were recognized with more genera added since as a result of ongoing work by Robinson and colleagues within a phylogenetic context. Among the most important of Robinson's treatment (1999a) was the redefinition of the core genus, *Vernonia.* Historically, *Vernonia* was the name given to any taxon within the tribe that was not morphologically distinctive enough to be easily separated from other species. The taxonomic confusion resulting this dumping together of many different, but difficult to separate entities is in large part the reason for the Vernonieae's nickname, "the evil tribe" (Funk *et al.*, 2005; Keeley *et al.*, 2007). Robinson's revision of *Vernonia* reduced the number of species from >1000 distributed worldwide to <25 and those entirely restricted to the New World. As a consequence, all the Old World and many the New World taxa had to be placed in other genera and subtribes (Robinson, 1999a, 1999b, 2007; Keeley & Robinson, 2009). While work ongoing studies will no doubt produce changes, the basic structure of the tribe has been established (Keeley *et al.*, 2007; Keeley & Robinson, 2009) and new taxa can be placed within this framework with a reasonable degree of certainty, and new subtribes recognized as required to maintain monophyly. The tribe has been shown to be unequivocably monophyletic (Keeley & Jansen, 1994; Kim *et al.*, 1998; Keeley *et al.*, 2007; Funk *et al.*, 2009) and its constitution has remained relatively

constant over time. The few changes in tribal membership that have been made in the taxa historically assigned to the Vernonieae have resulted from molecular studies, primarily removal of *Pluchea, Eremothamnus, Corymbium* and the addition of *Distephanus*, summarized in Robinson (2007) and Keeley & Robinson (2009). Based on the work of Keeley and Jansen (1994), Kim *et al.* (1998) and Keeley *et al.* (2007) Madagascar/eastern Africa is the site of origin of the tribe. The tribe also is divided into two major lineages, one in the Old World, with a concentration of taxa in Africa, and the other New World, where the center of diversity is Brazil (Robinson, 1999a, 199b; Keeley *et al.*, 2007). In general, there is little overlap between taxa from the two hemispheres; however work by Keeley *et al.* (2007) showed that trans-Atlantic dispersals have occurred in both directions. The status of inter-hemispheric relationships and the frequency of their occurence is currently under investigation by Keeley and Robinson.

2. Mophological characters used in Vernonieae taxonomy

2.1 Trichomes

Trichome type and cellular structure have been used in Vernonieae taxonomy (Fig. 2.1), particularly to distinguish between species; *e.g.*, Faust & Jones (1973), Jones (1973), Narayana (1979), Isawumi (1996), and Robinson (1999a, 1999b) and unite genera; e.g., stellate trichomes in *Piptocarpha* (Smith & Coile, 2007) and various other New World taxa (Robinson, 1999a). Isawumi (1984), Robinson (1999a, 1999b) and Adedeji & Jewoola (2008) also showed the value of trichome morphology at higher levels such as sections and subtribes. There are estimated 25-30 different types of trichomes recorded on stems, leaves, inflorescences, phyllaries, florets and styles providing a wide range of potentially useful characters. For example, Isawumi (1996) reported six different foliar trichome types in 61 species of West African *Vernonia* while Narayana (1979) found 18 different trichomes on leaves, stems and floral parts in south Indian Vernonieae. MacLeish (1987) Stutts & Muir (1981) and Stutts (1988) also observed additional trichome types bringing the number well above 25. Robinson (1999a, 1999b) has used style trichomes, in particular, to distinguish genera and subtribes.

2.2 Pollen

The pollen morphology of tribe Vernonieae is useful for generic, and sometimes for species delimitations (Keeley & Jones, 1977, 1979). *Vernonia* pollen morphology was originally described and illustrated as a potentially useful feature for *Vernonia* taxonomy by Wodehouse (1928, 1935) followed by Stix (1960). Keeley & Jones (1977, 1979) provided a system of classification for Vernonieae pollen types worldwide which continue to be used today. Additional studies, particularly those of Smith (1969), Kingham (1976), Robinson (1999a, 1999b), Robinson & Skvarla (2006, 2007, 2009) and Robinson *et al.* (2008) have made pollen morphology a fundamental character in distinguishing Vernonieae taxa. Pollen type is included in many recent species descriptions as well; *i.e.,* Skvarla *et al.* (2005), Bunwong & Chantaranothai (2008) and Dematteis & Pire (2008). Vernonieae pollen is variable in aperture number with 3-colporate, 3-porate and 6-porate forms and location in the tectum. The latter include echinate, subechinolophate, echinolophate and psilolophate. Most of paleotropical Vernonieae possess lophate 3-porate pollen.

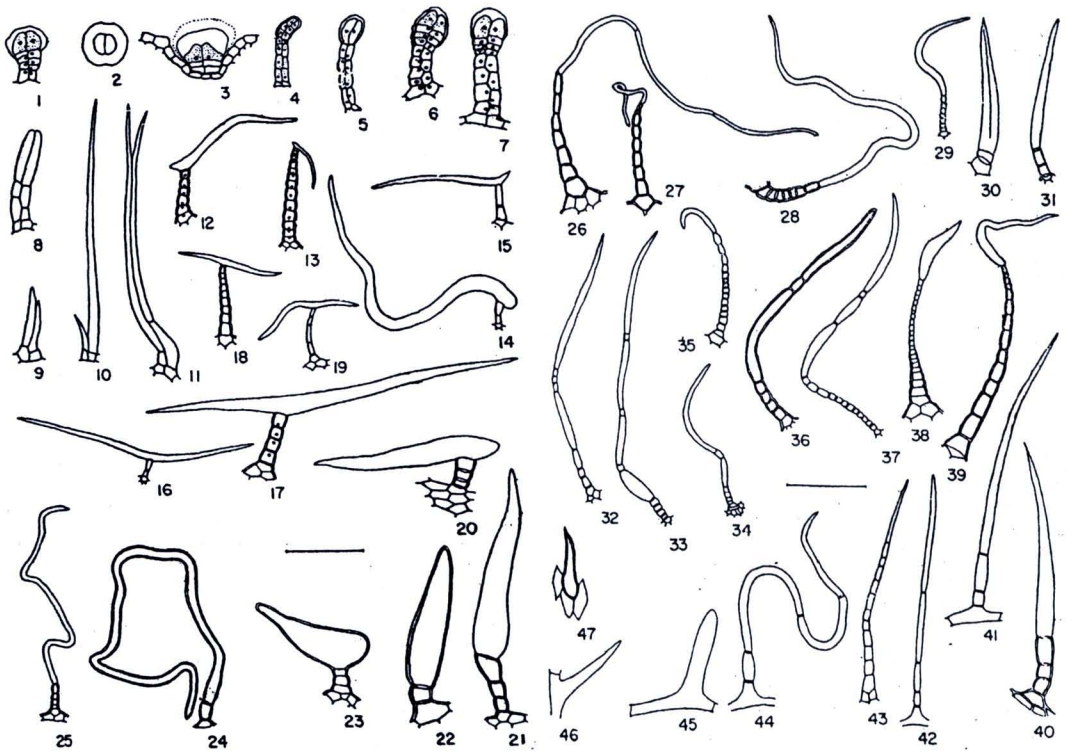

Figure 2.1 Type of Vernonieae trichome; 1 – 7. Glandular, 8 – 11. Biseriate or twin, 12 – 15. One armed, 16 – 19. T-shaped, 20 – 23. Swollen terminal celled, 24 – 25. Flagellate, 26 – 28. Whip-shaped, 29 – 31 and 45. Cylindrical, 32 – 44. Filiform, 46 – 47. Prickly.
(Applied from Narayana, 1979)

3. History of the Study of Vernonieae in Thailand

3.1 The first comprehensive work on Vernonieae in Thailand

Kerr (1936) in a treatment of Thai Compositae described 16 genera and 196 species overall. Twenty-eight of these were Vernonieae: *Camchaya kampotensis, C. loloana, Elephantopus scaber, E. scaber* var. *sinuata, Ethulia conyzoides, Vernonia andensonii, V. attenuata, V. cinerea, V. craibiana, V. cumingiana, V. curtisii, V. curtisii* var. *tomentosa, V. cylindriceps, V. divergens, V. elliptica, V. garrettiana, V. javanica, V. javanica* var. *mollissima, V. juncea, V. kerrii, V. kingii, V. parishii, V. patula, V. principis, V. roxburghii, V. rupicola, V. saligna, V. sangka, V. scandens, V. silhetensis, V. silhetensis* var. *subserrata, V. solanifolia, V. squarrosa, V. sutepensis, V. volkameriifolia, V. volkameriifolia* var. *siamica* and *V. wallichii*. Suvatti (1978)

published the name of flowering plants in Thailand, two genera and 11 species of Vernonieae are found. They are *Elephantopus scaber, Vernonia cinerea, V. curtisii* var. *curtisii, V. curtisii* var. *tomentosum, V. elliptica, V. javanica, V. juncea, V. saligna, V. solanifolia, V. squarrosa, V. volkameriifolia* and *V. wallichii.*

3.2 Koyama and the revision of the Vernonieae in Thailand

Koyama visited Thailand between October and December 1979 for a botanical expedition throughout the country. More than 500 sheets of specimens were collected. He reported taxonomical studies in the Asteraceae of Thailand for the years 1981-2005, and the first enumeration of Vernonieae taxa was published in 1984. The genera *Camchaya, Elephantopus, Ethulia* and *Struchium* were described early on with the recommendation that *Iodocephalus eberhardtii* Gagnep. can be considered a species of *Camchaya.*

In 1993, Koyama recognized four species of woody climbers and two sub-shrub species as members of *Vernonia* section *Decaneurum* (DC.) Oliver, otherwise uncommon in the flora. These are *Vernonia andersonii* C.B.Clarke, *V. eberhardtii* Gagnep., *V. garrettiana* Craib, *V. scandens* DC., *V. divergens* (DC.) Edgew. and *V. saligna* DC., according to their involucral bracts. Later, in 1997, he considered five woody plants; *V. arborea* Buch.-Ham., *V. elliptica* DC., *V. parishii* Hook.f., *V. solanifolia* Benth. and *V. volkameriifolia* DC. belonging to section *Strobocalyx* Blume based on the features of achenes and pappus. After that, in 1998, *V. benguetensis* Elm. and *V. cinerea* (L.) Less. in section *Tephrodes* DC. and *V. patula* (Dryand) Merr. in section *Cyanopis* Blume were examined.

In 2003, four taxa in *Vernonia* section *Calcarea* (Kitam.) H.Koyama; *V. birmanica* (Kuntze) Merr., *V. pseudobirmanica* H.Koyama, *V. curtisii* Craib and *V. calcarea* (Kitam.) H.Koyama) are confined to limestone areas were transferred from the genus *Camchaya* to *Vernonia.* These species are polyploid, based on 18 somatic chromosomes. Additionally, they have achenes with a caducous pappus. A year later, *V. doichangensis* H.Koyama, *V. namnaoensis* H.Koyama, *V. ngaoensis* H.Koyama, *V. pulicarioides* Gagnep., *V. roxburghii* Less., *V. silhetensis* (DC.) Craib and *V. squarrosa* (D.Don) Less. Were reported from mixed deciduous and dipterocarp forests.

Koyama's work, most recent report "Taxonomic studies in the Asteraceae of Thailand" in 2005, seven species were described in section *Lepidaploa,* subsection *Paniculatae*: *Vernonia attenuata* DC., *V. chiangdaoensis* H.Koyama, *V. kingii* C.B.Clarke, *V. kradungensis* H.Koyama, *V. principis* Gagnep., *V. pseudosutepensis* H.Koyama and *V. sutepensis* Kerr. In addition, Koyama thought two species had affinities to *V. tonkinensis* Gagnep. because of the ovate involucral phyllaries but the peduncles of the specimen are more slender than *V. tonkinensis*, and to *V. virgata* Gagnep. with subulate involucral phyllaries but the immature achene was unable to be observed.

Forty-four species in total were reported for the Vernonieae of Thailand (Koyama, 1984, 1993, 1997, 1998, 2003, 2004, 2005). Further study is needed to clarify the concept of particular species because of the poor state of the available material.

3.3 Robinson and generic classification in paleotropical Vernonieae

In order to redefine the Paleotropical members of Vernonieae, Robinson (1990, 1999b), Robinson & Skvarla (2006, 2007, 2009) and Robinson *et al.* (2008) transferred some Thai *Vernonia* species to eight new or resurrected genera; *i.e.*, *Acilepis, Cyanthillium, Decaneuropsis, Gymnanthemum, Koyamasia, Monosis, Strobocalyx* and *Tarlmounia.* These are found in the five subtribes *Centrapalinae* H.Rob., *Elephantopinae* Less, *Erlangeinae* H.Rob., *Gymnantheminae* H.Rob. and *Vernoniinae* Cass. ex Demort. (Table 2.1).

Table 2.1 Subtribal and generic classification of Vernonieae in Thailand.

	Koyama's classification	Robinson's classification	Subtribe
1	*Camchaya kampotensis*	*Camchaya kampotensis*	Centrapalinae
2	*C. eberhardtii*	*C. eberhardtii*	Centrapalinae
3	*C. loloana*	*C. loloana*	Centrapalinae
4	*C. pentagona*	*C. pentagona*	Centrapalinae
5	*C. spinulifera*	*C. spinulifera*	Centrapalinae
7	*Elephantopus mollis*	*Elephantopus mollis*	Elephantopinae
8	*E. scaber*	*E. scaber*	Elephantopinae
9	*Ethulia conyzoides*	*Ethulia conyzoides*	Erlangeinae
10	*Struchium sparganophorum*	*Sparganophoros sparganophora*	Vernoniinae

Table 2.1 Subtribal and generic classification of Vernonieae in Thailand. (Cont.)

	Koyama's classification	Robinson's classification	Subtribe
11	*Vernonia* aff. *tonkinensis*	*Acilepis tonkinensis*	Erlangeinae
12	*V.* aff. *virgata*	*A. virgata*	Erlangeinae
13	*V. andersonii*	*Decaneuropsis andersonii*	Gymnantheminae
14	*V. arborea*	*Strobocalyx arborea*	Gymnantheminae
15	*V. attenuata*	*A. attenuata*	Erlangeinae
16	*V. benguetensis*	not revised	not revised
17	*V. birmanica*	not revised	not revised
18	*V. calcarea*	*Koyamasia calcarea*	unplaced
19	*V. chiangdaoensis*	*A. chiangdaoensis*	Erlangeinae
20	*V. cinerea*	*Cyanthillium cinereum*	Erlangeinae
21	*V. curtisii*	not revised	not revised
22	*V. divergens*	*A. divergens*	Erlangeinae
23	*V. doichangensis*	*A. doichangensis*	Erlangeinae
24	*V. eberhardtii*	*D. eberhardtii*	Gymnantheminae
25	*V. elliptica*	*Tarlmounia elliptica*	Gymnantheminae
26	*V. garrettiana*	*D. garrettiana*	Gymnantheminae
27	*V. kingii*	*A. kingii*	Erlangeinae
28	*V. kradungensis*	*A. peguensis*	Erlangeinae
29	*V. namnaoensis*	*A. namnaoensis*	Erlangeinae
30	*V. ngaoensis*	*A. ngaoensis*	Erlangeinae
31	*V. parishii*	*Monosis parishii*	Gymnantheminae
32	*V. patula*	*Cyanthillium hookerianum*	Erlangeinae
33	*V. principis*	*A. principis*	Erlangeinae
34	*V. pseudobirmanica*	not revised	not revised
35	*V. pseudosutepensis*	*A. pseudosutepensis*	Erlangeinae
36	*V. pulicarioides*	not revised	not revised
37	*V. roxburghii*	not revised	not revised
38	*V. saligna*	*A. saligna*	Erlangeinae
39	*V. scandens*	*D. vagans*	Gymnantheminae
40	*V. silhetensis*	*A. silhetensis*	Erlangeinae
41	*V. solanifolia*	*S. solanifolia*	Gymnantheminae
42	*V. squarrosa*	*A. squarrosa*	Erlangeinae
43	*V. sutepensis*	*A. sutepensis*	Erlangeinae
44	*V. volkameriifolia*	*M. volkameriifolia*	Gymnantheminae

4. Materials and methods

4.1 Specimens were obtained during fieldworks in Thailand and from AAU, B, BCU, BK, BKF, BM, C, E, G, K, KKU, L, P, PSU, QBG and US herbarium specimens. The field collections have been deposited at KKU, QBG and US. Information recorded from specimens included distribution and ecological data when provided and the vernacular name if noted.

4.2 Keys to genera, species and varieties are provided along with descriptions of the genera, species and varieties. Only mature vegetative and reproductive parts were measured or scored for these descriptions.

4.3 Macromorphology: measurements, presence/absence and specifics of surfaces and vestitures were obtained manually or with a light microscope.

4.4 Micromorphology: cleaned achenes, leaf surfaces and unacetolyzed pollen were observed with scanning electron microscopy (SEM).

5. Explanatory notes on descriptions; based on Roque *et al.* (2009)

Capitulescence: secondary inflorescence in which the floral units are heads, the clustering of heads in the Compositae.

Capitulum or *head*: a short, dense indeterminate inflorescence of sessile flowers attached to a common receptacle.

Carpopodium: basal abscission zone of the achenes, formed by one or more seriated of cells generally different from the ones in the achene wall, more or less hardened.

Coroniform pappus: a pappus composed of very short, distinct or connate elements that collectively from crown-like ring.

Cymiform: a simple or compound secondary inflorescence that develops in the pattern of a simple or compound cyme. Usually restricted in Compositae descriptions to secondary inflorescences that develop in a distinctly cymose pattern. Most Compositae secondary inflorescences are technically cymiform because they are wholly or in part determinate in their pattern of development.

Discoid head: homogamous head contains only disk florets.

Disk florets: perfect, or less commonly functionally staminate, or rarely sterile, more or less tubulose, (3 – 4) 5-lobed, radial corolla limb, less commonly the limb bilabiate.

Floret: a small flower characteristic of the Compositae.

Involucre: disk-like to cup-shaped, ovoid, or cylindric group of bracts in one or more seriated that collectively subtend or surround the florets in a head.

Paniculate: more or less pyramidal compound secondary inflorescences with a central rachis and shorter side branches. The sequence of head initiation and maturation is determinate.

Pappus: modified calyx consisting of bristles, dry scales, and/or awns, characteristic of the Compositae.

Pappus bristle: flexible to stiff, more or less hair-like pappus element.

Phyllary: one of the bracts that forms the primary involucre in the Compositae.

Receptacle: basal part of head onto which are inserted phyllaries, florets, and often palea.

Ribbed achenes: bearing raised longitudinal ridges.

Solitary head: head that is not clustered with others in a secondary inflorescence.

Spiciform: more or less cylindrical secondary inflorescence with a central rachis and sessile or subsessile heads. The sequence of inflorescence development is usually determinate with distal heads maturing before proximal heads.

Style branches: the result of incomplete fusion of the distal most portions of connate carpels of a compound pistil in which the carpel tips are distinct.

Twin hairs: two-celled trichomes characteristic of the achenes of many Compositae.

6. Illustration of plant measurements

Plant measurements used in keys and descriptions.

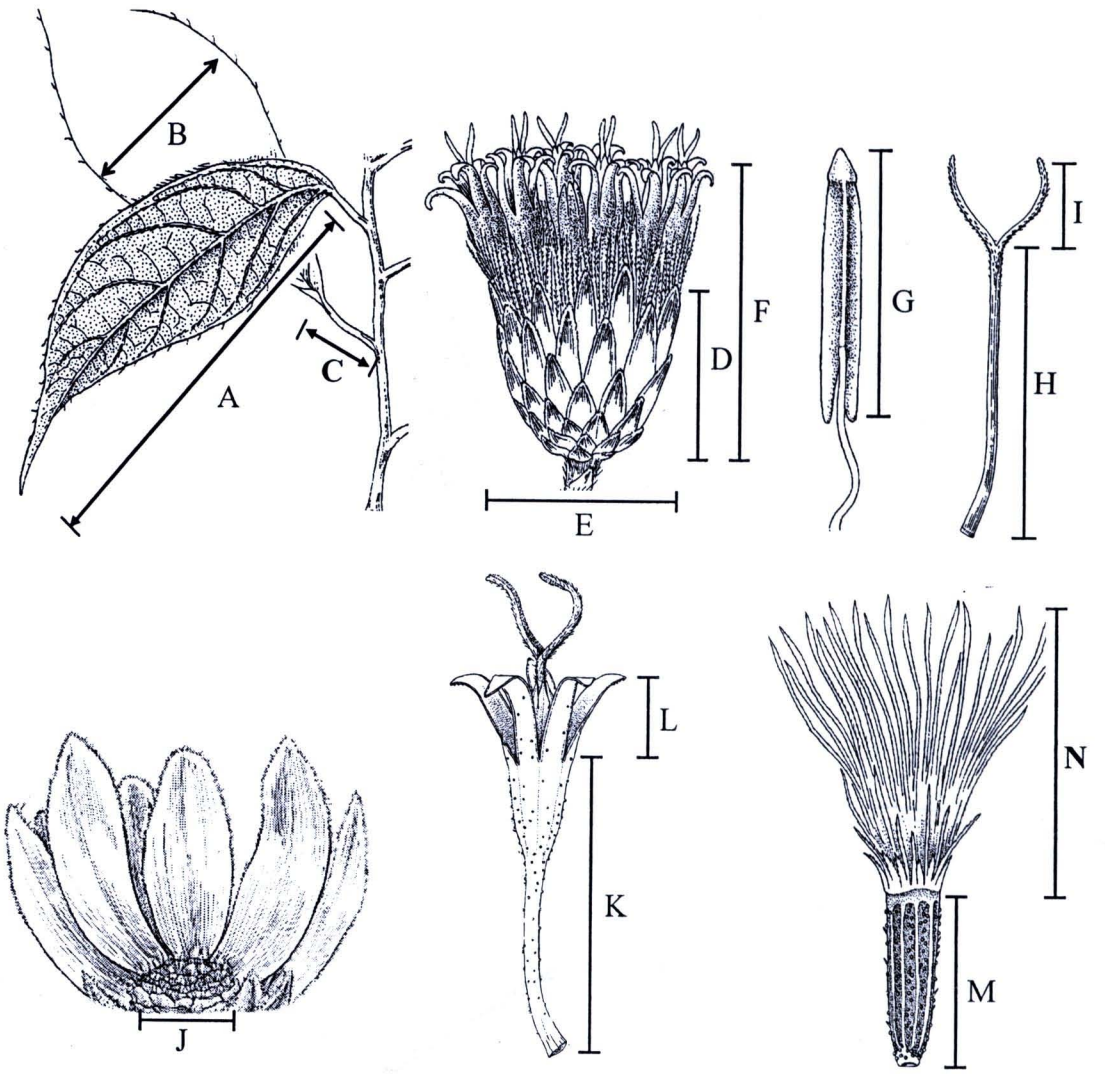

Figure 2.2 The illustrations of plant measurement were used in descriptions; **A.** Leave length, **B.** Leave width, **C.** Petiole length, **D.** Involucral length, **E.** Involucral diameter, **F.** Capitula height, **G.** Anther length, **H.** Style length, **I.** Stigma length, **J.** Receptacle diameter, **K.** Corolla tube length, **L.** Corola lobe length, **M.** Achene length, **N.** Inner pappus length. (Modified from Robinson, 1999a)

7. Results

Fifteen genera, 48 species and 51 taxa of Vernonieae are recognized in Thailand.

VERNONIEAE

Cassini in J. Phys. Chim. Hist. Nat. Arts 82: 132. 1816.

Type: *Vernonia noveboracensis* (L.) Willd., Sp. Pl., ed. 4, 3: 1632. 1803.

Serratula noveboracensis L., Sp.: 818. 1753.

Herbs, shrubs, vines or trees. *Stem* acaulescent or caulescent. *Leaves* simple, alternate or rosulate, petiolate or sessile; lamina ovate, obovate, lanceolate, oblanceolate or elliptic, pubescent, margins serrate or entire, apex rounded, acute or acuminate, base cuneate or attenuate, membranaceous, chartaceous or coriaceous. *Capitulescences* terminal or axillary, solitary, paniculate or corymbose with cymose branch, sometimes spicate. *Capitula* discoid, homogamous, pedunculate or sessile, florets bisexual and fertile. *Involucre* numerous, imbricate, persistent bracts. *Florets* purple to white, actinomorphic or zygomorphic, lobes 3 – 5, pubescent or glabrous. *Anthers* 5, purple to yellow or white, syngenesious. *Styles* purple to white, 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* subterete, clavate or obovate, 3 – 10-ribbed, carpopodium present or absent. *Pappus* present or absent; if present bristly or coroniform, with 1 – 2-seriate, persistent or deciduous. *Pollen* echinate or lophate, 3-porate, 6-porate or 3-colporate, with or without micropuncta.

KEY TO THE GENERA

1. Corolla strongly zygomorphic, liguliform with single deepest sinus
   2. Pappus with straight apex **5. Elephantopus**
   2. Pappus with N-shaped apex **12. Pseudelephantopus**
1. Corolla actinomorphic, without a single deepest sinus
   3. Achenes without carpopodium
      4. Pappus absent

5. Achenes 7 – 10-ribbed; pollen lophate and 3-colporate **8. Iodocephalopsis**

5. Achenes 4 – 6-ribbed; pollen non-lophate **6. Ethulia**

4. Pappus present

6. Corolla 3 – 4-lobed; capitula sessile; pappus coroniform **13. Sparganophoros**

6. Corolla 5-lobed; capitula pedunculate; pappus of short bristles

7. Achenes obovate; phyllaries not reflexed; pollen 6-porate **2. Camchaya**

7. Achenes oblong; phyllaries reflexed; pollen 3-porate **9. Koyamasia**

3. Achenes with carpopodium

8. Herbs

9. Leaves without T-shaped hair

10. Pappus 1-seriate; pollen echinate and 3-colporate **10. Kurziella**

10. Pappus 2-seriate; pollen lophate and 3-porate **1. Acilepis**

9. Leaves with T-shaped hairs **3. Cyanthillium**

8. Vines, erect or scandens shrubs or trees

11. Achenes $\leq$ 2.5 mm long; involucre $\leq$ 4 mm long

12. Achenes glabrous; involucre glandular **15. Tarlmounia**

12. Achenes pubescent; involucre eglandular **14. Strobocalyx**

11. Achenes > 2.5 mm long; involucre > 4 mm long

13. Involucre 7 – 10 mm long; pollen subechinolophate

14. Small trees; leaves serrate; achenes glandular **7. Gymnanthemum**

14. Scandent; leaves entire; achenes eglandular **4. Decaneuropsis**

13. Involucre 4 – 5 mm long; pollen psilolophate **11. Monosis**

1. Acilepis

D.Don, Prodr. Fl. Nepal.: 169. 1825.

Type: *Acilepis squarrosa* D.Don

Perennial herbs. *Stem* acaulescent or caulescent. *Leaves* simple, alternate or rosulate, petiolate, lamina ovate, obovate or elliptic, pubescent, margins serrate or entire, apex rounded, acute or acuminate, base cuneate or attenuate, subcoriaceous.

Capitulescences terminal or axillary, corymbose, paniculate, spiciform, scapose, solitary. *Capitula* discoid, homogamous, pedunculate or sessile, florets bisexual and fertile. *Involucre* herbaceous. *Florets* purple to white, actinomorphic, lobes 5. *Anthers* 5. *Styles* purple, 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* subterete or obovate, usually 10-ribbed, carpopodium present. *Pappus* bristles, 2-seriate. *Pollen* lophate, 3-porate, with or without micropuncta.

Sixteen species are recognized in Thailand.

KEY TO THE SPECIES

1. Capitula more than 30 florets
   2. Phyllaries mostly reflexed
      3. Leaves acauline; corolla and achenes hairy **1. A. attenuata**
      3. Leaves cauline; corolla and achenes without hairs **12. A. silhetensis**
   2. Phyllaries not reflexed
      4. Capitula terminal, pedunculate
         5. Phyllaries with dense tomentum; peduncles subsessile **4. A. doichangensis**
         5. Phyllaries with sparsely arachnoid hairs; peduncles elongated **7. A. ngaoensis**
      4. Capitula axillary, sessile **13. A. squarrosa**
1. Capitula < 30 florets
   6. Capitula pedunculate, involucre > 5 mm long
      7. Phyllaries herbaceous, apex mucronate or aristate
         8. Leaves chartaceous; achenes hairy
            9. Upper leaves elliptic, acute to acuminate; achenes glandular
               10. Leaves subsessile or with petioles up to 6 mm long
                  11. Capitula with *ca.* 20 florets, pedunculate and cup-shaped, involucre with dense hairs **6. A. namnaoensis**
                  11. Capitula with 8 – 12 florets, pedunculate and oblong,

involucre with sparse hairs **5. A. kingii**

10. Leaves petiolate, petioles up to 25 mm long

12. Corolla without hair; achenes 2 – 3.5 mm long

13. Inner pappus 8 – 9 mm long; involucres 8 – 10 mm long

14. Receptacle glabrous

15. Phyllaries and peduncles with densely villose; pappus 6 – 7 mm long; anthers purple **10. A. pseudosutepensis**

15. Phyllaries and peduncles with sparsely pilose; pappus 8 – 9 mm long; anthers yellowish **14. A. sutepensis**

14. Receptacle pubescent **15. A. tonkinensis**

13. Inner pappus 6 – 7 mm long; involucre 6 – 7 mm long **16. A. virgata**

12. Corolla with sparse hairs; achenes 4 – 5 mm long **11. A. saligna**

9. Upper leaves linear-lanceolate to falcate, or caudate; achenes eglandular **9. A. principis**

8. Leaves membranaceous; achenes without hairs **8. A. peguensis**

7. Phyllaries scarious, spinose **2. A. chiangdaoensis**

6. Capitula subsessile, involucre ≤ 5 mm long **3. A. divergens**

1. Acilepis attenuata (DC.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 137. 2009. Type: India orient; *Wallich* 3020 (K!). Figures 2.16, 2.58 A. & B.

Conyza attenuata Wall., Numer. List [Wallich] no. 3020, comp. no. 130, *nom. nud.*
Vernonia attenuata DC., Prodr. 5: 33. 1836.

Perennial herbs 50 – 120 cm tall. *Stem* erect, conspicuously ribbed, puberulous. *Leaves* simple, rosulate, 9 – 22 by 2 – 8 cm, obovate to obovate-lanceolate or elliptic, marginss entire or serrate, apex obtuse or acute, base cuneate or attenuate, subcoriaceous, upper surface scabrous and eglandular; lower surface scabrous with whip-shaped hairs and capitate glands; lateral veins 5 – 11-paired; petioles up to 5 mm long. *Capitulescences* terminal, scapose. *Capitula* campanulate, 15 – 18 mm long, pedunculate. *Receptacle* flat, 6 – 8 mm diam., glabrous. *Phyllaries*

6 – 7-seriate, herbaceous, campanulate, green with purple apex, 7 – 11 mm long, margins filiferous, outer surface arachnoid without glands; the outer and the middle ones ovate, apex apiculate, upper half reflexed; the inner ones ovate-lanceolate to oblong, apex acuminate. *Florets* 40 – 65, infundibular, purple, puberulous glandular; corolla tube 6 – 8.5 mm long; corolla lobes 2 – 3 mm long. *Anthers* 2.5 – 3 mm long, apical appendage acute, base obtuse. *Styles* purple, 7 – 10 mm long, branches 2.5 – 4 mm long, sweeping hairs on outside surface reaching below style bifurcation. *Achenes* subterete, 2.5 – 3 mm long, 10-ribbed, pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 7 – 7.5 mm long, persistent. *Pollen* echinolophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai; NORTH-EASTERN: Nong Bua Lum Phu, Udon Thani, Sakon Nakhon; SOUTH-WESTERN: Kanchanaburi; PENINSULAR: Satun.

Distribution.– Myanmar, Thailand.

Ecology.– Dipterocarp or dry evergreen forest, alt. 50 – 780 m; flowering October to February.

Note.– *A. attenuata* is distinguished by reflexed phyllaries, rosulate leaves and spicate capitulescences with a conspicuous scape.

Specimens examined.– *S. Bunwong* 15 (KKU), 347 (KKU, US), 351 (KKU, US), 354 (KKU, US), 373 (KKU, US); *G. Congdon* 62 (AAU, PSU), s.n. (PSU); *B. Hansen & T. Smitinand* 12722 (C, E, K, L, P); *A.F.G. Kerr* 10147 (BK, BM, K); *J.F. Maxwell* 87-88 (E), 93-190 (L); *W. Nanakorn et al.* 5415 (QBG); *Pradit* 641 (BK); *S. Sutheesorn* 3589 (BK); *Th. Sørensen, K. Larsen & B. Hansen* 2439 (C).

2. Acilepis chiangdaoensis (H.Koyama) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 140. 2009. Type: as *Vernonia chiangdaoensis* H.Koyama. Figures 2.17, 2.58 C. & D.

Vernonia chiangdaoensis H.Koyama, Bull. Natl. Sci. Mus., Tokyo, B. 31(2): 69. 2005. Type: Thailand, Chiang Mai, Doi Chiangdao, *M. Tagawa, K. Iwatsuki & N. Fukuoka* T-4038 (KYO!).

Perennial herbs, 1 – 2 m tall. *Stem* erect, conspicuously ribbed, villose. *Leaves* 10 – 30 by 4 – 10 cm, lanceolate, margins serrate, apex acuminate, base attenuate, subcoriaceous, upper surface scabrous and without glands; lower surface scabrous with whip-shaped hairs, cylindrical hairs and capitate glands; lateral veins 7 – 10-paired; petioles up to 3 cm long. *Capitulescences* terminal, paniculate. *Capitula* campanulate, 10 – 12 mm long, pedunculate. *Receptacle* flat, 2 – 2.5 mm diam., pubescent. *Phyllaries* 4 – 5-seriate, scarious, campanulate, green or purple apically, 8 – 10 mm long, margins filiferous, outer surface villose, glands capitate; the outer and the middle ones lanceolate, apex spinose; the inner lanceolate to oblong, apex acuminate. *Florets* 10 – 15, narrowly infundibular, purple or white, glandular; corolla tube 4 – 5 mm long; corolla lobes 2.5 – 3 mm long. *Anthers* 2.5 – 2.8 mm long, apical appendage acute, base obtuse. *Styles* purple, 4.5 – 6 mm long, branches 2.5 – 3 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 2.5 – 3.5 mm long, 10-ribbed, pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2 seriate, the inner ones 6 – 6.5 mm long, persistent. *Pollen* echinolophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai.

Distribution.– Endemic to Thailand.

Ecology.– Mixed deciduous or pine-oak forest, alt. 600 – 800 m; flowering December to February.

Vernacular.– Dok See Pa (ดอกสีป่า), DoK Doi Pa (ดอกดอยป่า).

Note.– *A. chiangdaoensis* is distinguished by the largest leaves within the genus and scarious apical spinose phyllaries.

Specimens examined.– *S. Bunwong* 77 (KKU, US); *J.F. Maxwell* 89-1585 (CMU, L), 89-1597 (QBG); *W. Nanakorn et al.* 209 (QBG), 10191 (QBG); *S. Sutheesorn* 2235 (K); *Th. Sørensen, K. Larsen & B. Hansen* 1073 (BKF, C, K); *M. Tagawa, K. Iwatsuki & N. Fukuoka* T-4038 (KYO).

3. Acilepis divergens (Edgew.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 140. 2009. Type: India; *Wallich* 3027A (K!). Figures 2.18, 2.59 A. & B.

Conyza divergens Wall., Numer. List [Wallich] no. 3027A, comp. no. 137, *nom. nud.*
Eupatorium divergens Roxb., Fl. Ind. 3: 414. 1832.
Vernonia divergens (Roxb.) Edgew., J. Asiat. Soc. Bengal 2: 172. 1853.

Shrubby herbs, 1 – 3 m tall. *Stem* erect, inconspicuously ribbed, pilose-villose or tomentose. *Leaves* 10 – 13 by 3 – 5 cm, ovate or elliptic, margins serrate, apex acute, base attenuate, subcoriaceous; both surfaces scabrous with whip-shaped hairs and capitate glands; lateral veins 6 – 10-paired; petioles up to 1 cm long. *Capitulescences* terminal and axillary, corymbose. *Capitula* narrowly campanulate, subsessile or shortly pedunculate, 9 – 10 mm long. *Receptacle* flat, *ca.* 1 mm diam., glabrous. *Phyllaries* 3 – 4-seriate, herbaceous, narrowly campanulate or slightly oblong-cylindrical, green or purple apically, 4 – 5 mm long, 3 – 3.5 mm diam., margins filiferous, outer surface arachnoid, glandular; the outer and the middle ones ovate, acuminate or apiculate; the inner ones lanceolate to oblong, apex acuminate. *Florets* 6 – 10, infundibular, purple, glandular; corolla tube 4 – 5 mm long; corolla lobes 2 – 2.5 mm long. *Anthers* 2 – 2.5 mm long, apical appendage acute, base obtuse. *Styles* purple, 5 – 6 mm long, branches 1.5 – 2 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, *ca.* 2 mm long, 10-ribbed, glandular, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 4 – 5 mm long, persistent. *Pollen* echinolophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai, Phayao, Nan, Tak, Sukhothai; NORTH-EASTERN: Loei; SOUTH-WESTERN: Kanchanaburi.

Distribution.– China (Yunnan), India, Myanmar, Thailand, Laos, Cambodia, Vietnam.

Ecology.– Open deciduous and hill evergreen forests, alt. 300 – 1,850 m; flowering October to April.

Vernacular.– San Ngern (สารเงิน), Nat Foi (หนาดฝอย).

Note.– *A. divergens* is clearly distinguished by having a corymbose capitulescences with short pedicel and its capitula that are among the smallest *Acilepis* spp.

Specimens examined.– *Adisai* 1046 (BK); *Amporn* 15 (BKF); *K. Bunchuai* 102 (BKF, C, E, K, L, P); *S. Bunwong* 39 (KKU), 56 (KKU), 377 (KKU, US); *Charal* 431 (BKF); *N. Fukuoka & H. Koyama* T-62103 (BKF); *R. Geesink, P. Hiepko & C. Phengklai* 8027 (L), 8115 (BKF, C); *B. Hansen, G. Seidenfaden & T. Smitinand* 10796 (L), 10976 (BKF, C); *B. Hansen & T. Smitinand* 12926 (BKF, C, E, K, L); *A.F.G. Kerr* 524 (BM, K), 2918 (BM, K), 8747 (BK, K), 10227 (BK, K, BM); *F. Konta, C. Phengklai & S. Khao-iam* 4135 (BKF); *H. Koyama, S. Mitsuta & T. Yahara* T-39916 (BKF), T-48693 (BKF); *H. Koyama & C. Phengklai* T-39844 (BKF); *T. Koyama, C. Phengklai, C. Niyomdham, M. Tamura, H. Okada & P.J. O'connor* 15357 (QBG), 15371 (QBG); *H. Koyama, H. Terao & Th. Wongprasert* T-31991 (AAU, BKF, C, L), T-32172 (BKF), T-32264 (BKF), T-32267 (BKF), T-32350 (BKF), T-32455 (BKF), T-32634 (BKF), T-32797 (BKF), T-32813 (BKF), T-33188 (AAU), T-33293 (BKF), T-33379 (BKF), T-33524 (BKF), T-33533 (BKF), T-48693 (BKF); *K. Larsen* 9533 (K, L); *J.F. Maxwell* 90-156 (CMU, E, L), 91-18 (CMU, L), 91-72 (CMU, L), 91-117 (CMU, L), 93-94 (CMU, L), 95-45 (BKF, L), 95-185 (BKF, L), 95-1306 (L), 96-95 (BKF, CMU, L), 97-1502 (BKF, CMU, L), 01-113 (BKF, CMU); *W. Nanakorn et al.* 388 (QBG), 2859 (QBG), 5459 (QBG), 5501 (QBG), 5561 (QBG), 5778 (QBG); *Y. Paisooksantivatana* 1590-85 (BK), 1747-86 (BK); *O. Petrmitr* 200 (L); *C. Phengklai et al.* 3092 (C, L); *R. Pooma* 1004 (BKF); *Put* 4423 (BK, BM, K, L); *J. Sadakorn* 292 (BK); *T. Santisuk* 1082 (BKF), 1599 (BKF); *T. Smitinand* 8738 (BKF); *T. Soradet* 390 (BKF); *P. Srisanga* 2623 (QBG); *P. Srisanga, S. Sasirat, W. Pongamornkul, S. Sukiam & P. Panyachan* 2452 (QBG); *P. Suksathan* 1573 (QBG); *S. Sutheesorn* 3281 (BK); *Th. Sørensen, K. Larsen & B. Hansen* 1232 (C, BKF, K), 6571 (BKF, C, K, L); *B. Tantisewie & C. Phengklai* 714 (BKF, C, K,)

4. Acilepis doichangensis (H.Koyama) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 140. 2009. Type: as *Vernonia doichangensis* H.Koyama. Figures 2.19, 2.59 C. & D.

Vernonia doichangensis H.Koyama, Bull. Natl. Sci. Mus. Tokyo, Ser. B. 30(1): 22. 2004. Type: Thailand, Chiang Mai, Mae Taeng District, Doi Chang; *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahara & T. Santisuk* T-20693 (KYO!).

Shrubby herbs, rhizomatous, 0.5 – 2 m tall. *Stem* erect, conspicuously ribbed, puberulose. *Leaves* 7 – 15 by 2 – 6 cm, elliptic or oblanceolate, margins subentire or remotely serrulate, apex acute or acuminate, base cuneate, subcoriaceous; both surfaces scabrous with hairs and capitate glands; lateral veins 8 – 10-paired; petioles up to 5 mm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, subsessile or pedunculate. *Receptacle* flat, glabrous. *Phyllaries* 5 – 6-seriate, herbaceous, narrowly campanulate, 10 – 12 mm long, margins filiferous, outer surface tomentose, glandular; the outer and the middle ones ovate, acuminate; the inner ones lanceolate to oblong, apex acute. *Florets ca.* 35, infundibular, purple, glandular; corolla tube 4 – 5 mm long; corolla lobes 4 – 5 mm long. *Achenes* oblong, *ca.* 5 mm long, 10-ribbed, glabrous. *Pappus* bristles, 2-seriate, the inner ones *ca.* 8 mm long, persistent.

Thailand.– NORTHERN: Chiang Mai.

Distribution.– Endemic to Thailand.

Ecology.– Hill evergreen forest, alt. 1,000 – 1,300 m; flowering September to January.

Note.– *A. doichangensis* is distinguished from *A. attenuata* and *A. silhetensis* by its tomentose involucre and glabrous achenes.

Specimens examined.– *T. Shimitzu, H. Toyokuni, H. Koyama, T. Yahara & T. Santisuk* T-19059 (KYO), T-20678 (KYO), T-20693 (KYO).

5. Acilepis kingii (C.B.Clarke) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 141. 2009. Type: as *Vernonia kingii* C.B.Clarke. Figures 2.20, 2.60 A. & B.

Vernonia kingii C.B.Clarke, Compos. Ind: 12. 1876. Type: Myanmar, Yomah Province, Pegu, Irrawaddy & Sittang Valley, *S. Kurz* s.n. (K!).

Perennial herbs, 1 – 1.5 m tall. *Stem* erect, conspicuously ribbed, puberulous. *Leaves* 10 – 20 by 4 – 8 cm, lanceolate, margins serrate, apex acuminate, base attenuate, subcoriaceous; both surfaces scabrous with whip-shaped hairs and capitate glands; lateral veins 9 – 10-paired; petioles up to 2.5 cm long. *Capitulescences*

terminal and axillary, paniculate. *Capitula* campanulate, 10 – 12 mm long, pedunculate. *Receptacle* flat, 2 – 2.5 mm diam., hairy. *Phyllaries* 4 – 5-seriate, herbaceous, narrowly campanulate, light green or purple apically, 5 – 6 mm long, 3 – 3.5 mm diam., margins filiferous, outer surface arachnoid, capitate glands; the outer and the middle ones ovate, apex obtuse and apiculate; the inner ones ovate-lanceolate to oblong, apex obtuse or apiculate. *Florets* 8 – 12, infundibular, purple or white, glandular; corolla tube 4 – 5 mm long; corolla lobes 2.5 – 3 mm long. *Anthers* yellowish, 2.5 – 3 mm long, apical appendage acute, base acute. *Styles* purple, 5 – 7 mm long, branches 2 – 3 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 2.5 – 3.5 mm long, 10-ribbed, pubescent, glands capitate, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6 – 6.5 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai.

Distribution.– China (Yunnan), India, Myanmar, Thailand, Laos.

Ecology.– Hill evergreen or pine-oak forest, alt. 1,000 – 1,800 m; flowering January to March.

Note.– *A. kingii* is recognized by obtuse and apiculate phyllaries and loose paniculate capitulescence.

Specimens examined.– *S. Bunwong* 78 (KKU, US); *S. Gardner* H172 (L); *R. Geesink, P. Hiepko & C. Phengklai* 8277 (BKF, C, K, L, P); *A.F.G. Kerr* 4729 (BK, BM, K); *J.F. Maxwell* 89-1442 (CMU, L), 97-157 (BKF); *W. Nanakorn et al.* 5683 (QBG); *Y. Paisooksantivatana* 840-82 (BKF).

6. Acilepis namnaoensis (H.Koyama) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 141. 2009. Type: as *Vernonia namnaoensis* H.Koyama. Figures 2.21, 2.60 C. & D.

Vernonia namnaoensis H.Koyama, Bull. Natl. Sci. Mus., Tokyo, B. 30(1): 22. 2004. Type: Thailand, Phetchabun, Nam Nao national park, *H. Koyama, H.Terao & Th. Wongprasert* T-311840 (KYO!).

Perennial herbs, 1 – 2 m tall. *Stem* erect, conspicuously ribbed, villose. *Leaves* 15 – 20 by 5 – 8 cm, obovate or oblanceolate, margins serrate, apex acuminate, base cuneate, subcoriaceous; both surfaces scabrous with whip-shaped hairs and capitate glands; lateral veins 6 – 8-paired; petioles up to 10 mm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, 12 – 15 mm long, pedunculate. *Receptacle* flat, 2 – 2.5 mm diam., hairy. *Phyllaries* 4 – 5-seriate, herbaceous, campanulate, light green, 7 – 8 mm long, 6 – 7 mm diam., margins filiferous, outer surface with densely arachnoid, glands capitate; the outer and the middle ones ovate, apex spinose; the inner ones ovate-lanceolate, apex apiculate. *Florets ca.* 20, infundibular, purple, glandular; corolla tube *ca.* 5 mm long; corolla lobes *ca.* 3 mm long. *Anthers* yellowish, *ca.* 3 mm long, apical appendage acute, base acute. *Styles* purple, 5 – 8 mm long, branches 1.5 – 2.5 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 3.5 – 4 mm long, 10-ribbed, covered with sparse hairs and glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6 – 7 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTH-EASTERN: Phetchabun; EASTERN: Chaiyaphum.

Distribution.– Endemic to Thailand.

Ecology.– Dry dipterocarp or dry evergreen forest, alt. 800 m; flowering November to December.

Note.– *A. namnaoensis* ia characterized by its involucre is cup-shaped and phyllaries are spinose with whitish tomentose. Its specific epithet is derived from Nam Nao national park in Pethchabun province.

Specimens examined.– *S. Bunwong* 385 (KKU, US); *H. Koyama, H.Terao & Th. Wongprasert* T-311840 (KYO).

7. Acilepis ngaoensis (H.Koyama) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 141. 2009. Type: as *Vernonia ngaoensis* H.Koyama. Figures 2.22, 2.61 A. & B.

Vernonia ngaoensis H.Koyama, Bull. Natl. Sci. Mus., Tokyo, B. 30(1): 25. 2004. Type: Thailand, Ranong, Muang District, Ngao waterfall, *T. Shimitzu, H. Toyokuni, H. Koyama, T. Yahara & C. Niyomdham* T-26543 (KYO!).

Perennial herbs, 0.6 – 1.2 m tall. *Stem* erect, conspicuously ribbed, puberulous. *Leaves* 10 – 20 by 2 – 5 cm, elliptic or oblanceolate, margins serrate, apex acuminate to acuminate, base cuneate, subcoriaceous; both surfaces scabrous with whip-shaped hairs and capitate glands; lateral veins 9 – 11-paired; petioles up to 10 mm long. *Capitulescences* terminal or axillary, solitary or loosely paniculate. *Capitula* campanulate, 10 – 20 mm long, pedunculate. *Receptacle* flat, hairy. *Phyllaries* 6 – 7-seriate, herbaceous, campanulate, light green or purple apically, 10 – 15 mm long, margins filiferous, outer surface arachnoid, glands capitate; the outer and the middle ones ovate or lanceolate, apex spinose; the inner ones lanceolate or oblong, apex apiculate. *Florets ca.* 80, infundibular, purple, glandular; corolla tube 7 – 8 mm long; corolla lobes 3 – 4 mm long. *Anthers* 3.5 – 4 mm long, apical appendage acute, base obtuse. *Styles* purple, 7 – 9 mm long, branches 3 – 3.5 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 3 – 4 mm long, 10-ribbed, pubescent with twin hairs, and glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 8 – 9 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– PENINSULAR: Ranong.

Distribution.– Endemic to Thailand.

Ecology.– Rocky dry dipterocarp, alt. 100 m; flowering December to January.

Note.– *A. ngaoensis* is recognized by having large capitula with a long peduncle, phyllaries are non reflexed and capitulescences are solitary or loosely paniculate. Its specific epithet is derived from Ngao waterfall national park in Ranong province.

Specimens examined.– *S. Bunwong* 386 (KKU, US); *S. Indrapong* 84 (BKF), 843 (K, L); *J.F. Maxwell* 87-88 (AAU, BKF, CMU, L, P, PSU); *T. Santisuk* 650 (BKF); *T. Shimitzu, H. Toyokuni, H. Koyama, T. Yahara & C. Niyomdham* T-26543 (KYO).

8. Acilepis peguensis (C.B.Clarke) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 141. 2009. Type: as *Vernonia peguensis* C.B.Clarke. Figures 2.23, 2.61 C. & D.

Vernonia peguensis C.B.Clarke, Compos. Ind.: 13. 1876. Type: Myanmar, Yomah province, Pegu, *S. Kurz* 882 (K!).
Vernonia kradungensis H.Koyama, Bull. Natl. Sci. Mus., Tokyo, B. 30(2): 72. 2005. Type: Thailand, Loei, Phu Kradung national park; *H. Koyama, H. Terao & Th. Wongprasert* T-31211 (KYO!).

Perennial herbs, 0.5 – 1.5 m tall. *Stem* erect, conspicuously ribbed, sericeous. *Leaves* 10 – 20 by 3 – 6 cm, oblanceolate or obovate, margins serrate, apex acute or acuminate, base attenuate, chartaceous; both surfaces scabrous with whip-shaped hairs and capitate glands; lateral veins 4 – 8-paired; petioles up to 30 mm long. *Capitulescences* terminal or axillary, paniculate. *Capitula* campanulate, 10 – 12 mm long, pedunculate. *Receptacle* flat, 2 – 2.5 mm diam., hairy. *Phyllaries* 4 – 5-seriate, herbaceous, narrowly campanulate or slightly oblong-cylindrical, light green, 5 – 6 mm long, 3 – 4 mm diam., margins filiferous, outer surface arachnoid, glands capitate; the outer and the middle ones ovate, apex acuminate or aristate; the inner ones lanceolate to oblong, apex acuminate. *Florets* 10 – 15, infundibular, white or purple, glandular; corolla tube 4.5 – 5 mm long; corolla lobes 2.5 – 3 mm long. *Anthers* purple, 3 – 3.5 mm long, apical appendage acute, base obtuse. *Styles* purple, 6 – 7 mm long, branches 2 – 2.5 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 2.5 – 3.5 mm long, 10-ribbed, glandular, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 5.5 – 6 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTH-EASTERN: Loei.

Distribution.– Myanmar, Thailand.

Ecology.– Deciduous or dry evergreen forest, alt. 800 m; flowering November to December.

Vernacular.– Dok Khon Kai Noi (ดอกขนไก่น้อย).

Note.– The distinct features of *A. peguensis* are membranaceous leaves and achenes without hair.

Specimens examined.– *D. Bunpheng* 264 (K); *S. Bunwong* 372 (KKU, US); *H. Koyama, H. Terao & Th. Wongprasert* T-31211 (KYO); *G. Murata, C. Phengklai, S. Mitsuta & T. Yahara* T-43083 (BKF, L, KYO); *H. Nagamasu & N. Nantasan* T-43024 (AAU, BKF, KYO, US).

9. Acilepis principis (Gagnep.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 143. 2009. Type: as *Vernonia principis* Gagnep. Figures 2.24, 2.62 A. & B.

Vernonia principis Gagnep., Bull. Mus. Hist. Nat. 25: 490. 1919. Type: Thailand, Molu, *Prince H. d'Orleans* s.n. (P!).

Perennial herbs, 0.5 – 2 m tall. *Stem* erect, conspicuously ribbed, puberulous. *Leaves* 10 – 25 by 3 – 8 cm, ovate-lanceolate or lanceolate, margins serrate, apex acute, base cuneate, subcoriaceous; upper surface scabrous without glandss; lower surface scabrous with whip-shaped hairs and capitate glands, lateral veins 9 – 15-paired; petioles up to 10 mm long. *Capitulescences* terminal or axillary, paniculate. *Capitula* campanulate, 10 – 15 mm long, pedunculate. *Receptacle* flat, 2.5 – 3 mm diam., hairy. *Phyllaries* 5 – 6-seriate, herbaceous, campanulate, light green or purple apically, 7 – 8 mm long, 4 – 5 mm diam., margins filiferous, outer surface arachnoid, eglandular; the outer and the middle ones ovate, apex aristate or apiculate; the inner ones ovate-lanceolate, apex obtuse or apiculate. *Florets* 20 – 25, infundibular, purple or white, glabrous; corolla tube 5 – 6 mm long; corolla lobes 3 – 4 mm long. *Anthers* purple, 3 – 4 mm long, apical appendage acute, base obtuse. *Styles* purple, 8 – 9 mm long, branches 3 – 4 mm long, sweeping hairs on the outer surface reaching at style bifurcation. *Achenes* subterete, 2.5 – 3 mm long, 10-ribbed, pubescent with twin hairs, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 7 – 8 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Rai, Nan, Lamphun, Lampang, Tak.

Distribution.– Endemic to Thailand.

Ecology.– Evergreen forest, alt. 600 – 1,400 m; flowering December to March.

Note.– This species is similar to *A. kingii* and *A. saligna* in capitula shape but differs in achenes without hair and the upper leaves lanceolate-oblong with caudate apex or falcate shape.

Specimens examined.– *S. Bunwong* 382 (KKU, US); *H.B.G Garrett* 855 (BKF, E, K, L, P); *B. Hansen, G. Seidenfaden & T. Smitinand* 10862 (C, K, L, P); *C.C. Hosseus* 328 (BM, K, L); *K. Iwatsuki & N. Fukuoka* T3464 (AAU, BKF), T3556 (KYO); *H. Koyama & C. Phengklai* T-39099 (AAU); T-39209 (AAU, KYO, US); *J.F. Maxwell* 91-123 (L), 93-1382 (L), 93-1563 (BKF, L), 96-22 (L), 97-1540 (L); *Put* 3449 (BM, K), 3454 (K); *P. Srisanga* 2392 (QBG); *P. Srisanga, S. Sasirat, W. Pongamornkul, S. Sukiam & P. Panyachan* 2483 (QBG); *S. Sutheesorn* 1557 (BKF); *Th. Wongprasert & S. Khao-iam* 212-43 (BKF).

10. Acilepis pseudosutepensis (H.Koyama) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 143. 2009. Type: as *Vernonia pseudosutepensis* H.Koyama. Figures 2.25, 2.62 C. & D.

Vernonia pseudosutepensis H.Koyama, Bull. Natl. Sci. Mus. Tokyo, Ser. B. 31(2): 74. 2005. Type: Thailand, Uthai Thani, Huay Ka Kaeng, *J.F. Maxwell* 76-94 (AAU!, L!).

Perennial herbs, 60 – 150 cm tall. *Stem* erect, conspicuously ribbed, sericeous. *Leaves* simple, alternate at base, 10 – 14 by 4 – 7 cm, ovate-lanceolate or elliptic, margins serrate, apex acuminate, base cuneate or acuminate, subcoriaceous; upper surface scabrous without glands; lower surface scabrous with whip-shaped hairs and capitate glands; lateral veins 9 – 11-paired; petioles up to 10 mm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, 10 – 15 mm long, pedunculate. *Receptacle* flat, 1.5 – 3 mm diam., glabrous. *Phyllaries* 5 – 6-seriate, herbaceous, narrowly campanulate, light green or purple apically, 8 – 10 mm long, 3 – 4 mm diam., margins filiferous, outer surface densely arachnoid, capitate glands; the outer and the middle ones ovate or lanceolate, apex apiculate or aristate; the inner ones ovate-lanceolate to oblong, apex apiculate. *Florets* 10 – 15, infundibular, purple, glandular; corolla tube 7 – 8 mm long; corolla lobes 3 – 4 mm

long. *Anthers* 3.5 – 4 mm long, apical appendage acute, base obtuse. *Styles* purple, 7 – 9 mm long, branches 3 – 3.5 mm long, sweeping hairs on the outer surface reaching at style bifurcation. *Achenes* subterete, 2 – 3.5 mm long, 10-ribbed, pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6 – 7 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Tak; SOUTH-WESTERN: Uthai Thani, Kanchanaburi.

Distribution.– Endemic to Thailand.

Ecology.– Limestone mountain or mixed evergreen forest, alt. 200 – 400 m; flowering December to February.

Vernacular.– Ka Ma Plong (กะม่าปล่อง).

Note.– *A. pseudosutepensis* is recognized by leaves usually alternate at base, elongate peduncle, loose capitulescences, densely villose and scarious phyllaries.

Specimens examined.– *S. Bunwong* 388 (KKU, US); *K. Larsen* 8794 (C, L), 8990 (C, L); *J.F. Maxwell* 76-94 (AAU, BK, L), 94-41 (L); *Y. Paisooksantivatana* 1558-85 (BK); *C. Phengklai* 346 (BKF, L).

11. Acilepis saligna (DC.) H.Rob. Proc. Biol. Soc. Wash. 112(1): 226. 1999. Type: India Orient, Silhet, *Wallich* 3061 (E!, G!, K!). Figures 2.26, 2.63 A. & B.

Conyza saligna Wall., Numer. List [Wallich] no. 3061, comp. no. 171, *nom. nud.*
Vernonia saligna DC., Prodr. 5: 33. 1836.

Perennial herbs, 2 – 2.5 m tall. *Stem* erect, conspicuously ribbed, sericeous. *Leaves* 10 – 15 by 3 – 6 cm, lanceolate or elliptic, margins serrate, apex acuminate, base cuneate, subcoriaceous; both surfaces scabrous with whip-shaped hairs and capitate glands; lateral veins 6 – 10-paired; petioles up to 6 mm long. *Capitulescences* terminal or axillary, paniculate. *Capitula* campanulate, 6 – 7 mm long, pedunculate. *Receptacle* flat, 2 – 2.5 mm diam., hairy. *Phyllaries* 5 – 6-seriate, herbaceous, campanulate, light green or purple apically, 6 – 7 mm long, 3.5 – 4.5 mm diam., margins filiferous, outer surface arachnoid, glands capitate; the outer and the middle

ones ovate, apex acuminate or cuspidate; the inner ones ovate-lanceolate to oblong, apex rounded or apiculate. *Florets* 10 – 15, infundibular, purple, puberulous glandular;corolla tube 6 – 7 mm long; corolla lobes 2 – 3 mm long. *Anthers* purple, 2.5 – 3 mm long, apical appendage acute, base obtuse. *Styles* purple, 5 – 7 mm long, branches 1.5 – 2 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 3 – 3.5 mm long, 10-ribbed, pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6 – 7 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai.

Distribution.– China (Yunnan), India, Nepal, Bhuthan, Myanmar, Thailand, Laos, Vietnam.

Ecology.– Pine-oak forest, alt. 1,100 – 1,400 m; flowering November to December.

Note.– *A. saligna* is different from *A. kingii* by its sessile leaves and smaller capitula in a dense panicle.

Specimens examined.– *S. Bunwong* 357 (KKU, US); *E. Hennipman* 3220 (BKF, P).

12. Acilepis silhetensis (DC.) H.Rob., Proc. Biol. Soc. Wash. 112(1): 227. 1999. Type: India, Silhet; *Wallich* 2921 (E!). Figures 2.27, 2.63 C. & D.

Vernonia bracteata Wall., Numer. List [Wallich] no. 2921, comp. no. 31, *nom. nud.*
Decaneurum silhetense DC., Prodr. 5: 67. 1836.
Vernonia silhetensis (DC.) Hand.– Mazz., Zymb. Sin. Pt. 7: 1084. 1936.

Perennial herbs, 1 – 3 m tall. *Stem* erect, inconspicuously ribbed, pilose. *Leaves* 7 – 12 by 2 – 4 cm, lanceolate or oblanceolate, margins serrate, apex acute or acuminate, base attenuate, subcoriaceous; both surfaces scabrous with whip-shaped hairs and capitate glands; lateral veins 5 – 10-paired; petioles up to 1 cm long. *Capitulescences* terminal, paniculate or solitary. *Capitula* campanulate, 15 – 20 mm long, pedunculate. *Receptacle* flat, 6 – 10 mm diam., hairy. *Phyllaries* 6 – 7-seriate,

herbaceous, campanulate, dark purple or green with purple apex, 11 – 18 mm long, 10 – 15 mm diam., margins filiferous, outer surface arachnoid lacking glands; the outer and the middle ones ovate, apex acuminate, upper half strongly reflexed; the inner ones ovate-lanceolate to oblong, apex acuminate or aristate. *Florets* 50 – 75, infundibular, purple, glandular; corolla tube 8 – 12 mm long; corolla lobes 3.5 – 5 mm long. *Anthers* 3.5 – 4.5 mm long, apical appendage acute, base obtuse. *Styles* purple, 10 – 12 mm long, branches 3.5 – 4.5 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 4 – 5 mm long, 10-ribbed, glandular, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6.5 – 8 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Lamphun, Lampang; NORTH-EASTERN: Phetchabun, Loei, Khon Kaen.

Distribution.– China, India, Bhutan, Myanmar, Thailand, Laos, Cambodia.

Ecology.– Dipterocarp or pine-oak forest, alt. 700 – 1,350 m; flowering August to January.

Vernacular.– Phak Phet Kao Kum (ผักเผ็ดข้าวก่ำ), Ya Klung (หญ้าคลัง), Ya Hang Nok Kiew (หญ้าหางนกเขียว), Hudsakuen (หัสคืน).

Note.– This species is distinguished by its strongly reflexed phyllaries and glandular achenes lacking trichomes.

Specimens examined.– *Adisai* 714 (BK); *K. Buchuai* 279 (AAU, BKF); *S. Bunwong* 19 (KKU), 49 (KKU), 364 (KKU, US); *C. Charoenpol, K. Larsen & E. Warncke* 4855 (BKF); *Dee* 159 (BKF), 195 (E); *Din* 125 (BKF); *N. Fukuoka & M. Ito* T-35208 (BKF); *C. Glamwaewwong* 45 (QBG); *C.C. Hosseus* 313a (BM, K); *A.F.G. Kerr* 828A (BM, K); *F. Konta, Th. Wongprasert & B. Sangkhachand* 29740 (BKF), 29741 (BKF); *H. Koyama* T-39781 (BKF, L), T-39884 (BKF, L), T-61104 (BKF); *H. Koyama, S. Mitsuta, T. Yahara & H. Nagamasu* T-39671 (BKF, L), T-39760 (L); *H. Koyama, T. Yahara, H. Nagamasu, W. Nanakorn & N. Nantasan* T-39710 (AAU, BKF, L), T-39736 (BKF, L); *H. Koyama & C. Phengklai* T-39197 (BKF, L); *H. Koyama, H. Terao & Th. Wongprasert* T-31330 (C, BKF), T-31340 (BKF); *J.F. Maxwell* 73-636 (AAU, BK, BKF), 95-1065 (CMU, BKF), 95-1227 (BKF, L); *S. Mitsuta, T. Yamada & H. Nagamazu* T-46454 (BKF); *G. Murata, K. Iwatsuki, C.*

Phengklai & C. Charoenpol T-15497 (BKF), T-15498 (BKF, P); *G. Murata, C. Phengklai, S. Mitsuta, H. Nagamasu & N. Nantasan* T-40224 (BKF); *W. Nanakorn et al.* 209 (QBG), 1920 (QBG), 5245 (QBG), 5302 (QBG), 9948 (QBG); *Native* 25 (BKF), 68 (BKF); *M. Norsangsri* 925 (QBG); *Y. Paisooksantivatana* 1645b-85 (BK); *R. Pooma* 43 (BKF), 62 (BKF); *Prayad* 1076 (BK); *Put* 311 (BK, BM, K), 4458 (BK, BM, K); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & T. Santisuk* T-18726 (BKF), T-20113 (BKF, L), T-22531 (BKF, L), T-22618 (BKF, L), T-22724 (BKF), T-22730 (BKF, L), T-22803 (BKF), T-22814 (BKF, L), T-22959 (BKF, L), T-22998 (BKF), T-23018 (BKF, L), T-23132 (BKF); *P. Sooksathan* 1930 (QBG), 2111 (QBG); *Th. Sørensen, K. Larsen & B. Hansen* 6227 (C, K); *M. Tagawa, K. Iwatsuki & N. Fuguoka* T-486 (BKF, K, L); *M. Tagawa, K. Iwatsuki, N. Fuguoka, A. Nalampoon & A. Chintaynhgkuh* 9099 (BKF); *H. Takahashi* T-60557 (BKF), T-63527 (BKF); *Vidal* 5337 (AAU, BKF, L, P).

13. Acilepis squarrosa D.Don, Prodr. Fl. Nepal.: 169. 1825. Type: Nepal, *Hamilton* s.n. Figures 2.28, 2.64 A. & B.

Vernonia teres Wall., Numer. List [Wallich] no. 2926, comp. no. 36, *nom. nud.*
Vernonia squarrosa Less., Linaea 6: 678. 1831.

Perennial herbs, 30 – 80 cm tall. *Stem* erect, inconspicuously ribbed, villose. *Leaves* 3 – 10 by 1 – 3 cm, oblanceolate, margins serrate, apex acute, base cuneate, coriaceous; both surfaces scabrous with whip-shaped hairs and capitate glands; lateral veins 5 – 10-paired; petioles up to 5 mm long. *Capitulescences* terminal and axillary, solitary. *Capitula* campanulate, 15 – 20 mm long, sessile or subsessile. *Receptacle* flat, 4.5 – 5.5 mm diam., glabrous. *Phyllaries* 12 – 13-seriate, light green or purple apically, herbaceous, campanulate, 15 – 20 mm long, 10 – 15 mm diam., margins filiferous, outer surface arachnoid lacking glands; the outer and the middle ones ovate or lanceolate, apex acuminate or apiculate; the inner ones ovate-lanceolate to oblong, apex acuminate or apiculate. *Florets* 50 – 80, infundibular, purple, puberulous, glands capitate; corolla tube 7 – 10 mm long; corolla lobes 4 – 6 mm long. *Anthers* 3 – 3.5 mm long, apical appendage acute, base obtuse. *Styles* purple, 9 – 11 mm long,

branches 2 – 3 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 2.8 – 3.2 mm long, 10-ribbed, pubescent without glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 7 – 11 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Tak; NORTH-EASTERN: Phetchabun, Loei, Sakon Nakhon, Mukdahan, Kalasin, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima, Surin; SOUTH-WESTERN: Uthai Thani, Kanchanaburi; CENTRAL: Lop Buri; SOUTH-EASTERN: Prachin Buri, Chon Buri.

Distribution.– China (Yunnan), India, Bhutan, Myanmar, Thailand, Laos.

Ecology.– Dipterocarp, deciduous, hill evergreen or pine-oak forest, alt. 10 – 1,200 m; flowering September to May.

Vernacular.– Kiang Pa Chang (เกี๋ยงพาช้าง), Nat Dhum (หนาดดำ), Nat Khum (หนาดคำ).

Note.– *A. squarrosa* is easily recognized by its large and sessile capitula (with more than 100 phyllaries) in the axils of the leaves.

Specimens examined.– *Adisai* 155 (BK); *M. Bult* 156 (BKF); *S. Bunwong* 14 (KKU), 20 (KKU), 374 (KKU, US); *Dee* 21 (BKF); *C. Glamwaewwong* 63 (QBG); *C.C. Hosseus* 50 (BM, C, E, G, K, L, P); *A.F.G. Kerr* 828 (BM, K), 19775 (B, BK, BM, E, K, L); *H. Koyama & C. Phengklai* T-39155 (BKF, L); *H. Koyama & H. Terao & Th. Wongprasert* T-1737 (BKF), T-30901 (BKF), T-30934 (BKF), T-31777 (BKF), T-32161 (BKF), T-32187 (BKF), T-32251 (BKF), T-32388 (BKF), T-32454 (BKF), T-32609 (BKF), T-32909 (BKF); *A. Marcan* 2768 (BM, K); *J.F. Maxwell* 73-630 (AAU, BK), 75-626 (AAU, BK, L), 87-1243 (BKF, CMU, L), 87-1313 (CMU, BK, BKF, L), 89-1254 (CMU, L), 91-806 (AAU, CMU, E, L, P), 93-1257 (CMU, L), 96-1329 (BK, BKF, CMU, L); *G. Murata, K. Iwatsuki, C. Phengklai & C. Charoenpol* T-15425 (BKF, P); *G. Murata & C. Phengklai* 50372 (BKF), 50415 (BKF), 50438 (BKF); *G. Murata, C. Phengklai, S. Mitsuta, H. Nagamasu & N. Nantasan* T-51568 (BKF); *W. Nanakorn et al.* 1515 (QBG), 4816 (QBG), 9823 (QBG), 10044 (QBG); *M. Norsangsri* 906 (QBG); *Y. Paisooksantivatana* 1780-86 (BK), 2306-89 (BK),

2548-89 (BK); *C. Phengklai et al.* 3595 (BKF), 3993 (BKF), 12315 (BKF); *Ploenchit* 1368 (BKF), 1938 (BKF); *W. Pongamornkul* 343 (QBG); *R. Pooma* 1301 (BKF); *Pradit* 523 (BK); *Prayad* 9 (BK), 44 (BK); *Put* 2059 (K), 2175 (BK, BM, K), 3111 (K), 4239 (AAU, B, BK, BM, K); *J. Sadakorn* 664 (BK); *W. Sakamethawee* 271 (BKF); *T. Santisuk* 6663 (BKF); *T. Shimitzu, H. Toyokuni, H. Koyama, T. Yahara & C. Niyomdham* T-21892 (BKF, L), T-22532 (BKF), T-22533 (BKF, L); *T. Shimitzu, H. Toyokuni, H. Koyama, T. Yahara & T. Santisuk* T-18263 (BKF), T-18271 (BKF), T-18272 (BKF, L), T-19331 (BKF), T-20080 (BKF, L), T-20141 (BKF); *T. Smitinand* 12035 (BKF); *P. Srisanga* 2183 (QBG); *S. Sutheesorn* 3048 (BK), 3503 (BK); *Th. Sørensen, K. Larsen & B. Hansen* 1349 (K), 5392 (C), 5417 (C);); *C.F. van Beusekom & C. Phengklai* 2301 (AAU, L); *C.F. van Beusekom, C. Phengklai, R. Geesink & B. Wongwan* 3804 (BKF, C, K, L); *Winit* 1515 (BKF, K).

14. Acilepis sutepensis (Kerr) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 144. 2009. Type: as *Vernonia sutepensis* Kerr. Figures 2.29, 2.64 C. & D.

Vernonia sutepensis Kerr, Bull. Misc. Inform., Kew. 1935: 329. 1935. Type: Thailand, Chiang Mai, Doi Sutep, *A.F.G. Kerr* 3561 (K!).

Perennial herbs, 60 – 150 cm tall. *Stem* erect, conspicuously ribbed, villose. *Leaves* rosulate, 10 – 14 by 4 – 7 cm, ovate-lanceolate or elliptic, margins serrate, apex acuminate, base cuneate or acuminate, subcoriaceous; both surfaces scabrous with whip-shaped hairs and capitate glands, lateral veins 9 – 11-paired; petioles up to 10 mm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, 10 – 15 mm long, pedunculate. *Receptacle* flat, 1.5 – 3 mm diam., glabrous. *Phyllaries* 5 – 6-seriate, herbaceous, narrowly campanulate, light green or purple apically, 8 – 10 mm long, 3 – 4 mm diam., margins filiferous, outer surface with sparsely arachnoid, capitate glands; the outer and the middle ones ovate or lanceolate, apex apiculate or aristate; the inner ones ovate-lanceolate to oblong, apex apiculate. *Florets* 13 – 20, infundibular, purple, glandular; corolla tube 7 – 8 mm long; corolla lobes 3 – 4 mm long. *Anthers* 3.5 – 4 mm long, apical appendage acute, base obtuse. *Styles* purple, 7 – 9 mm long, branches 3 – 3.5 mm long, sweeping hairs on the outer

surface reaching below style bifurcation. *Achenes* subterete, 2 – 3.5 mm long, 10-ribbed, pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 8 – 9 mm long, persistent. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai, Chiang Rai, Lamphun, Lampang.

Distribution.– Endemic to Thailand.

Ecology.– Hill evergreen or pine-oak forest, alt. 1,100 – 1,500 m; flowering November to March.

Note.– *A. sutepensis* is distinguished from *A. pseudosutepensis* by having larger capitula and sparse hairs on the phyllaries.

Specimens examined.– *S. Bunwong* 18 (KKU), 361 (KKU, US); *A.F.G. Kerr* 3561 (K); *H. Koyama & H. Nagamasu* T-40125 (L); *T. Koyama, C. Phengklai, C. Niyomdham, H. Okada & P.J. O'Connor* 15599 (AAU, BKF); *T. Koyama, H. Terao & Th. Wongprasert* T-23692 (KYO); *J.F. Maxwell* 88-56 (CMU), 88-182 (AAU, CMU, BKF, L), 91-88 (CMU, L), 91-123 (AAU, CMU), 95-168 (BKF, CMU, L), 97-157 (CMU, L); *W. Nanakorn* 6015 (QBG), 6033 (QBG); *C. Niyomdham & R. Kubat* 1347 (AAU, BKF, C, E, K, L); *P. Suvarnakoset* 95 (E); *W. Ponggamornkul* 391 (QBG); *J. Sadakorn* 526 (BK); *C.H. & B. Sangkachand* 287 (BKF); *T. Smitinand* 152 (P); *T. Smitinand & P. Suvarnakoset* 152 (BKF); *P. Srisanga, S. Sasirat, W. Pongamornkul, S. Sukiam & P. Panyachan* 2477 (QBG); *B. Sukkri* 68 (BKF); *Th. Sørensen, K. Larsen & B. Hansen* 915 (BKF, C, K), 6903 (BKF, C, K); *Th. Wongprasert* s.n. (BKF).

15. Acilepis tonkinensis (Gagnep.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 144. 2009. Type: as *Vernonia tonkinensis* Gagnep. Figure 2.65 A. & B.

Vernonia tonkinensis Gagnep., Bull. Mus. Hist. Nat. 25: 492. 1919. Type: Vietnam, Tonkin, *Balansa* 3078 (P!).

Perennial herbs, 1 – 1.5 m tall. *Stem* erect, inconspicuously ribbed, villose. *Leaves* alternate, 5 – 10 by 1.5 – 4 cm, elliptic or obovate, margins serrate, apex acute, base cuneat or truncate, subcoriaceous; upper surface scabrous, lower surface pilose

glandular; lateral veins 6 – 11-paired; petioles up to 5 mm long. *Capitulescences* terminal, paniculate. *Capitula* campanulate, 9 – 12 mm long, pedunculate. *Receptacle* flat, hairy. *Phyllaries* 5 – 6-seriate, herbaceous, broadly campanulate, 8 – 10 mm long, outer surface arachnoid, glands capitate; the outer and the middle ones ovate, apex acute; the inner ones ovate-lanceolate to oblong, apex apiculate. *Florets ca.* 20, infundibular, purple, glandular; corolla tube *ca.* 5 mm long; corolla lobes *ca.* 4 mm long. *Achenes* subterete, *ca.* 3 mm long, 10-ribbed, pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 8 – 9 mm long, persistent.

Thailand.– NORTHERN: Chiang Mai.

Distribution.– Vietnam, Thailand.

Ecology.– Granite bedrock in dry dipterocarp forest, alt. 930 – 1,200 m; flowering January to February.

Note.– *A. tonkinensis* can be recognized by its pubescent receptacle and broadly ovate phyllaries with acute apicies.

Specimens examined.– *H. Koyama, H. Terao & Th. Wongprasert* T-33577 (KYO); *J. Kubiniok* 392/6 (CMU).

16. Acilepis virgata (Gagnep.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 122(2): 144. 2009. Type: as *Vernonia virgata* Gagnep. Figures 2.65 C. & D.

Vernonia virgata Gagnep., Bull. Mus. Hist. Nat. 25: 493. 1919. Type: Laos, Xieng-Kouang, *Spire* 1302 (type not seen).

Perennial herbs, *ca.* 1 m tall. *Stem* erect, conspicuously ribbed, pilose. *Leaves* cauline 8 – 10 by 2.5 – 3.5 cm, elliptic, margins serrate, apex acuminate, base cuneate, subcoriaceous; upper surface pilose along main and lateral veins; lower surface pilose glandular;lateral veins 7 – 10-paired; petioles up to 5 mm long. *Capitulescences* terminal, paniculate. *Capitula* campanulate, 7 – 10 mm long, pedunculate. *Receptacle* flat, hairy. *Phyllaries* 5 – 6-seriate, herbaceous, campanulate, *ca.* 6 mm long, outer surface arachnoid, glands capitate; the outer and the middle ones ovate-lanceolate,

apex acuminate; the inner ones ovate-lanceolate to oblong, apex acute. *Florets ca.* 20, infundibular, purple, glandular; corolla tube *ca.* 3 mm long; corolla *ca.* 4 mm long. *Achenes* subterete, *ca.* 2 mm long, 10-ribbed, pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6 – 7 mm long, persistent.

Thailand.– PENINSULAR: Surat Thani.

Distribution.– Thailand, Laos.

Ecology.– Evergreen forest, alt. 180 m; flowering March.

Note.– *A. virgata* is distinguished from *A. tonkinensis* by phyllaries are nearly scarious and capitula that are long pedunculate in loosely paniculate capitulescences.

Specimen examined.– *H. Koyama, H. Terao & Th. Wongprasert* T-33960 (KYO).

2. Camchaya

Gagnep., Notul. Syst. 4: 14. 1920.

Type: *Camchaya kampotensis* Gagnep.

Annual herbs. *Stem* erect, pubescent. *Leaves* simple, alternate, usually petiolate; lamina ovate to lanceolate, pubescent with hairs and glands, margins serrate, apex acute to acuminate, base attenuate, usually chartaceous. *Capitulescences* terminal or axillary, paniculate or corymbose. *Capitula* campanulate or hemispherical, pedunculate, homogamous; florets bisexual and fertile. *Involucre* imbricate, campanulate or hemispherical. Phyllaries persistent, the outer and the middle ones ovate or lanceolate, the inner ones linear-oblong, sometimes pubescent, glands capitate. *Florets* purple or white, narrowly infundibular, pubescent with hairs and/or capitate glands; lobes 5. *Anthers* apical appendage acute, base rounded. *Styles* purple, 2-branched, slender, acute, inner surface covered with stigmatic papillae, outer surface and shaft covered with sweeping hairs. *Achenes* obovate, usually 10-ribbed, carpopodium absent. *Pappus* bristles, 1-seriate, often deciduous. *Pollen* echinolophate, 6-porate, without micropuncta.

Seven species are recognized in Thailand.

KEY TO THE SPECIES

1. Phyllaries broadly ovate without marginal spines
   2. Achenes 4 – 5-ribbed **1. C. gracilis**
   2. Achenes 10-ribbed **7. C. sp.**
1. Phyllaries broadly ovate with marginal spines
   3. Achenes 10-ribbed
      4. Phyllaries glandular, spines up to 5 mm
         5. Phyllaries aristate or apiculate; achenes 1.5 – 2 mm
            6. Leaves with T-shaped hairs; phyllaries spinose ≤ 1 mm long **3. C. loloana**
            6. Leaves without T-shaped hairs; phyllaries spinose ≥ 1 mm long **6. C. tenuiflora**
         5. Phyllaries acuminate; achenes 2.5 – 3 mm long **2. C. kampotensis**
      4. Phyllaries without glands, spines up to 10 mm **5. C. spinulifera**
   3. Achenes 5 (6 – 9)-ribbed **4. C. pentagona**

1. Camchaya gracilis (Gagnep.) S. Bunwong & H. Rob., Proc. Biol. Soc. Wash. 122(3): 361. 2009. Type: as *Iodocephalus gracilis* Thorel ex Gagnep. Figures 2.30, 2.66 A. & B.

Iodocephalus gracilis Thorel ex Gagnep., Notul. Syst. (Paris) 4: 17. 1920. Type: Laos, Bassac, *Thorel* 2396 (P!).

Annual herbs, 50 – 100 cm tall. *Stem* erect, rounded, inconspicuously ribbed; villose with uniseriate hairs, T-shaped hairs and glands. *Leaves* alternate, elliptic-oblong, 3 – 6 by 0.3 – 1 cm, margins serrate or entire, apex acute, base attenuate, subcoriaceous; upper surface scabrous lacking glands, lower surface scabrous with whip-shaped hairs and capitate glands, lateral veins 8 – 10-paired; petioles up to 3

mm long. *Capitulescences* terminal and axillary, corymbose. *Capitula* campanulate, 8 – 10 mm long, pedunculate. *Receptacle* flat, 2 – 3 mm diam., glabrous. *Phyllaries* 4 – 5 seriate, imbricate, campanulate, light green or purple, 7 – 8 mm long, 6 – 7 mm diam., margins entire without spines, outer surface arachnoid, glandular; the outer one ovate, apex acute to acuminate; the inner ones ovate-lanceolate, apex acute to acuminate. *Florets* 50 – 70, infundibular, purple, puberulous, glands capitate; corolla tube 3 – 5 mm long; corolla lobe 2 – 3 mm long. *Anthers ca.* 2 mm long, apical appendage acute, base rounded. *Styles* purple, 5 – 7 mm long, branches 1.5 – 2 mm long; sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, *ca.* 2 mm long, puberulous with twin hairs and capitate glands, 4 – 5-ribbed, carpopodium absent. *Pappus* bristles, 1 – 2 mm long, frequently deciduous or lacking, present in some floret with 1-rowed, deciduous. *Pollen* echinolophate, 6-porate, without micropuncta.

Thailand.– EASTERN: Ubon Ratchathani.

Distribution.– Thailand, Laos.

Ecology.– Dipterocarp forest, alt. 150 m; flowering October to December.

Note.– *C. gracilis* is characterized by phyllaries without marginal spines, *Achenes* with 4 – 5 ribs and leaves that are narrowly elliptic-oblong. This species is included in *Camchaya* as it shares 6-porate pollen found in no other genus.

Specimens examined.– *S. Bunwong* 33 (KKU), 45 (KKU), 346 (KKU, US); *R. Pooma, K. Phattanahirankanok & S. Sirimongkol* 4737 (AAU); *Th. Wongprasert et al.* s.n. (BKF).

2. Camchaya kampotensis Gagnep., Notul. Syst. 4: 14. 1920. Type: Cambodia, Kampot, *Geoffray* 331 (P!). Figures 2.66 C. & D.

Annual herbs 30 – 80 cm tall. *Stem* erect, rounded, inconspicuously ribbed, pubescent with T-shaped hairs and glands. *Leaves* lanceolate, 7 – 25 by 5 – 9 cm, margins serrate, apex acute, base attenuate, chartaceous; both surfaces puberulous glandular;petioles up to 7 mm long. *Capitulescences* terminal and axillary, paniculate or solitary. *Capitula* campanulate, 10 – 15 mm long, pedunculate. *Phyllaries* 6 – 7-

seriate, 9 – 12 mm long, margins with spines up to 5 mm long, outer surface puberulous, glands capitate; the outer and the inner ones lanceolate, apex acuminate; the inner ones lanceolate or linear-oblong, apex acute. *Florets* purple, puberulous, glands capitate. *Anthers ca.* 2 mm long, apical appendage acute, base rounded. *Styles* purple, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, 2.5 – 3 mm long, glabrous, 10-ribbed, carpopodium absent. *Pappus* bristles, 1-seriate, caducous or lacking. *Pollen* echinolophate, 6-porate, without micropuncta.

Thailand.– SOUTH-EASTERN: Chanthaburi.

Distribution.– Thailand, Cambodia.

Ecology.– Evergreen forest, alt. 700 – 900 m; flowering December.

Note.– *C. kampotensis* can be recognized by its acute to broadly acuminate phyllaries and its large achenes.

Specimens examined.– *A.F.G. Kerr* 17783 (BK, E, K, P); *T. Kira, K. Hozumi, K. Yoda & S. Kokawa* 102 (BKF); *M. Martin* 769 (L); *J.F. Maxwell* 99-624 (CMU); *T. Santisuk* s.n. (BKF); *J.E. Vidal* 4766 (L).

3. Camchaya loloana Kerr, Bull. Misc. Inform., Kew. 1935: 327. 1935. Type: Thailand, Chiang Mai, Chiangdao district; *A.F.G. Kerr* 6650 (BK!, BM!, K!, P!). Figures 2.67 A. & B.

Key to variety

1. Florets 65 – 100, corolla tube 7 – 9.5 mm long, corolla lobes 2.5 – 3 mm long **1. var. loloana**

1. Florets 32 – 60, corolla tube 5.5 – 5.6 mm long, corolla lobes 1.5 – 2 mm long **2. var. mukdahanensis**

3.1 var. loloana

Annual herbs, 30 – 70 cm tall. *Stem* erect, rounded, inconspicuously ribbed, pubescent with T-shaped hairs and glands. *Leaves* ovate, 3 – 10 by 2 – 4 cm, margins

serrate, apex acute or acuminate, base attenuate, chartaceous; both surfaces scabrous with whip-shaped hairs, cylindrical hairs and capitate glands; lateral veins 8 – 12-paired; petioles up to 10 mm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, 9 – 10 mm long, pedunculate. *Receptacle* convex, 3.5 – 4 mm diam., glabrous. *Phyllaries* 7 – 8-seriate, imbricate, campanulate, greenish with purple apex, 8 – 10 mm long, margins with spines up to 1 mm long, outer surface arachnoid, glands capitate; the outer lanceolate, apex spinose; the inner ones lanceolate or linear-oblong, apex acuminate. *Florets* 65 – 100, infundibular, purple rarely white, puberulous, glands capitate; corolla tube 7 – 9.5 mm long; corolla lobes 2.5 – 3 mm long. *Anthers* 1.8 – 2.5 mm long, apical appendage acute, base rounded. *Styles* purple, 7 – 11 mm long, branches *ca.* 2 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, 1.3 – 1.7 mm long, glabrous, 10-ribbed, carpopodium absent. *Pappus* bristles, 1-seriate, 1.5 – 3 mm long, some florets absent, deciduous. *Pollen* echinolophate, 6-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai, Lampang, Phitsanulok; NORTH-EASTERN: Khon Kaen; EASTERN: Nakhon Ratchasima, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi; CENTRAL: Saraburi.

Distribution.– China (Yunnan), Thailand, Laos, Cambodia.

Ecology.– On limestone in dipterocarp, dry evergreen, and hill evergreen forests, alt. 400 – 1,500 m; flowering July to December.

Vernacular.– Dok Lea (ดอกแล่), Phu Muang (พู่ม่วง).

Note.– *C. loloana* is recognized by having short marginal spines on phyllaries, 10-ribbed achenes and leaves with T-shaped hairs.

Specimens examined.– *S. Bunwong* 25 (KKU), 330 (KKU, US), 339 (KKU, US); *R. Geesink & C. Phengklai* 6192 (AAU, BKF, E, L, P); *A.F.G. Kerr* 6650 (BM, K, P) & 7982 (BK, BM, K, P); *M.C. Lakshanakara* 286 (BK, BM, K); *K. Larsen, T. Santisuk & E. Warncke* 2862 (BKF, E); *J.F. Maxwell* 96-1215 (BKF); *W. Nanakorn et al.* 1626 (QBG), 1821 (QBG) & 8472 (QBG); *T. Santisuk* s.n. (BKF); *T. Shimizu, H. Toyokumi, H. Koyama, T. Yahara & T. Santisuk* 20639 (AAU, BKF, L); *S. Sutheesorn* 2637 (BK).

3.2 var. mukdahanensis H.Koyama, Acta Phytotax. Geobot. 35(1-3): 52. 1984. Type: Thailand, Mukdahan, Muang district, Dongman village, *H. Koyama et al.* T-30941 (KYO!). Figures 2.31, 2.67 C. & D.

Annual herbs, 10 – 70 cm tall. *Stem* erect, rounded, inconspicuously ribbed, scabrous with uniseriate hairs and T-shaped hairs. *Leaves* alternate, 5 – 11 by 2 – 5 cm, ovate or lanceolate, margins serrate or undulate, apex acute or acuminate, base attenuate, chartaceous; both surfaces scabrous with whip-shaped hairs, cylindrical hairs and capitate glands; lateral veins 5 – 9-paired; petioles up to 15 mm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, 9 – 10 mm long, pedunculate. *Receptacle* convex, 2 – 2.5 mm diam., glabrous. *Phyllaries* 5 – 6-seriate, campanulate, greenish with purple apex, 7 – 9 mm long, 4 – 6 mm diam., margins with spines up to 0.2 mm long, outer surface arachnoid, glands capitate; the outer lanceolate, apex spinose; the inner ones lanceolate to oblong, apex acuminate. *Florets* 30 – 70, infundibular, purple, puberulous, glands capitate; corolla tube *ca.* 5.5 mm long; corolla lobes 1.5 – 2 mm long. *Anthers* 1.5 – 2 mm long, apical appendage acute, base rounded. *Styles* purple, 5 – 6 mm long, branches *ca.* 2 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, 1.3 – 1.5 mm long, glabrous, 10-ribbed, carpopodium absent. *Pappus* bristles, 1- seriate, 1.5 – 2 mm long, some florets absent, deciduous. *Pollen* echinolophate, 6-porate, without micropuncta.

Thailand.– NORTH-EASTERN: Nong Khai, Mukdahan; EASTERN: Ubon Ratchathani.

Distribution.– Thailand, Laos.

Ecology.– Rocky area in dipterocarp forest, alt. 250 – 400 m; flowering August to January.

Vernacular.– Phu Muang (ภูม่วง).

Note.– *C. loloana* var. *mukdahanensis* differs from the typical variety by having smaller capitula which is shorter involucre and the number of florets is less than the typical variety.

Specimens examined.– *S. Bunwong* 38 (KKU), 41 (KKU), 338 (KKU, US), 343 (KKU, US); *H. Koyama et al.* T-30941 (KYO); *H. Koyama, H. Terao & Th. Wongprasert* T-30662 (BKF, L), T-30866 (BKF), T-30904 (BKF, L), T-31137 (BKF, L); *M. Norsangsri* 1158 (QBG).

4. Camchaya pentagona H.Koyama, Acta Phytotax. Geobot. 35(1-3): 53. 1984. Type: Thailand, Ubon Ratchathani, *H. Koyama, H. Terao & Th. Wongprasert* T-30791 (KYO!, AAU!, L!). Figures 2.32 A., 2.68 A.

Annual herbs, 20 – 60 cm tall. *Stem* erect, rounded, inconspicuously ribbed, scabrous with uniseriate and T-shaped hairs. *Leaves* alternate, ovate or lanceolate, 3 – 10 by 2 – 4 cm, margins serrate or sinuate, apex acute, base attenuate, chartaceous; both surfaces scabrous with whip-shaped hairs, cylindrical hairs and capitate glands; lateral veins 5 – 10-paired; petioles up to 2 cm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* broadly campanulate or hemispherical, 13 – 15 mm long, peduculate. *Receptacle* convex, 3.5 – 6 mm diam., glabrous. *Phyllaries* 8 – 9-seriate, imbricate, hemispherical, 11 – 12 mm long, margins with spines up to 0.5 mm long, outer surface arachnoid eglandular; the outer and the middle ones lanceolate, apex spinose; the inner ones lanceolate to oblong, apex acuminate. *Florets* 80 – 150, infundibular, purple, puberulous, glands capitate; corolla tube 6 – 7 mm long; corolla lobes 2 – 2.5 mm long. *Anthers ca.* 2 mm long, apical appendage acute, base rounded. *Styles* purple, 6 – 7.5 mm long, branches *ca.* 2 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, 1.7 – 2 mm long, glabrous, 5 (–6 – 9)-ribbed, carpopodium absent. *Pappus* bristles, 1-seriate, 2 – 3.5 mm long, some florets absent, deciduous. *Pollen* echinolophate, 6-porate, without micropuncta.

Thailand.– EASTERN: Ubon Ratchathani.

Distribution.– Endemic to Thailand.

Ecology.– Disturbed area in dipterocarp forest, alt. 220 – 300 m; flowering October to December.

Note.– *C. pentagona* is distinguished by its typically 5-ribbed achenes.

Specimens examined.– *S. Bunwong* 29 (KKU), 32 (KKU), 33 (KKU), 344 (KKU, US); *H. Koyama, H. Terao & Th. Wongprasert* T-30760 (L), T-30791 (KYO, AAU, L).

5. Camchaya spinulifera H.Koyama, Acta Phytotax. Geobot. 35(1-3): 54. 1984. Type: Thailand, Mukdahan, Nikomkhamsoi district, Phu Moo forest park; *H. Koyama, H.Terao & Th. Wongprasert* T-30837 (KYO!, L!). Figures 2.32 B., 2.68 B. - D.

Annual herbs, 40 – 100 cm tall. *Stem* erect, rounded, inconspicuously ribbed, scabrous with uniseriate and T-shaped hairs. *Leaves* alternate, ovate to lanceolate, 4 – 10 by 1.5 – 4 cm, margins serrate, apex acute, base attenuate, chartaceous; both surfaces scabrous with whip-shaped hairs, cylindrical hairs, T-shaped hairs and capitate glands; lateral veins 5 – 13-paired; petioles up to 1 cm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate or hemispherical, 10 – 15 mm long, pedunculate. *Receptacle* convex, 4.5 – 6.5 mm diam., glabrous. *Phyllaries* 8 – 9-seriate, imbricate, hemispherical, 10 – 15 mm long, 10 – 20 mm diam., margins with spines up to 10 mm long, outer surface arachnoid eglandular; the outer lanceolate, apex spinose; the inner ones lanceolate to oblong, apex acuminate. *Florets* 130 – 220, infundibular, purple, puberulous, glands capitate; corolla tube 7.5 – 9 mm long; corolla lobes 2.5 – 3 mm long. *Anthers ca.* 2 mm long, apical appendage acute, base rounded. *Styles* purple, 8 – 11 mm long, branches 2 – 2.5 mm long; sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, 1.3 – 1.5 mm long, glabrous, 10-ribbed, carpopodium absent. *Pappus* bristles, 1- seriate, 1.5 – 3 mm long, some florets absent, deciduous. *Pollen* echinolophate, 6-porate, without micropuncta.

Thailand.– NORTH-EASTERN: Nong Khai, Sakon Nakhon, Mukdahan, Kalasin; EASTERN: Chaiyaphum, Ubon Ratchathani.

Distribution.– Endemic to Thailand.

Ecology.– Rocky area in dipterocarp forest, alt. 200 – 300 m; flowering September to December.

Vernacular.– Phu Muang (ผู่ม่วง), Up-Pa-Kud (อุปคุต).

Note.– *C. spinulifera* is recognized by having the longest marginal spineson their phyllaries of any species, and the lack of glands on the phyllaries.

Specimens examined.– *S. Bunwong* 11 (KKU), 39 (KKU), 40 (KKU), 327 (KKU, US), 332 (KKU, US), 336 (KKU, US); *C. Chermsirivathana* 1596 (BK); *H. Koyama, H. Terao & Th. Wongprasert* T-30837 (AAU, BKF), T-30954 (BKF), T-31007 (L), T-31054 (BKF), T-31068 (BKF); *G. Murata & C. Phengklai* T-50396 (BKF); *G. Murata, C. Phengklai, S. Mitsuta, T. Yahara, H. Nagamasu & N. Nantasan* T-50638 (BKF) & T-51352 (BKF); *I.C. Nielsen, C. Niyomdham, T. Jonganurak, N. Hemrath & J. Rithipheth* 1628 (AAU); *C. Niyomdham* 4897 (BKF); *T. Smitinand* 10097 (BKF, L), s.n. (BKF); *S. Suddee* 6 (BKF); *S. Sutheesorn* 654 (BK), 3500 (BK), 3529 (BK); *P. Suvanakoses* 1947 (BKF); *Th. Wongprasert et al.* s.n. (BKF).

6. Camchaya tenuiflora Kerr, Bull. Misc. Inform., Kew. 1935: 327. 1935. Type: Thailand, Bangkok, *A.F.G. Kerr* 20563 (BK!, E!, K!, L!, P!). Figures 2.32 C., 2.69 A.- B.

Annual herbs, 20 – 70 cm tall. *Stem* erect, rounded, inconspicuously ribbed, scabrous with uniseriate and T-shaped hairs. *Leaves* alternate, ovate or lanceolate, 3 – 10 by 1.5 – 2.5 cm, margins serrate, apex acute, base attenuate, chartaceous; both surfaces scabrous with whip-shaped hairs, cylindrical hairs and capitate glands; lateral veins 5 – 10-paired; petioles up to 10 mm long. *Capitulescences* terminal and axillary, paniculate and solitary. *Capitula* campanulate, 8 – 10 mm long, pedunculate. *Receptacle* convex, 1.5 – 3 mm diam., glabrous. *Phyllaries* 6 – 7-seriate, imbricate, campanulate, light green with purple apex, 8 – 9 mm long, 6 – 10 mm diam., margins with spines up to 5 mm long, outer surface arachnoid glandular; the outer and the middle ones lanceolate, apex spinose; the inner ones lanceolate to oblong apex acuminate. *Florets* 40 – 60, infundibular, purple or white, puberulous, glands capitate; corolla tube 4 – 6 mm long; corolla lobes 1.5 – 2.5 mm long. *Anthers ca.* 2 mm long, apical appendage acute, base rounded. *Styles* purple, 4 – 7 mm long, branches 1.5 – 1.7 mm long; sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, 1.5 – 1.7 mm long, glabrous, 10-ribbed, carpopodium absent.

Pappus bristles, 1-seriate, 1 – 4 mm long, some florets absent, deciduous. *Pollen* echinolophate, 6-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai, Chiang Rai; NORTH-EASTERN: Loei; EASTERN: Chaiyaphum, Nakhon Ratchasima.

Distribution.– Endemic to Thailand.

Ecology.– Open area in evergreen forest, alt. 700 m; flowering October to December.

Note.– *C. tenuiflora* differs from *C. loloana* by its longer marginal spine on phyllaries and leaf surfaces without T-shaped hair.

Specimens examined.– *S. Bunwong* 48 (KKU), 348 (KKU, US); *Put* 4264 (BK, E, K, P), *R. Pooma* 1231 (BKF).

7. Camchaya sp. Figures 2.33, 2.69 C.-D.

Annual herbs, 50 – 100 cm tall. *Stem* erect, rounded, inconspicuously ribbed; scabrous with uniseriate hairs, T-shaped hairs and glands. *Leaves* alternate, elliptic to oblong, 3 – 8 by 2 – 3 cm, margins serrate, apex acute, base attenuate, chartaceous; both surfaces puberulous with cylindrical hairs, T-shaped hairs and capitate glands; lateral veins 5 – 10-paired; petioles up to 2 cm long. *Capitulescences* terminal and axillary, corymbose. *Capitula* campanulate, 8 – 10 mm long, pedunculate. *Receptacle* convex, 2.5 – 3 mm diam., glabrous. *Phyllaries* 5 – 6-seriate, imbricate, broadly campanulate, light green with purple apex, 7 – 8 mm long, 5 – 6 mm diam., margins pale without spine, outer surface arachnoid glandular; the outer and the middle ones ovate, apex acuminate; the inner ones lanceolate to oblong, apex acuminate. *Florets* 50 – 70, infundibular, purple, puberulous, glands capitate; corolla tube 6 – 7 mm long; corolla lobe 2.5 – 3 mm long. *Anthers ca.* 2 mm long, apical appendage acute, base rounded. *Styles* purple, 6 – 7 mm long, branches 2 – 2.5 mm long; sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* obovate, *ca.* 1.5 mm long, glandular, 10-ribbed, carpopodium absent. *Pappus* bristles, 1-seriate, 1 – 2 mm long, some florets absent, deciduous. *Pollen* echinolophate, 6-porate, without micropuncta.

Thailand.– NORTH-EASTERN: Udon Thani.

Distribution.– Endemic to Thailand.

Ecology.– Rocky area in dipterocarp forest, alt. 300 m; flowering November to December

Note.– This species is similar to *V. gracilis* in having ovate phyllaries which its without marginal spine but differs in 10-ribbed achenes and broadly ovate leaf shape.

Specimens examined.– *S. Bunwong* 328 (KKU, US).

3. Cyanthillium

Blume, Bidjr.: 889. 1826.

Type: *Cyanthillium villosum* Blume.

Annual herbs. *Stem* erect, pubescent. *Leaves* simple, alternate, petiolate; lamina ovate, lanceolate, elliptic or rhombic, pubescent, margins serrate or undulate, apex acute or acuminate, base attenuate, chartaceous. *Capitulescences* terminal or axillary. *Capitula* discoid, homogamous, pedunculate, florets bisexual and fertile. *Involucre* imbricate, persistent. *Corolla* purple to white, actinomorphic, lobes 5. *Anthers* 5, syngenesious. *Styles* purple, 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* clavate or turbinate, 5 – 10-ribbed, carpopodium present. *Pappus* bristles, 1 – 2-seriate. *Pollen* echinolophate, 3-porate, with micropuncta.

Two species are recognized in Thailand.

KEY TO THE SPECIES

1. Pappus 2-seriate, achenes with indistinct ribs and dense hairs **1. C. cinereum**
1. Pappus 1-seriate, achenes 5-ribbed, without hair **2. C. hookerianum**

1. Cyanthillium cinereum (L.) H.Rob., Proc. Biol. Soc. Wash. 103(1): 252. 1990. Type: not located. Figures 2.70 A. & B.

Conyza cinerea L., Sp. Pl.: 862. 1753.
Vernonia cinerea (L.) Less., Linnaea 4: 291. 1829.

Annual herbs, 20 – 80 cm tall. *Stem* erect, conspicuously ribbed, sericeous. *Leaves* 3 – 5 by 2 – 3 cm, lanceolate or ovate to broadly ovate, margins undulate to serrate, apex acute to acuminate, base attenuate, chartaceous; upper surface sericeous without glands; lower surface sericeous with cylindrical hairs, T-shaped hairs and capitate glands, lateral veins 5 – 7-paired; petioles up to 2 cm long. *Capitulescences* terminal or axillary, paniculate. *Capitula* campanulate, 5 – 6 mm long, pedunculate. *Receptacle* flat, 2 – 2.5 mm diam., glabrous. *Phyllaries* 3 – 4-seriate, imbricate, campanulate, green with purple apex, 4 – 4.5 mm long, 2.5 – 3 mm diam., margins filiferous, outer surface sericeous glandular;the outer and the middle ones lanceolate, apex acute to acuminate; the inner ones lanceolate to oblong, apex acuminate. *Florets* 25 – 30, infundibular, purple or white, puberulous glandular; corolla tube 3 – 3.5 mm long; corolla lobes *ca.* 1 mm long. *Anthers ca.* 0.6 mm long, apical appendage acute, base obtuse. *Styles* purple, *ca.* 3 mm long, branches *ca.* 0.5 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* clavate, 1.5 – 1.8 mm long, rib inconspicuous, densely pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 3 – 3.5 mm long, persistent. *Pollen* echinolophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Phitsanulok, Nakhon Sawan; NORTH-EASTERN: Phetchabun, Loei, Nong Bua Lum Phu, Udon Thani, Nong Khai, Sakon Nakhon, Nakhon Phanom, Mukdahan, Kalasin, Maha Sarakham, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchama, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi; CENTRAL: Lop Buri, Saraburi, Nakhon Nayok, Bangkok; PENINSULAR: Chumphon, Ranong, Phangnga, Phuket.

Distribution.– Tropics and subtropics.

Ecology.– Open area or dipterocarp or dry evergreen forest, alt. 0 – 250 m; flowering January to December.

Vernacular.– Mor Noi (หมอน้อย), Kan Toop (ก้านธูป), Tua Haa Din (ถั่วแฮะดิน), Fa Rang Kok (ฝรั่งโคก), Suea Sam Kha (เสือสามขา), Ya Dok Kao (หญ้าดอกขาว), Ya La Ong (หญ้าละออง).

Note.– *C. cinereum* is a widespread weed of disturbed areas throughout the tropics. It is widely known by its former name, *Vernonia cinerea*. Its leaf shape and capitula size vary continuously therefore plants in dry areas frequently have small capitula and leaves while those in more mesic situations have larger heads and leaves.

Specimens examined.– *L.B. & E.C. Abbe & T. Smitinand* 2470 (BKF); *T. Boonkird* 66 (BK); *S. Bunwong* 22 (KKU), 24 (KKU), 25 (KKU), 52 (KKU), 55 (KKU), 56 (KKU); *G. Congdon* 36 (AAU), 327 (AAU); *N. Fukuoka & M. Ito* T-34854 (BKF); *Hamilton & G. Congdon* 36 (BKF); *K. Iwatsuki & N. Fukuoka* T3230 (L), T7313 (BKF, E); *K. Iwatsuki* T246 (BKF, E, K); *Kasem* 156 (BK); *A.F.G. Kerr* 2475 (BM, E), 3284 (BM), 3769 (BM), 5087 (BM, E, K), 6400 (BK, BM), 8344 (BM), 8366 (BM, K), 12838 (BK, BM, K), 16459 (BK, BM, K), 19650 (AAU, BK, BM, K), 21420 (BK, BM, E); *R.M. King* 5569 (L); *H. Koyama* T-33031 (BKF), T-61504 (BKF); *H. Koyama & H. Terao* T-32863 (BKF); *H. Koyama, H. Terao & Th. Wongprasert* T-30953 (BKF), T-31066 (BKF), T-31164 (BKF, C), T-31449 (BKF), T-31508 (BKF), T-31576 (BKF), T-31585 (BKF), T-32000 (BKF), T-32543 (BKF), T-32912 (BKF), T-33025 (BKF), T-33079 (BKF), T-33134 (BKF), T-33135 (BKF), T-33170 (BKF), T-33327 (BKF), T-34034 (BKF), T-34084 (BKF), T-33464 (BKF, C), T-33552 (BKF), T-33646 (BKF); *H. Koyama, H. Terao, C. Niyomdham & Th. Wongprasert* T-30059 (BKF), T-30220 (BKF), T-30330 (BKF), T-31889 (BKF), T-33956 (BKF) ; *W.R.S. Ladell* 257 (BK, K); *K. Larsen, T. Smitinand, E. Warncke* 189 (AAU); *J.F. Maxwell* 73-789 (AAU, BK), 74-8 (AAU), 87-1484 (CMU), 91-1088 (E); *G. Murata, N. Fuguoka* T-17330 (BKF); *G. Murata, N. Fuguoka & C. Phengklai* T-16634 (BKF, L), T-17537 (BKF, L); *G. Murata, K. Iwatsuki & D. Chaiglom* T-16634 (BKF); *G. Murata, K. Iwatsuki & C. Phengklai* T-14764 (AAU, BKF, P); *G. Murata, C. Phengklai, S. Mitsuta, H. Nagamasu & N. Nantasan* T-37036 (BKF), T-38672 (BKF), T-41774 (BKF), T-50999 (BKF), T-51995 (BKF), T-52587 (BKF) ; *M.F. Newman, T. Boonthavikoon, C. Hemrat & D.J. Middleton* 1142 (AAU, E); *Y. Paisooksantivatana* 495-81(BK), 521-81(BK), 548-81(BK), 843-82 (BK), 1181-82

(BK), 1887-86 (BK); *Parikarn* 11 (BK); *Parikarn & Prayad* 71 (BK), 95 (BK); *O. Petrmitr* 229 (L); *C. Phengklai et al.* 12590 (BKF), 12928 (BKF), 14308 (BKF); *R. Pooma* 1003 (BKF); *Put* 2211 (AAU, BK, BM, K), s.n. (BK, BM); *J. Sadakorn* 287 (BK); *G. Seidenfaden* 2195 (C); *T. Shimizu, H. Koyama & N. Fukuoka* T-7550 (BKF) ; *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & C. Niyomdham* T-21360 (BKF), T-26074 (BKF), T-26228 (BKF), T-27115 (BKF), T-27122 (BKF), T-27296 (BKF); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & D. Phanichapol* T-23255 (BKF), T-23453 (BKF) ; *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & T. Santisuk* T-19409 (BKF), T-27668 (BKF); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & Th. Wongprasert* T-27576 (BKF) ; *T. Smitinand* 4930 (BKF), 6284 (BKF); *W. Somprasong* 112 (BK); *Th. Sørensen, K. Larsen & B. Hansen* 709 (C), 1848 (C), 6182 (K); *M. Tagawa, K. Iwatsuki & N. Fukuoka* T-1963 (BKF, E, L); *M. Tagawa, T. Shimizu, H. Koyama & A. Nalampoon* T-10630 (BKF); *Vacharee* 34 (BK); *C.F. van Beusekom, C. Phengklai, R. Geesink & B. Wongwan* 3508 (BKF, C, K, L), 3651 (BKF, K); *Th. Wongprasert* 9912-05 (BKF); *R. Zimmermann* s.n. (G).

2. Cyanthillium hookerianum (Arn.) H.Rob., Proc. Biol. Soc. Wash. 112(1): 229. 1999. Type: Sri Lanka. Figures 2.34, 2.70 C. & D.

Vernonia hookeriana Arn., Nov. Act. Nat. Cur. 18(1): 346. 1836.
Conyza patula Ait., Hortus Kew. 3: 184. 1789.
Vernonia chinensis Less., Linnaea 6: 105, 674. 1831.

Annual herbs, 1 – 2 m tall. *Stem* erect, conspicuously ribbed, white sericeous. *Leaves* 3 – 10 by 2 – 5 cm, elliptic to ovate or slightly rhombic, margins serrate or slightly sinuate, apex acute or obtuse, base attenuate, chartaceous; upper surface puberulous glandular;lower surface sericeous with T-shaped hairs and capitate glands; lateral veins 4 – 8-paired; petioles up to 2 cm long. *Capitulescences* terminal or axillary, paniculate. *Capitula* broadly campanulate or subglobose, 7 – 10 mm long, pedunculate. *Receptacle* flat, 2 – 3 mm diam., glabrous. *Phyllaries* 4 – 5-seriate, imbricate, semispherical, light green, 6 – 7 mm long, 5 – 6 mm diam., margins filiferous, outer surface arachnoid glandular;the outer and the middle ones lanceolate,

apex acuminate or aristate; the inner ones lanceolate to oblong, apex acuminate. *Florets* 80 – 120, infundibular, purple or white, corolla tube 4 – 5 mm long; corolla lobes *ca.* 2 mm long. *Anthers* 1.5 – 2 mm long, apical appendage acute, base obtuse. *Styles* purple, 4 – 5 mm long, branches 1 – 1.5 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* turbinate, 1 – 1.5 mm long, 5-ribbed, glandular, carpopodium present. *Pappus* bristles, 1-seriate, 2 – 3 mm long, deciduous. *Pollen* echinolophate, 3-porate, with prominent micropuncta.

Thailand.– NORTHERN: Nan, Sukhothai; NORTH-EASTERN: Mukdahan; EASTERN: Buri Ram; CENTRAL: Bangkok, Samut Prakan; SOUTH-EASTERN: Prachin Buri; PENINSULAR: Surat Thani.

Distribution.– China, India, Malay Peninsula, Thailand, Laos, Cambodia, Philippines, New Guinea.

Ecology.– Open area in dry evergreen forest or secondary forest, alt. 0 – 100 m; flowering August to February.

Note.– *C. hookerianum* differs from *C. cinereum* by having only a single series of pappus, a 5-ribbed achene without hair and a globose capitula.

Specimens examined.– *A.F.G. Kerr* 3892 (BM, K), 3983 (BM, K), s.n. (BM); *R.M. King* 5563 (L), 5564 (L); *H. Koyama, H. Terao & Th. Wongprasert* T-33138 (AAU, BKF, L); *M.C. Lakshnakara* 948 (BK, BM, K); *A. Marcan* 39 (BM), 416 (BM, K); *J.F. Maxwell* 70-19 (BK, L), 71-643 (BK, L); *Y. Paisooksantivatana* 1879-86 (BK); *C. Phengklai et al.* 3392 (BKF); *R. Schomburgk* 1859 (K); *S. Sutheesorn* 1875 (BK); *Vanpruk* 1015 (BKF, K), 999 (K).

4. Decaneuropsis

H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 120(3): 360. 2007.
Type: *Vernonia cumingiana* Benth.

Perennial shrubs. *Stem* scandent, young branches rounded, pubescent or glabrous. *Leaves* simple, alternate, petiolate, pubescent with uniseriate hairs; lamina ovate, lanceolate or elliptic; margins entire, apex acute or acuminate, base cuneate,

subcoriaceous. *Capitulescences* terminal or axillary. *Capitula* discoid, homogamous, pedunculate; florets bisexual and fertile. *Involucre* imbricate, 4 – 6-seriate, phyllaries 7 – 12 mm long, persistent, eglandular. *Florets* purple or white, actinomorphic; lobes 5. *Anthers* 5, syngenesious. *Styles* 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs reaching below style bifurcation. *Achenes* clavate or turbinate, 10-ribbed, hairy, eglandular, carpopodium present. *Pappus* bristles, 2-seriate. *Pollen* echinolophate, 3-colporate, with micropuncta.

Three species are recognized in Thailand.

KEY TO THE SPECIES

1. Phyllaries whitish puberulous
   2. Phyllaries obtuse; leaves glandular **3. D. garrettiana**
   2. Phyllaries acute; leaves eglandular **2. D. eberhardtii**
1. Phyllaries furruginous tomentose **1. D. cumingiana**

1. Decaneuropsis cumingiana (Benth.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 120(3): 364. 2007. Type: as *Vernonia cumingiana* Benth. Figures 2.35, 2.71 A. & B.

Vernonia cumingiana Benth. in Hook.f., Kew Journ. 4: 232. 1852. Type: Philippines, *M. Cuming* 1092 (G!).
Vernonia sangka Kerr, Bull. Misc. Inform., Kew 1935, 329. 1935. Type: Thailand, Kanchanaburi, Sangka, *A.F.G. Kerr* 8302 (K!).

Climbing or scandent shrubs, 3 – 10 m tall. *Stem* sprawling, young branches rounded, inconspicuously ribbed, ferruginous tomentose. *Leaves* 7 – 10 by 3 – 4 cm, elliptic to oblong-elliptic, margins entire, apex acute, base cuneate, subcoriaceous; upper surfaces puberulous with glands, lower surface sericeous with whip-shaped hairs, cylindrical hairs and capitate glands; lateral veins 5 – 6-paired; petioles up to 1 cm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, 12 – 15 mm long, pedunculate. *Receptacle* flat, 4 – 4.5 mm diam., hairy. *Phyllaries* 5 –

6-seriate, imbricate, campanulate, dull green, 7 – 8 mm long, 6 – 7 mm diam., margins filiferous, outer surface ferruginous tomentose, glands capitate; the outer and the middle ones ovate, apex acute; the inner ones lanceolate to oblong, apex acute. *Florets* 20 – 30, infundibular, purple, glandular, corolla tube 5 – 6.5 mm long; corolla lobes *ca.* 2 mm long. *Anthers* 2.8 – 3 mm long, apical appendage acute, base obtuse. *Styles* purple, 7 – 7.5 mm long, branches 3.5 – 4 mm long. *Achenes* clavate, 3 – 3.5 mm long, 10-ribbed, puberulous without glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 9 – 9.5 mm long, persistent. *Pollen* echinolophate, 3-colporate, with micropuncta.

Thailand.– NORTHERN: Chiang Mai, Nan, Lampang; NORTH-EASTERN: Phetchabun; SOUTH-WESTERN: Kanchanaburi; CENTRAL: Phra Nakhon Si Ayutthaya, Saraburi, Nakhon Nayok; PENINSULAR: Yala.

Distribution.– Hong Kong, India, Thailand, Laos, Cambodia, Vietnam, Philippines, New Guinea.

Ecology.– Evergreen or pine-oak forest, alt. 200 – 850 m; flowering November to April.

Vernacular.– Phaya Rak Pa (พญารักป่า), Pan Sieng (พันเชียง).

Note.– *D. cumingiana* is recognized by its leaf surface and phyllaries are furruginuous tomentose.

Specimens examined.– *S. Bunwong* 74 (KKU); *A.F.G. Kerr* 1114 (BK, BM, K), 8302 (BM, K, P); *A. Marcan* 1844 (BK, BM, K); *J.F. Maxwell* 02-27 (BKF); *C. Phengklai* 562 (K); *B. Sangkhachand* 1409 (BKF); *P. Srisanga* 1315 (QBG); *Th. Sørensen, K. Larsen & B. Hansen* 6942 (C, K); *Winit* 1287 (BK, BKF, K), 1916 (K).

2. Decaneuropsis eberhardtii (Gagnep.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 120(3): 365. 2007. Type: as *Vernonia eberhardtii* Gagnep. Figures 2.36, 2.71 C. & D.

Vernonia eberhardtii Gagnep., Bull. Mus. Natl. Hist. Nat.: 489. 1919. Type: Vietnam, Tonkin, *Eberhardt* 4230 (P!).

Vernonia craibiana Kerr, Bull. Misc. Inform., Kew 1935: 328. 1935. Type: Thailand, *A.F.G. Kerr* 9969 (K!, L!, P!).

Climbing or scandent shrubs. *Stem* sprawling, young branches inconspicuously ribbed, puberulous. *Leaves* 10 – 15 by 5 – 7 cm, elliptic or obovate, margins entire, apex acute, base cuneate, subcoriaceous; both surfaces puberulous with cylindrical hairs, lateral veins 5 – 7-paired; petioles up to 1 cm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, 10 – 15 mm long, pedunculate. *Receptacle* flat, 2 – 3 mm diam., hairy. *Phyllaries* 4 – 5-seriate, imbricate, campanulate, dark green or purple apically, 7 – 8 mm long, 4 – 5 mm diam., margins filiferous, outer surface puberulous without gland; the outer and the middle ones ovate, acute or apiculate; the inner ones ovate or ovate-lanceolate, apex acute or obtuse. *Florets* 11 – 13, infundibular, purple, glabrous; corolla tube 5 – 5.5 mm long; corolla lobes 2 – 2.5 mm long. *Anthers* 3 – 3.5 mm long, apical appendage acute, base acute. *Styles* purple, 6 – 6.5 mm long, branches 4 – 5 mm long. *Achenes* turbinate, 2.5 – 3 mm long, 10-ribbed, covered with dense hairs, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6 – 7 mm long, persistent. *Pollen* echinolophate, 3-colporate, with micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai; NORTH-EASTERN: Phetchabun; EASTERN: Chaiyaphum; SOUTH-WESTERN: Kanchanaburi.

Distribution.– Thailand, Cambodia, Vietnam.

Ecology.– Dry evergreen forest, alt. 500 – 800 m; flowering December to February.

Vernacular.– Ya Kae Krua (ยาแก้เครือ).

Note.– *D. eberhardtii* differs from *D. cumingiana* by having nearly glabrous leaves and phyllaries.

Specimens examined.– *S. Bunwong* 67 (KKU), 376 (KKU, US), 384 (KKU, US); *H.B.G. Garrett* 1483 (K, L, P); *A.F.G. Kerr* 6413 (K, P), 9969 (BM, E, K, L, P); *F. Konta & S. Khao-iem* 11451 (BKF); *H. Koyama, F. Konta & W. Nanakorn* T-48974 (BKF); *J.F. Maxwell* 75-1122 (AAU, BK, L), 76-681 (AAU, BK), 92-129 (E, L), 96-466 (BKF), 97-101 (BKF), 02-21(BKF, CMU); *C. Phengklai* 562 (BKF); *Put*

3553 (BK, BM, E, K, P); *J. Sadakorn* 531 (BK); *B. Sangkhachand* 3064 (BKF); *T. Santisuk* 1122 (BKF); *T. Smitinand* 871 (BKF); *Vacharapong* 370 (BK); *C.F. van Beusekom, C. Phengklai, R. Geesink & B. Wongwan* 3774 (BKF, C, K, L, P), 4459 (BKF, C, K, L); *Th. Wongprasert & S. Khao-iem* 041-31 (BKF).

3. Decaneuropsis garrettiana (Craib) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 120(3): 365. 2007. Type: as *Vernonia garrettiana* Craib. Figures 2.37, 2.72 A. & B.

Vernonia garrettiana Craib, Bull. Misc. Inform., Kew. 1915: 431. 1915. Type: Thailand, *A.F.G. Kerr* 2341 (BM!, E!, K!).

Climbing or scandent shrubs, young branches rounded, inconspicuously ribbed, puberulous. *Leaves* 9 – 25 by 4 – 15 cm, elliptic or obovate, margins entire, apex acute, base cuneate, chartaceous; upper surfaces puberulous without glands; lower surface puberulous with whip-shaped hairs, cylindrical hairs and capitate glands, lateral veins 4 – 11-paired; petioles up to 3.5 cm long. *Capitulescences* terminal and axillary, paniculate. *Capitula* campanulate, 12 – 15 mm long, pedunculate. *Receptacle* flat, 5 – 5.5 mm diam., hairy. *Phyllaries* 5 – 6-seriate, imbricate, campanulate, totally green, 10 – 12 mm long, 8 – 8.5 mm diam., margins filiferous, outer surface puberulous without glands; the outer and the middle ones ovate or ovate-lanceolate, obtuse; the inner ones obovate-lanceolate, apex obtuse. *Florets* 20 – 30, infundibular, dark purple, glandular; corolla tube 7 – 8 mm long; corolla lobes *ca.* 2 mm long. *Anthers* 3 – 3.5 mm long, apical appendage acute, base acute. *Styles* white, 7 – 7.5 mm long, branches 3.5 – 4 mm long. *Achenes* subterete, 2.8 – 3 mm long, 10-ribbed, covered with dense hairs without glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6.5 – 8.5 mm long, persistent. *Pollen* subechinolophate, 3-colporate, with micropuncta.

Thailand.– NORTHERN: Chiang Mai, Chiang Rai, Lampang, Phrae; SOUTH-WESTERN: Kanchanaburina.

Distribution.– Myanmar, Thailand.

Ecology.– Mixed deciduous, evergreen or pine-oak forest, alt. 400 – 800 m; flowering November to February.

Note.– *D. garrettiana* is distinguished from *D. cumingiana* and *D. eberhardtii* by its obtuse phyllaries.

Specimens examined.– *S. Bunwong* 75 (KKU), *H.B.G. Garrett* 130 (BK, BKF, K); *B. Hansen, G. Siedenfaden & T. Smitinand* 11049 (BKF, C, K, P); *A.F.G. Kerr* 2341 (BM, E, K) & 10216 (BK, BM, K); *K. Larsen* 9339 (C, K); *J.F. Maxwell* 93-1437 (CMU, L), 93-1481(CMU), 96-65 (CMU, L); *W. Nanakorn et al.* 5337 (QBG), 6156 (QBG); *S. Phusomseang* 66 (BKF, K, L); *W. Pongamornkul* 23 (QBG), 48 (QBG); *R. Pooma* 386 (BKF); *S. Sutheesorn* 1639 (BK), 2287 (BK); *C.F. van Beusekom & C. Phengklai* 2316 (AAU, BKF, C, E, L, P).

5. Elephantopus

L., Sp. Pl.: 814. 1753.

Type: *Elephantopus scaber* L.

Annual or perennial herbs. *Stem* rosulate or caulescent, pubescent. *Leaves* simple, alternate or rosette, usually petiolate; lamina obovate, oblanceolate, elliptic, pilose-villose glandular; margins crenate, dentate or serrate; apex acute or obtuse, base attenuate, usually chartaceous. *Capitulescences* terminal or axillary, scapose or paniculate. *Capitula* discoid, tubular; clusters subtended by secondary foliose bracts, homogamous; florets bisexual and fertile. *Phyllaries* 8, in 2 seriate, decussate, persistent, oblong, outer surface puberulous or pilose-villose, glands capitate. *Florets* purple or white, glabrous or glandular, zygomorphic; corolla tube slender; corolla lobes 5, *Anthers* 5, syngenesious, apical appendage acute. *Styles* purple or white, 2 – 3-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* usually clavate, 10-ribbed, pubescent, carpopodium present. *Pappus* bristles, 1-seriate. *Pollen* lophate, 3-porate, without micropuncta.

Two species are recognized in Thailand.

KEY TO THE SPECIES

1. Leaves cauline; capitulescences terminal and axillary	**1. E. mollis**
1. Leaves rosulate; capitulescences scapiform	**2. E. scaber**

1. Elephantopus mollis Kunth, Nov. Gen. Sp. [H.B.K.] 4: 26. 1820. Type: Venezuala, Caracas, *Humboldt & Bonpland* 627 (P!). Figures 2.38, 2.72 C. & D.

Elephantopus tomemtosus Koster, Blumea 1: 464. 1935, non L.

Perennial herbs, 50 – 200 cm tall. *Stem* caulescent, erect or procumbent, rounded, inconspicuously ribbed, pilose. *Leaves* alternate, 10 – 20 by 3 – 5 cm, elliptic or oblong, margins crenate, apex acute, base attenuate, subcoriaceous; both surfaces sparsely pilose with filiform hairs, cylindrical hairs and capitate glands; lateral veins 10 – 16-paired; petioles up to 10 mm long. *Capitulescences* terminal and axillary, paniculate. *Foliose bracts* 3, deltoid. *Capitula* tubular, 7 – 8 mm long. *Receptacle* flat, *ca.* 1 mm diam., glabrous. *Phyllaries* 8, 2-seriate, decussate, tubular, light green, 6.5 – 8 mm long, 3 – 4 mm diam., margins entire, outer surface puberulous, without glands; the outer ovate, apex acute; the inner ones lanceolate, apex acuminate. *Florets* 4, white, zygomorphic, glabrous; corolla tube slender, 3 – 5 mm long; corolla lobes bilabiate, 1.5 – 2 mm long. *Anthers ca.* 1 mm long, apical appendage acute, base rounded. *Styles* white, 4 – 5 mm long, branches *ca.* 1 mm long; sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* clavate, 2.5 – 3 mm long, pubescent densely covered with twin hairs, eglandular, inconspicuously ribbed, carpopodium present. *Pappus* bristles, dilated at base, 1-seriate, 4 – 6 by 2.5 – 4.5 mm long. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– EASTERN: Nakhon Ratchasima; Ubon Ratchathani; PENINSULAR: Satun, Songkhla.

Distribution.– Pantropics.

Ecology.– Evergreen forest, alt. 0 – 100 m; flowering October to December.

Vernacular.– Doo Mai Ru Lom (ไดไมรูลม), Hun Huay (หุนหวย).

Note.– *E. mollis* is recognized by its cauline leaves and completely white flowers.

Specimens examined.– *S. Bunwong* 34 (KKU), 50 (KKU), 340 (KKU, US); *D.J. Collins* 451 (BM); *J.F. Maxwell* 86-47 (BKU, CMU, L); *C. Phengklai* 10667 (BKF); *Put* 2205 (BM); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & C. Niyomdham* T-27159 (BKF); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & T. Santisuk* T-27555 (AAU, BKF); *T. Smitinand* 7194 (BKF).

2. Elephantopus scaber L., Sp. Pl.: 814. 1753. Type: India. Figures 2.39, 2.73 A. & B.

Two varieties are recognized in Thailand.

KEY TO THE VARIETIES

1. Leaves and inflorescences densely pilose-tomentose	**1. var. penicillatus**
1. Leaves and inflorescences sparsely pilose	**2. var. scaber**

2.1 var. penicillatus Gagnep., Fl. Indo-Chine [M.H. Lecomte *et al.*] 3: 503. 1924. Type: Laos, Chedom, *Thorel* 1407 (K!). Figures 2.40, 2.73 C. & D.

Perennial herbs, 40 – 100 m tall. *Stem* acaulescent except inflorescence scapose, erect, rounded, inconspicuously ribbed and pilose-villose. *Leaves* rosette at base, 6 – 20 by 6 – 10 cm, obovate, obovate-lanceolate, elliptic, margins crenate to serrate, apex obtuse, base attenuate, subcoriaceous; upper surface sparsely pilose, without glands; lower surface densely pilose, with filiform cylindrical hairs and capitate glands; lateral veins 7 – 16-paired; petioles up to 6 cm long. *Capitulescences* terminal, scapose. *Foliose bracts* 3, deltoid. *Capitula* tubular, 7 – 9 mm long. *Receptacle* flat, *ca.* 1 mm diam., glabrous. *Phyllaries* 8, distichous, decussate, tubular, 6.5 – 8 mm long, 3 – 4 mm diam., margins entire, outer surface puberulous, glands capitate; the outer ovate-lanceolate, apex acuminate; the inner ones lanceolate or oblong, apex acuminate. *Florets* 4, salverform, white or purple, zygomorphic,

glabrous or rarely hairy; corolla tube 4 – 6 mm long; corolla lobe, 2.5 – 3.5 mm long. *Anthers ca.* 2 mm long, apical appendage acute, base rounded. *Styles* purple, 6 – 8 mm long, branches *ca.* 1 mm long; sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* clavate, 2 – 2.5 mm long, pubescent with a dense covering of twin hairs, without glands, 10-ribbed, carpopodium present. *Pappus* bristles 5, *ca.* 3 mm long, 1-seriate, dilated at base. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTH-EASTERN: Loei, Sakon Nakhon; EASTERN: Nakhon Ratchasima; Ubon Ratchathani; SOUTH-EASTERN: Chon Buri.

Distribution.– Thailand, Laos, Vietnam.

Ecology.– Dipterocarp or dry evergreen forest, alt. 100 – 400 m; flowering August to January.

Vernacular.– Doo Mai Ru Lom (ไต่ไม่รู้ล้ม), Kee Fai Nok Khum (ขี้ไฟนกคุ้ม).

Note.– *E. scaber* var. *penicillatus* differs from the typical variety in having large capitula and whitish pilose-tomentose leaf surface and involucres.

Specimens examined.– *S. Bunwong* 10 (KKU), 326 (KKU, US), 333 (KKU, US), 345 (KKU, US); *C. Charoenpol, K. Larsen & E. Warncke* 4933 (AAU, BKF, K, L); *Damrongsak* 447 (BKF); *Dee* 20 (BKF), 444 (BKF); *Din* 174 (BKF); *N. Fukuoka & M. Ito* T-34864 (L); *H. Koyama* T-31316 (BKF, L); *H. Koyama, H. Terao & Th. Wongprasert* T-31019 (BKF) & T-31139 (BKF); *J.F. Maxwell* 75-1040 (AAU, BK, BKF); *G. Murata, C. Phengklai, S. Mitsuta, T. Yahara, H. Nagamasu & N. Nantasan* T-37463 (BKF), T-50689 (BKF), T-51129 (BKF); *C. Niyomdham* 5582 (BKF); *Put* 4216 (BM, BK, K, L); *B. Sangkhachand & S. Sutheesorn* 3528 (BK).

2.2 var. scaber

Perennial herbs, 10 – 40 cm tall. *Stem* acaulescent, erect, rounded, inconspicuously ribbed, sericeous. *Leaves* rosette at base, 8 – 20 by 3 – 5 cm, obovate or obovate-lanceolate, margins crenate or serrate, apex obtuse or acute, base attenuate, subcoriaceous; upper surface sparsely pilose without glands, lower surface densely pilose with filiform and cylindrical hairs and capitate glands; lateral veins 12 – 15-

paired; petioles up to 2 cm long. *Capitulescences* terminal, scapose. *Foliose bracts* 3, deltoid. *Capitula* tubular, 8 – 10 mm long. *Receptacle* flat, *ca.* 0.5 mm diam., glabrous. *Phyllaries* 8, 2-seriate, decussate, green with purple apex, 7 – 10 mm long, 2 – 3 mm diam., margins entire or filiferous, outer surface pilose, without glands; the outer lanceolate, apex acuminate to acuminate; the inner ones oblong, apex acuminate. *Florets* 4, salverform, purple, zygomorphic, glabrous; corolla tube 3 – 3.5 mm long; corolla lobes, 1.5 – 2 mm long. *Anthers ca.* 2 mm long, apical appendage acute, base acute. *Styles* purple, 7 – 8 mm long, branches *ca.* 0.5 mm long; sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* clavate, 2.5 – 3 mm long, pubescent with dense twin hairs, eglandular, inconspicuously ribbed, carpopodium present. *Pappus* bristles 5, 1-seriate, dilateat bases. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Nan, Lampang, Sukhothai, Phitsanulok; NORTH-EASTERN: Phetchabun, Loei, Nong Khai, Sakon Nakhon, Mukdahan, Kalasin, Maha Sarakham, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima, Buri Ram, Surin, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi, Prachuap Khiri Khan; SOUTH-EASTERN: Chon Buri, Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Phangnga, Phuket, Nakhon Si Thammarat, Trang, Satun, Songkhla.

Distribution.– Pantropics.

Ecology.– Open area in dipterocarp, evergreen or pine-oak forest, alt. 0 – 300 m; flowering August to January.

Vernacular.– Doo Mai Ru Lom (ดูไม่รู้ล้ม), Kee Fai Nok Khum (ขี้ไฟนกคุ่ม), Ya Kai Nok Khum (หญ้าไก่นกคุ่ม), Ya Prab (หญ้าปราบ), Ya Sam Sib Song Hab (หญ้าสามสิบสองหาบ), Nat Pha (หนาดผา), Ta Che Go Wa (ตะชีโกวะ), Nat Mee Klan (หนาดมีแคลน).

Note.– This plant is characterized by having rosette leaves and spiciform capitulescence with conspicuous scape and variable leaf shape.

Specimens examined.– *E.F. Anderson* 5534 (CMU), 5545 (CMU), 6125 (CMU); *M. Balick & W. Nanakorn* 3468 (L); *S. Bunwong* 22 (KKU), 23 (KKU), 36 (KKU), 58 (KKU), 325 (KKU, US), 334 (KKU, US), 349 (KKU, US); *D.J. Collins*

2024 (K); *G. Congdon* 52 (AAU), 179 (AAU), 345 (AAU); *Dee* 138 (BKF); *N. Fukuoka & M. Ito* T-35664 (BKF); *H.B.G. Garrett* 242 (BM, E, K); *Hamilton & G. Congdon* 52 (BKF); *K. Iwatsuki & N. Fukuoka* T3562 (BKF, L); *A.F.G. Kerr* 11418 (BK, BM), 13792 (BK, BM, K), 1619B (BM, K); *H. Koyama* T-39867 (BKF); *H. Koyama, H. Terao, C. Niyomdham & Th. Wongprasert* T-30363 (BKF), T-30518 (AAU, BKF), T-30910 (BKF), T-31745 (BKF), T-32168 (BKF); *A. Marcan* 545 (BM), 1849 (BM); *J.F. Maxwell* 71-687 (AAU, BK, BKF), 72-493 (BK), 87-1404 (BK, CMU, L), 93-1106 (BKF, L), 96-1380 (BKF), 97-1207 (BKF); *J.F. Maxwell, S. Suttajit, W. Pannavalee & P. Tantipathananandh* 83 (CMU, L); *Morakot* 41 (QBG); *G. Murata, C. Phengklai, S. Mitsuta, T. Yahara, H. Nagamasu & N. Nantasan* T-37560 (AAU, BKF), T-38186 (BKF), T-38633 (BKF), T-43075 (BKF); *W. Nanakorn & H.T. Beck* 88104 (K); *W. Nanakorn et al.* 165 (QBG), 1393 (QBG), 4154 (QBG), 8171 (QBG), 9751 (QBG), 10062 (QBG); *Y. Paisooksantivatana* 375-80 (BK); *Y. Paisooksantivatana & S. Sutheesorn* 959-82 (BK); *C. Phengklai* 228 (BKF, L), 13153 (BKF), 46446 (K), s.n. (BKF); *W. Pongamornkul* 325 (QBG), 345 (QBG), 563 (QBG); *Pradit* 601 (BK); *Put* 2203 (BK); *B. Sangkhachand* 78 (BK), 1085 (BK), 1182 (BKF), 1560 (BK), 1762 (BK), 2218 (BK), 45577 (BKF, K); *B. Sangkhachand & T. Smitinand* 260 (L, P); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & T. Santisuk* T-18383 (BKF, L), T-19054 (BKF, L), T-19344 (BKF), T-27466 (BKF), T-27548 (BKF, L), T-27555 (AAU, BKF, L); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & C. Niyomdham* T-21350 (BKF), T-22264 (BKF), T-22566 (BK), T-26209 (BKF, L), T-26213 (BKF), T-26304 (BKF, L), T-26397 (BKF), T-26474 (BKF), T-26519 (BK), T-26547 (BKF, L), T-26562 (BKF), T-27152 (BKF), T-27305 (BKF, L); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & D. Phanichaphol* T-23949 (BKF), T-26028 (BKF, L); *S. Sutheesorn* 259 (BK), 697 (BK), 2794 (BK); *Th. Sørensen, K. Larsen & B. Hansen* 648 (BKF), 5668 (K); *T. Smitinand* s.n. (BKF); *P. Srisanga* 2618 (QBG); *J. Supapol* 119 (CMU); *S. Suwannaratana* 19 (L); *M. Tagawa, K. Iwatsuki & N. Fukuoka* T-2297 (BKF), T-5382 (BKF); *Umpai* 236 (BK); *C.F. van Beusekom & C. Phengklai* 2007 (AAU, E, L, P); *C.F. van Beusekom, C. Phengklai, R. Geesink & B. Wongwan* 3478 (BKF, K, L, P); *J.E. Vidal* 5291 (P); *L. Williams* 17010 (K); *Th. Wongprasert et al.* s.n. (BKF).

6. Ethulia

L.f., Dec. Pl. Hort. Upsal.: 1. 1762.
Type: *Ethulia conyzoides* L.

Annual herbs. *Stem* erect. *Leaves* simple, alternate, petiolate; lamina ovate, lanceolate, elliptic, pubescent, margins serrate, apex acute to acuminate, base attenuate, chartaceous. *Capitulescences* terminal or axillary, corymbose. *Capitula* discoid, pedunculate, homogamous; florets bisexual and fertile. *Involucre* imbricate. *Corolla* purple, infundibular, glandular; lobes 5, actinomorphic. *Anthers* 5, syngenesious, apical appendage acute, base obtuse. *Styles* white, 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* turbinate, 6-ribbed, glandular. *Pappus* absent.

One species is recognized in Thailand.

1. Ethulia conyzoides L., Sp. Pl.: 1171. 1763. Type: Egypt, *P. Forsskal* 1387 (K!). Figures 2.41, 2.74 A. & B.

Annual herbs, 50 – 150 cm tall. *Stem* erect, conspicuously ribbed, puberulous. *Leaves* alternate, 5 – 8 by 1 – 2 cm, elliptic or lanceolate, margins serrate, apex acuminate or acute, base attenuate, chartaceous; both surfaces ferrugineous puberulous with unicellular hairs and capitate glands, shortly petiolate. *Capitulescences* terminal and axillary, corymbose. *Capitula* hemispherical, 3 – 4 mm long. *Receptacle ca.* 1.5 mm diam., glabrous. *Phyllaries* 3 – 4-seriate, imbricate, semispherical, green with purple apex, 1.5 – 2 mm long, 1 – 2 mm diam., margins filiferous, outer surface puberulous, glands capitate; the outer and the middle ones ovate to lanceolate, apex acute; the inner ones lanceolate to oblong, apex acute. *Florets* 20 – 30, infundibular, corolla purple, glandular; corolla tube 0.5 – 1 mm long; corolla lobes *ca.* 1 mm long. *Anthers* 1.5 – 2 mm long, apical appendage acute, base obtuse. *Styles* purple, inner surface covered with stigmatic papillae, sweeping hairs.

Achenes turbinate, 1.5 – 2 mm long, glandular, 6-ribbed, carpopodium absent. *Pappus* absent.

Thailand.– NORTHERN: Chiang Mai, Chiang Rai; NORTH-EASTERN: Nakhon Phanom.

Distribution.– Tropics.

Ecology.– Open area along river bank in evergreen forest, alt. 200 – 400 m; flowering May to September.

Note.– *E. conyzoides* is distinguished by achenes having 4 – 6 ribs, pappus and carpopodium are absent.

Specimens examined.– *H.B.G. Garrett* 227 (BKF, BM, K); *A.F.G. Kerr* 21396 (BK, BM, K), 21809 (K).

7. Gymnanthemum

Cass., Bull. Soc. Philom. Paris 1: 10. 1817.

Type: *Gymnanthemum cupulare* Cass.

Small trees. *Stem* caulescent. *Leaves* simple, alternate, petiolate; lamina ovate, or elliptic, pubescent, margins serrate, apex acuminate, base attenuate, chartaceous. *Capitulescences* terminal or axillary, corymbose. *Capitula* discoid, homogamous, pedunculate. *Florets* bisexual and fertile. *Involucre* herbaceous, persistent, apex obtuse. *Corolla* purple to white, actinomorphic; lobes 5. *Anthers* 5, syngenesious. *Styles* purple, 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* subterete or obovate, usually 10-ribbed, carpopodium present. *Pappus* bristles, 2-seriate. *Pollen* lophate, 3-porate, with or without micropuncta.

One species is recognized in Thailand.

1. Gymnanthemun cylindriceps (C.B.Clarke) H.Rob., Proc. Biol. Soc. Wash. 112(1): 241. 1999. Type as *Vernonia cylindriceps* C.B.Clarke. Figures 2.42, 2.75 A. & B.

Vernonia cylindriceps C.B.Clarke, J. Linn. Soc. Bot. 25: 35. 1880. Type: India, Hartook Mekong, *C.B. Clarke* 42109 (K!).

Shrubs or subshrubs 2 – 6 m tall. *Stem* caulescent, young branches inconspicuously ribbed, white puberulous. *Leaves* 7 – 13 by 2 – 4 cm, oblanceolate, margins serrate, apex acute, base attenuate, chartaceous; upper surface puberulous, without glands; lower surface puberulous with whip-shaped hairs, cylindrical hairs and capitate glands; lateral veins 7 – 12-paired; petioles up to 1 cm long. *Capitulescences* terminal, corymbose. *Capitula* narrowly campanulate, 14 – 16 mm long, pedunculate. *Receptacle* convex, 1 – 1.5 mm diam., hairy. *Phyllaries* 5 – 6-seriate, imbricate, slightly oblong-cylindrical, green, 8 – 10 mm long, 3 – 4 mm diam., margins filiferous, outer surface arachnoid without glands; the outer and the middle ones, ovate, apex obtuse; the inner ones lanceolate or ovate-lanceolate, apex obtuse or rounded. *Florets* 5 – 10, infundibular, purple or white, glandular, corolla tube 6 – 7 mm long; corolla lobes 4 – 4.5 mm long. *Anthers* 4 – 4.5 mm long, apical appendage acute, base obtuse. *Styles* purple, 9 – 10 mm long, branches 2, 4 – 5 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* turbinate, 3 – 3.5 mm long, 10-ribbed, covered with dense hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 8.5 – 9 mm long. *Pollen* subechinolophate, 3-colporate, with prominent micropuncta.

Thailand.– NORTHERN: Chiang Mai, Chiang Rai.

Distribution.– China (Yunnan), India, Nepal, Myanmar, Thailand.

Ecology.– Evergreen or pine-oak forest, alt. 1,000 – 2,000 m; flowering December to April.

Note.– This species is characterized by distinctly sweet smell, shrubs or subshrubs and obtuse phyllaries.

Specimens examined.– *S. Bunwong* 76 (KKU), 378 (KKU, US); *H.B.G. Garrett* 629 (BKF, BM, K, P); *F. Konta & S. Khao-iam* 10846 (BKF), 10949 (BKF); *F. Konta & C. Phengklai* 3950 (BKF), 3998 (BKF); *F. Konta, C. Phengklai & S. Khao-iam* 4200 (BKF); *H. Koyama, H. Terao & Th. Wongprasert* T-33185 (BKF), T-33345 (BKF), T-33458 (BKF), T-33515 (BKF); *H. Koyama, T. Yahara & W. Nanakorn* T-32726 (BKF, L), T-39717 (BKF); *T. Koyama, C. Phengklai, C. Niyomdham, M. Tamura, H. Okada & R.J. O'Connor* 15558 (AAU); *B. Løjtnant & C. Niyomdham* 155 (AAU, K); *C. Maknoi* 651 (QBG); *W. Nanakorn et al.* 2916 (QBG), 5760 (QBG), 5858 (QBG), 8629 (QBG); *R. Pooma* 382 (BKF), 932 (BKF); *J. Sadakorn* 435 (BK); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & T. Santisuk* 20608 (BKF); *T. Smitinand et al.* 6628 (BK, BM, K), 10280 (BK, BKF, K, L, P); *Th. Wongprasert* 5012-60 (BKF); *Worawoot* 95 (BKF).

8. Iodocephalopsis

S.Bunwong & H.Rob., Proc. Biol. Soc. Wash. 122(3): 358. 2009.
Type: *Iodocephalopsis eberhardtii* (Gagnep.) S.Bunwong & H.Rob.

Erect perennial herbs. *Stem* erect, pubescent with T-shaped hairs. *Leaves* simple, alternate, petiolate; lamina ovate, pubescent. *Capitulescences* laxly cymose with capitula solitary and 2-3 in a group. *Capitula* discoid, campanulate, pedunculate, homogamous; florets fertile. *Involucre* imbricate, hairy, phyllaries with entire margins. *Florets* purplish or whitish, infundibular; lobes 5. *Anthers* 5, purplish or yellowish, syngenesious, exerted. *Styles* purple, 2-branched, without enlarged basal node, inner surface covered with stigmatic papillae, outer surface and lower style shaft covered with sweeping hairs. *Achenes* 7 – 10-ribbed, glandular, with vermicular seriate of idioblasts on the surface; achene walls with distinct fibrous layer inside, without raphids, base without carpopodium. *Pappus* absent. *Pollen* echinolophate, 3-colporate, pores in short colpus formed of two partially fused lacunae.

One species is recognized in Thailand.

1. Iodocephalopsis eberhardtii (Gagnep.) S.Bunwong & H.Rob., Proc. Biol. Soc. Wash. 122(3): 358. 2009. Type: as *Iodocephalus eberhardtii* Gagnep. Figures 2.43, 2.74 C. & D.

Iodocephalus eberhardtii Gagnep., Notul. Syst. (Paris) 4: 18. 1920. Type: Vietnam, Lang-bian, *Eberhardt* 1711 (P!).
Iodocephalus glandulosus Kerr, Bull. Misc. Inform., Kew.: 326. 1935. Type: Thailand, Chiang Mai, Doi Sutep, *Kerr* 789 (BM!).
Camchaya eberhardtii (Gagnep.) Kitam. Acta Phytotax. Geobot. 23: 71. 1968.

Perennial herbs, 0.5 – 1 m tall. *Stem* erect, rounded, inconspicuously ribbed, puberulous with T-shaped hairs and glands. *Leaves* alternate, obovate-lanceolate, 4 – 10 by 1 – 4 cm, margins serrate or entire, apex acute, base attenuate, chartaceous; both surfaces puberulous with whip-shaped hairs, cylindrical hairs and capitate glands; lateral veins 5 – 8-paired; petioles up to 3 mm long. *Capitulescences* terminal or axillary, corymbose or solitary. *Capitula* campanulate, 8 – 10 mm long, pedunculate. *Receptacle* convex, 2.5 – 4 mm diam., glabrous. *Phyllaries* 3 – 4-seriate, imbricate, campanulate, dull green, 6 – 7 mm long, margins filiferous, outer surface arachnoid, glandular; the outer and the middle ones ovate, apex acute to acuminate; the inner ones ovate-lanceolate, apex acute to acuminate. *Florets* 15 – 25, infundibular, purple or white, puberulous, glands capitate; corolla tube 2.5 – 4 mm long; corolla lobes 2 – 2.5 mm long. *Anthers ca.* 2 mm long, apical appendage acute, base rounded. *Styles* purple, 3 – 5 mm long, branches 1 – 2 mm long; sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* turbinate, 3 – 5 mm long, glandular, 7 – 10-ribbed, carpopodium and pappus absent. *Pollen* echinolophate, 3-colporate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai, Chiang Rai, Nan, Phitsanulok; NORTH-EASTERN: Loei, Khon Kaen; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Phetchaburi; CENTRAL: Nakhon Nayok.

Distribution.– Thailand, Laos, Cambodia.

Ecology.– Edge of evergreen and pine-oak forests, alt. 700 – 1700 m; flowering August to December.

Note.– *I. eberhardtii* is different from other *Camchaya* spp. by having 3-colporate pollen, pappus is absent and phyllaries are without marginal spine.

Specimens examined.– *S. Bunwong* 12 (KKU), 335 (KKU, US); *B.L. Burtt* 5602 (E); *T. Boonkird* 24 (BK); *C. Charoenphol, K. Larsen & E. Warncke* 4223 (L); *Din* 6 (P), 249 (BKF, P); *N. Fukuoka & M. Ito* T-34597 (L); *A.F.G. Kerr* 199 (K), 789 (BM), 1619 (BM); *H. Koyama* T-61475 (L); *H. Koyama, H. Terao, Th. Wongprasert* T-30837 (BKF), T-31570 (BKF, L), T-31637 (L); *K. Larsen, T. Santisuk & E. Warncke* 969 (K, L, P), 2792 (K); *J.F. Maxwell* 74-808 (BK), 87-1492 (CMU, L), 91-770 (E, P); *D.J. Middleton, S. Suddee, S.J. Davies & C. Hemrat* 996 (K); *S. Mitsuta, H. Nagamasu, T. Yahara & N. Nantasan* T-42260 (BKF); *G. Murata, K. Iwatsuki, C. Phengklai & C. Charenphol* T-15328 (K, L), 41669 (BKF); *G. Murata, C. Phengklai, S. Mitsuta, T. Yahara, H. Nagamasu & N. Nantasan* T-42599 (L); *P. Palee* 228 (L); *W. Pongamornkul* 334 (QBG); *Y. Paisooksantivatana* 1857-86 (BK), 2469-89 (BK); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & C. Niyomdham* T-23017 (L); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & T. Santisuk* T-18098 (AAU, L), T-18595 (AAU, L), T-18670 (L); *P. Srisanga* 949 (QBG), 1125 (QBG); *Th. Sørensen, K. Larsen & B. Hansen* 4060 (K); *H. Tagahashi & M.N. Tamura* T-63301 (AAU, BKF); *Th. Wongprasert s.n.* (BKF).

9. Koyamasia

H.Rob., Proc. Biol. Soc. Wash. 112(1): 234. 1999.

Type: *Camchaya calcarea* Kitam.

Perennial herbs. *Stem* erect, pubescent. *Leaves* simple, alternate, petiolate; lamina ovate or elliptic, margins serrate, apex acute or acuminate, base attenuate, subcoriaceous. *Capitulescences* terminal, solitary. *Capitula* discoid, homogamous; pedunculate, florets bisexual and fertile. *Involucre* imbricate, reflexed. *Florets* purplish or white, actinomorphic; lobes 5. *Anthers* 5, syngenesious. *Styles* 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping

hairs. *Achenes* subterete, 10-ribbed, carpopodium absent. *Pappus* bristles, 1-seriate, deciduous. *Pollen* echinolophate, 3-porate, without micropuncta.

One species is recognized in Thailand.

1. Koyamasia calcarea (Kitam.) H.Rob., Proc. Biol. Soc. Wash. 112(1): 235. 1999. Type: as *Camchaya calcarea* Kitam. Figures 2.44, 2.76 A. & B.

Camchaya calcarea Kitam., Acta Phytotax. Geobot. 23: 71. 1968. Type: Thailand, Chiang Mai, Doi Chiangdao, *T. Shimizu, H. Koyama & A. Nalampoon* T-10011 (KYO!).
Vernonia calcarea (Kitam.) H.Koyama, Bull. Natn. Sci. Mus., Tokyo, Ser. B, 29(1): 20. 2003.

Perennial herbs, 20 – 80 m tall. *Stem* erect, conspicuously ribbed, puberulous with glands. *Leaves* 10 – 30 by 3 – 6 cm, ovate or elliptic, margins serrate, apex acute to acuminate, base attenuate, subcoriaceous, upper surface scabrous without glands, lower surface scabrous with whip-shaped hairs, and capitate glands, lateral veins 7 – 10-paired; petioles up to 6 cm long. *Capitulescences* terminal, solitary. *Capitula* broadly campanulate, 1.5 – 3 cm long, pedunculate. *Receptacle* glabrous. *Phyllaries* 6 – 7 seriate, imbricate, hemispherical, green or purple, 15 – 20 mm long, 15 – 20 mm diam., margins entire, outer surface puberulous glandular; the outer and the middle ones ovate to lanceolate, acuminate or aristate, upper half strongly reflexed; the inner ones ovate-lanceolate, apex acute. *Florets* more than 80, infundibular, purple or white, glandular; corolla tube 5 – 6 mm long; corolla lobes 2 – 3 mm long. *Anthers* 3 – 4 mm long, apical appendage acute, base obtuse. *Styles* purple, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* subterete, 3.5 – 4.5 mm long, 10-ribbed, glabrous, carpopodium absent. *Pappus* bristles, 1-seriate, 1 – 3 mm long, deciduous. *Pollen* echinolophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai.
Distribution.– Endemic to Thailand.

Ecology.– Limestone mountain, alt. *ca.* 1,300 m; flowering October to December.

Note.– *C. calcarea* differs from the other species of *Camchaya* by having oblong achenes, 3-porate pollen and reflexed phyllaries.

Specimens examined.– *Adisai* 611 (BK), *A.F.G. Kerr* 6548 (BM, BK, K); *H. Koyama, H. Nagamasu & W. Nanakorn* T-39755 (AAU); *Put* 373 (BK, BM, K); *T. Shimitzu, H. Toyokuni, H. Koyama, T. Yahara, T. Santisuk & C. Niyomdham* T-21121 (L), T-21128 (L), T-21181 (L); *T. Smitinand & E.C. Abbe* 6246 (US); *T. Smitinand & W. Nanakorn* T-39755 (AAU, L); *P. Suksathan* 2169 (QBG), 2847 (QBG).

10. Kurziella

H.Rob & S. Bunwong, Proc. Biol. Soc. Wash. 123(2): 174. 2010.
Type: *Vernonia gymnoclada* Collett & Hemsl.

Perennial herbs. *Stem* erect, young branches angled, puberulous. *Leaves* simple, alternate, subsessile, pubescent, glands capitate, subcoriaceous. *Capitulescences* axillary, spicate or solitary. *Capitula* discoid, homogamous, sessile or subsessile. *Florets* bisexual and fertile. *Involucre* imbricate, persistent, eglandular. *Corolla* purple, actinomorphic, lobes 5. *Anthers* 5, syngenesious. *Styles* 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* terete, carpopodium present, hairy without glands. *Pappus* bristles, 1-seriate. *Pollen* echinate, 3-colporate, with micropuncta.

One species is recognized in Thailand.

1. Kurziella gymnoclada (Collett & Hemsl.) H.Rob & S.Bunwong, Proc. Biol. Soc. Wash. 123(2): 174. 2010. Type: as *Vernonia gymnoclada* Collett & Hemsl. Figures 2.45, 2.75 C. & D.

Vernonia gymnoclada Collett & Hemsl., J. Linn. Soc., Bot. 28: 70. 1890. Type: Myanmar, Meiktila, *S.N.* (K!).

Vernonia juncea Hook.f., Fl. Br. Ind. 3: 231. 1881, *nom. nud.*

Perennial herbs, up to 1 m tall. *Stem* erect, conspicuously ribbed, puberulous. *Leaves* 1 – 3 by 1 – 2 cm, obovate, margins serrate, apex obtuse or truncate, base cuneate, subcoriaceous, both surfaces scabrous with whip-shaped hairs and capitate glands, lateral veins 2 – 3-paired; petioles up to 5 mm long. *Capitulescences* terminal and axillary, spicate or solitary. *Capitula* campanulate, 10 – 13 mm long, subsessile or shortly pedunculate. *Receptacle* flat, 1.5 – 2 mm diam. *Phyllaries* 5 – 6-seriate, imbricate, campanulate, green or purple apically, 8 – 10 mm long, 4 – 5 mm diam., margins filiferous, outer surface puberulous without glands; the outer and the middle ones ovate or lanceolate, acute; the inner ones lanceolate to oblong, apex acute. *Florets* 15 – 20, infundibular, purple, glabrous; corolla tube 8 – 10 mm long; corolla lobes 3 – 3.5 mm long. *Anthers* 2 – 2.5 mm long, apical appendage acute, base obtuse. *Styles* purple, 7 – 8 mm long, branches 2 – 2.5 mm long, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* 2 – 3 mm long, *ca.* 5-ribbed, covered with dense hairs, carpopodium present. *Pappus* bristles, 1-seriate, 9 – 10 mm long. *Pollen* echinate, 3-colporate, with micropuncta.

Thailand.– NORTHERN: Kamphaeng Phet; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Kanchanaburi, Ratchaburi, Phetchaburi, Prachuap Khiri Khan; CENTRAL: Chai Nat, Saraburi, Bangkok.

Distribution.– Myanmar, Thailand.

Ecology.– Dipterocarp forest, alt. 40 – 200 m; flowering November to March.

Vernacular.– Yoong Pad Mae Mai (ยุ้งปัดแม่หม้าย).

Note.– *K. gymnoclada* is distinguished by a single row of persistent pappus, deciduous leaves and sessile or subsessile capitula in axillary leaves.

Specimens examined.– *S. Bunwong* 391 (KKU, US); *A.F.G. Kerr* 7029 (AAU, BK, BM, E, K), 8037 (BK, BM, C, E, K, L, P), 10618 (BK, BM, C, E, K), 10670 (AAU, BM, BK, K), 19911 (AAU, BK, BM, E, K); *A. Marcan* 595 (BM, K); *Put* 1980 (K), 2273 (AAU, BK, BM, E, K), 2654 (BK, BM, E, L, K); *ST. Santisuk* s.n. (BKF); *T. Smitinand* 11398 (BKF); . *Sutheesorn* 478 (BK), 479 (BK); *Th. Sørensen, K. Larsen & B. Hansen* 1013 (BKF), 2161 (BKF, C, K), 2166 (BKF, C, K), 3611 (K).

11. Monosis

DC. in Wight, Contrib. Bot. Ind.: 5. 1834.
Type: *Monosis wightiana* DC.

Perennial plants. *Stem* small trees or shrubs, young branches rounded, tomentose. *Leaves* simple, alternate, petiolate, pubescent with flagellate hairs; lamina ovate, obovate, oblanceolate or elliptic, margins serrate, apex acute, base attenuate or cuneate, subcoriaceous. *Capitulescences* terminal, thyrsoid paniculate. *Capitula* discoid, homogamous, pedunculate, florets bisexual and fertile. *Involucre* imbricate, 4 – 5-seriate, 4 – 5 mm long, persistent, eglandular. *Florets* purple, actinomorphic, lobes 5. *Anthers* 5, syngenesious. *Styles* 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* turbinate, 10-ribbed, carpopodium present, hairy with glands. *Pappus* bristles, 2-seriate. *Pollen* psilolophate, 3-colporate, without micropuncta.

Two species are recognized in Thailand.

KEY TO THE SPECIES

1. Shrubs; lower leaf surface and young shoot ferruginous tomentose; achenes 2.5 – 3.5 mm long **1. M. parishii**
1. Small tree; lower leaf surface and young shoot whitish puberulous; achenes 4 – 5 mm long **2. M. volkameriifolia**

1. Monosis parishii (Hook.f.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 119(4): 605. 2006. Type: as *Vernonia parishii* Hook.f. Figures 2.46, 2.76 C. & D.

Vernonia parishii Hook.f., Fl. Br. Ind. 3: 240. 1882. Type: Myanmar, Attran, *Parish* 103 (K!).

Shrubs or subshrubs, 1 – 3 m tall. *Stem* erect, young branches inconspicuously ribbed, ferruginous tomentose. *Leaves* 10 – 26 by 3 – 11 cm, ovate or elliptic, margins serrate, apex acute, base attenuate, coriaceous; upper surface ferruginous puberulous without glands; lower surface ferruginous tomentose with flagellate hairs and capitate glands; lateral veins 11 – 13-paired; petioles up to 3 cm long. *Capitulescences* terminal, thyrsoid paniculate. *Capitula* narrowly campanulate or slightly oblong-cylindrical, 6 – 7 mm long, subsessile or pedunculate. *Receptacle* flat, 2 – 3 mm diam., glabrous. *Phyllaries* 4 – 5-seriate, imbricate, narrowly campanulate, purple or green with purple apex, 4 – 5 mm long, 2.5 – 3 mm diam., margins filiferous, outer surface arachnoid without glands; the outer and the middle ones ovate, apex acute or obtuse; the inner ones lanceolate or oblong, apex acute. *Florets* 7 – 9, infundibular, purple, glandular; corolla tube 4 – 5 mm long; corolla lobes 2 – 2.5 mm long. *Anthers* 3 – 3.5 mm long, apical appendage acute, base obtuse. *Styles* purple, 4 – 5.5 mm long, branches 2, 2 – 2.5 mm long. *Achenes* turbinate, 2.5 – 3.5 mm long, 10-ribbed, covered with sparse hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 5 – 6 mm long, persistent. *Pollen* psilolophate, 3-colporate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Sukhothai; SOUTH-WESTERN: Kanchanaburi.

Distribution.– China (Yunnan), India, Myanmar, Thailand, Laos.

Ecology.– Hill evergreen or pine-oak forest, alt. 250 – 800 m; flowering December to April.

Vernacular.– Khang Hang Lek (ขางหางเล็ก), Tree Cha Wa (ตรีชะวา), Nat Ngern (หนาดเงิน).

Note.– *M. parishii* is recognized by leaf surface which is ferruginuous tomentose and it is a shrub.

Specimens examined.– *S. Bunwong* 66 (KKU), 72 (KKU), 394 (KKU, US); *C. Chermsirivathana* 416 (BK); *C.C. Hosseus* 458 (BM, C, E, G, K, L); *L.K. Juaton* 126 (BK); *F. Konta, C. Niyomdham & S. Khao-iam* 4108 (BKF), 4347 (BKF); *H. Koyama, C. Phengklai* T-39152 (BKF); *H. Koyama, S. Mitsuta & H. Nagamasu* T-39776 (BKF); *T. Koyama, C. Phengklai, C. Niyomdham, H. Okada & P.J. O'Connor*

T-15579 (AAU, BKF); *H. Koyama, H. Terao & Th. Wongprasert* T-32677 (BKF), T-33472 (BKF), T-33630 (BKF, L); *K. Larsen* 8570 (C); *J.F. Maxwell* 88-226 (AAU, BKF, CMU, L), 89-487 (BKF, L), 90-238 (CMU, E, L), 94-287 (CMU, L), 94-348, (CMU, L), 95-225 (CMU, BKF, L), 96-197 (CMU, BKF, L), 97-265 (BKF), 98-367 (BKF), 98-390 (BKF), 01-80 (BKF); *J.F. Maxwell, S. Suttajit, W. Pannavalee & U. Sangsorn* 153 (CMU); *S. Mitsuta, T. Yahara & H. Nagamasu* 46455 (BKF); *W. Nanakorn et al.* 598 (QBG), 610 (QBG); *C. Niyomdham* 5311 (BKF); *B. Nimanong & S. Phusomsaeng* 1729 (BKF, PSU); *M. Panatkool* 99 (L); *Parikarn & Prayad* 168 (BK); *C. Phengklai* 215 (BKF), 303 (BKF); *A. Phuakam* 1 (CMU, L); *Put* 3830 (BK, BM, K), 4527 (BK, BM, E, K, L, P); *J. Sadakorn* 231 (BK); *T. Santisuk* 1067 (PSU), s.n. (BKF); *T. Smitinand* 3769 (BKF); *P. Srisanga, S. Sasirat, W. Pongamornkul, S. Sukiam & P. Panyachan* 2457 (QBG); *S. Sutheesorn* 1634 (BK), 2272 (BK), 2337 (BK); *M. Tagawa & I. Yamada* T-13 (BKF); *Th. Sørensen, K. Larsen & B. Hansen* 7067 (C); *S. Thalamphai* (QBG); *S. Watthana & W. Pongamornkul* 230 (QBG); *Th. Wongprasert* 043-62 (BKF); *Th. Wongprasert & S. Khao-iam* 033-02 (BKF); *Worawoot* 4 (BKF).

2. Monosis volkameriifolia (DC.) H.Rob. & Skvarla, Proc. Biol. Soc. Wash. 119(4): 606. 2006. Type: Nepal, *Wallich* 3001 (K!). Figures 2.47, 2.77 A. & B.

Conyza volkameriifolia Wall., Numer. List [Wallich] no. 3001, comp. no. 111, *nom. nud.*

Vernonia volkameriifolia DC., Prodr. 5: 32. 1836.

Small trees, 3 – 6 m tall. *Stem* erect, bark grey, young branches inconspicuously ribbed, white tomentose. *Leaves* alternate, 10 – 50 by 5 – 20 cm, obovate or oblanceolate, margins serrate, apex acute, base cuneate, coriaceous; upper surface whitish puberulous, eglandular; lower surface whitish puberulous with flagellate hairs and capitate glands; lateral veins 10 – 20-paired; petioles up to 3 cm long. *Capitulescences* terminal, thyrsoid paniculate. *Capitula* campanulate, 9 – 10 mm long, subsessile or shortly pedunculate. *Receptacle* flat, 1.5 – 2 mm diam., glabrous, *Phyllaries* 4 – 5-seriate, imbricate, narrowly campanulate or slightly oblong-

cylindrical, light green or purple apically, 4 – 5 mm long, 2 – 3 mm diam., margins filiferous or entire, outer surface white arachnoid without glands; the outer and the middle ones ovate, apex acute; the inner ones ovate or lanceolate, apex acute. *Florets* 8 – 10, purple, corolla campanulate, glandular; corolla tube 5.5 – 6 mm long; corolla lobes 2 – 3 mm long. *Anthers* 3 – 3.5 mm long, apical appendage acute, base acute. *Styles* purple, 5 – 7 mm long, branches 2, 3 – 4 mm long. *Achenes* turbinate, 4 – 5 mm long, 10-ribbed, covered with dense twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 7 – 8 mm long. *Pollen* psilolophate, 3-colporate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Lamphun, Lampang.

Distribution.– China (Yunnan), India, Bhutan, Myanmar, Thailand, Vietnam.

Ecology.– Hill evergreen or pine-oak forest, alt. 500 – 1,750 m; flowering November to March.

Vernacular.– Kla Po Pha Du (คละปอพะดุ), Ya Kaa (หญ้าแก้), Ma Hok Ton (มะโหกต้น), Yarn (หยาน).

Note.– *M. volkameriifolia* is similar to *M. parisii* in capitula and leaf shape but differs in tree habits and whitish puberulous leaves surfaces.

Specimens examined.– *K. Bunchuai* 110 (BKF), 1397 (BKF, K, L, P); *S. Bunwong* 17 (KKU), 60 (KKU), 362 (KKU, US), 393 (KKU, US); *H.B.G. Garrett* 617 (AAU, BKF, K, L, P); *R. Geesink, P. Hiepko & C. Phengklai* 8160 (AAU, BKF, L); *C.C. Hosseus* 227 (BM, G, K, L); *A.F.G. Kerr* 523 (BM, K, P), 1329 (K); *F. Konta, C. Phengklai & S. Khao-iam* 4164 (BKF); *H. Koyama, S. Mitsuta, T. Yahara & H. Nagamasu* T-49522 (BKF); *H. Koyama & C. Phengklai* T-39091 (BKF, L), T-39196 (AAU, BKF, L); *H. Koyama, H. Terao & Th. Wongprasert* T-32615 (BKF), T-32617 (BKF), T-33277 (BKF), T-33284 (AAU), T-33373 (BKF), T-33452 (BKF), T-33616 (BKF); *K. Larsen, S.S. Larsen, Chr.T. Nøgoard, K. Pharsen, P. Puudjaa & W. Ueachirakan* 44912 (AAU); *C. Maknoi* 645 (QBG); *J.F. Maxwell* 88-71 (BKF), 95-212 (BKF, L); *W. Nanakorn* 1125 (A,AU); *W. Nanakorn et al.* 1775 (QBG), 1965 (QBG), 5474 (QBG), 5539 (QBG), 8925 (QBG); *C. Phengklai, C. Niyomdham, M. Tamura, H. Okada & P.J. O'Connor* 15595 (BKF, US); *J.F. Rock* 410 (US); *R. Pooma* 378 (BKF); *R. Pooma & J.F. Maxwell* 75-327 (AAU), 88-71 (CMU, L), 89-

487 (CMU), 94-150 (L); *T. Santisuk* 1067 (BKF); *T. Shimitzu, H. Toyokuni, H. Koyama, T. Yahara & T. Santisuk* T-18605 (BKF, L), T-20140 (BKF, L), T-20886 (BKF, L); *T. Shimitzu, H. Toyokuni, H. Koyama, T. Yahara, T. Santisuk & C. Niyomdham* T-20886 (BKF); *Soraded* 344 (US); *P. Srisanga* 458 (QBG), 1229 (QBG), 2681 (QBG); *Th. Sørensen, K. Larsen & B. Hansen* 1578 (C, BKF, K), 6041 (C, K), 6042 (C, K), 6604 (BKF, C, K), 6905 (BKF, C, K); *B. Tantisewie & C. Phengklai* 701 (BKF, C, K, L); *Th. Wongprasert et al.* 043-11 (BKF), 043-40 (BKF), 043-76 (BKF); *Th. Wongprasert & S. Khao-iam* 033-27 (BKF); *Winit* 1329 (BK, K).

12. Pseudelephantopus

Rohr, Skkrift. Nat. Selsk. Kiobenl. 2: 214. 1792.
Type: *Pseudelephantopus spicatus* (Aubl.) C.F.Baker

Perennial herbs. *Stem* erect, surface pilose-villose. *Leaves* simple, alternate or rosette, sessile or petiolate; lamina obovate, oblanceolate, puberulous glandular; margins crenate, slightly serrate, dentate to entire; apex acute or obtuse, base cuneate to attenuate, chartaceous. *Capitulescences* terminal and axillary, spicate. *Capitula* discoid, tubular, clusters supported by foliaceous bracts, homogamous, florets bisexual and fertile. *Phyllaries* 8, 2-seriate, decussate, persistent, oblong, outer surface puberulous. *Florets* white, glabrous, lobes 5, zygomorphic. *Anthers* 5, syngenesious, apical appendage acute. *Styles* white, 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* usually clavate, 10-ribbed, pubescent, carpopodium present. *Pappus* unequal bristles, apex N-shaped. *Pollen* lophate, 3-porate, without micropuncta.

One species is recognized in Thailand.

1. Pseudelephantopus spicatus (Aubl.) C.F.Baker, Trans. Acad. Sci. St. Louis 12: 45, 55 & 56. 1902. Type: not ascertained. Figures 2.48, 2.77 C. & D.

Pseudelephantopus spicatus Rohr, Skrifl. Nat. Selsk. Kiobenh. 2: 216. 1792.

Elephantopus spicatus Jussien ex Aublet, Pl. Guiana 2: 808. 1932.

Perennial herbs, 10 – 40 cm tall. *Stem* erect, inconspicuously ribbed, puberulous. *Leaves* simple, rosulate or alternate at baes, 5 – 15 by 1.5 – 5 cm, obovate or oblanceolate, margins slightly serrate to entire, apex obtuse or rounded, base cuneate or attenuate, subcoriaceous; upper surface puberulous without glands, lower surface puberulous with filiform hairs and capitate glands; lateral veins 9 – 15-paired; petioles up to 2 cm long. *Capitulescences* terminal and axillary, 1 – 4. *Capitula* 14 – 17 mm long, aggregated in clusters supported by foliaceous bracts, clusters arranged in spicate. *Receptacle* flat, 1 – 1.5 mm diam., glabrous. *Florets* bisexual and fertile. *Phyllaries* 8, 2-seriate, decussate, oblong, light green, 10 – 11 mm long, margins entire or filiferous, outer surface pilose without glands; the outer lanceolate, apex acute; the inner ones obovate-lanceolate or oblong, apicies acute. *Florets* 4, salverform, white, zygomorphic, glabrous; corolla tube 5 – 9 mm long; corolla lobes 2.5 – 2.8 mm long. *Anthers* 1.5 – 2 mm long, apical appendage acute, base acute. *Styles* white, 5 – 9 mm long, branches *ca.* 2 mm long, inner surface covered with stigmatic papillae, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* clavate, 4 – 5 mm long, pubescent with densely twin hairs, without glands, 10-ribbed, carpopodium present. *Pappus* bristles, 1-seriate, often of two sizes and apex N-shaped, 6 – 9, 2 – 6 mm long. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Rai; NORTH-EASTERN: Nakhon Phanom; EASTERN: Ubon Ratchathani.

Distribution.– Tropics.

Ecology.– Open area in dipterocarp forest or river bank, alt. 100 – 400 m; flowering October to December.

Vernacular.– Doo La Doo (ได่ลาได่), Ton Tai Din (ต้นใต้ดิน).

Note.– *P. spicatus* is distinguished from *Elephantopus* by having spicate capitulescences and N-shaped apex.

Specimens examined.– *S. Bunwong* 42 (KKU), 80 (KKU), 81 (KKU), 352 (KKU, US); *Th. Wongprasert et al.* 032-17 (BKF).

13. Sparganophoros

Vaill., Königl. Akad. Wiss. Paris Phys. Abh. 5: 368. 1754.
Type: *Sparganophoros vaillantii* Crantz

Annual herbs. *Stem* caulescent, erect or decumbent, puberulous. *Leaves* simple, alternate, usually petiolate; lamina elliptic, pubescent, margins serrate, apex acute, base attenuate, chartaceous. *Capitulescences* axillary, clusters. *Capitula* discoid, homogamous, hemispherical, sessile, florets bisexual and fertile. *Involucre* imbricate. *Florets* purple to white, actinomorphic, glandular, lobes 3 – 4. *Anthers* 5, syngenesious. *Styles* purple, 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs. *Achenes* turbinate, 3 – 4-angular, usually 3 – 5-ribbed, carpopodium absent. *Pappus* coroniform, thick, 1-seriate, persistent. *Pollen* echinolophate, 3-porate, without micropuncta.

One species is recognized in Thailand.

1. Sparganophoros sparganophora (L.) C.Jeffrey, Kew Bull. 43: 272. 1988. Type: *Vaillanz* s.n. (P!). Figures 2.49, 2.79 A. & B.

Ethulia sparganophora L., Sp. Pl.: 1171. 1763.
Sparganophoros vaillantii Crantz, Inst. Rei. Herb. 1: 261. 1766.
Struchium sparganophorum (L.) Kuntze, Revis. Gen. Pl. 1: 366. 1891.

Annual, 20 – 50 cm tall. *Stem* erect, inconspicuously ribbed, puberulous. *Leaves* 4 – 12 by 2 – 15 cm, elliptic, pubescent, margins serrate, apex acute, base attenuate, chartaceous; both surfaces puberulous with cylindrical hairs and capitate glands; lateral veins 7 – 11-paired; petioles up to 12 mm long. *Capitulescences* axillary, solitary or clustered. *Capitula* hemispherical, sessile, 4 – 6 mm diam. *Receptacle* convex, 2 – 2.5 mm diam., glabrous. *Phyllaries* 3 – 4 seriate, imbricate, hemispherical, light green, 3 – 4 mm long, margins filiferous, outer surface puberulous without glands; the outer ovate to lanceolate, apex acute to acuminate; the

inner ones obovate-lanceolate, apex acuminate. *Florets* 50 – 70, infundibular, white, glandular; corolla tube 1 – 1.5 mm long; corolla lobes 3 – 4, 0.5 – 1 mm long. *Anthers ca.* 1 mm long, apical appendage acute, base acute. *Styles* purple, *ca.* 2 mm long, branches 1 – 1.5 mm long, inner surface covered with stigmatic papillae, sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* turbinate, 3 – 4-angular, 1 – 1.5 mm long, 3 – 5-ribbed, glandular, carpopodium absent. *Pappus* corona 3 – 4, *ca.* 1 mm long, whitish. *Pollen* echinolophate, 3-porate, grains covered with net-like pattern.

Thailand.– NORTHERN: Lamphun; NORTH-EASTERN: Nakhon Phanom; SOUTH-WESTERN: Kanchanaburi; CENTRAL: Bangkok; PENINSULAR: Ranong, Phangnga, Krabi, Trang, Songkhla, Yala.

Distribution.– Tropics.

Ecology.– Open sandy grassland or secondary evergreen forest, alt. 50 – 400 m; flowering August to April.

Note.– Distinct characters of *S. sparganophora* are sessile capitula in axillary head, achenes has coroniform pappus and florets have 3 – 4 corolla lobes.

Specimens examined.– *S. Bunwong* 28 (KKU); *C. Chermsirivathana* 1266 (BK, L); *G. Congdon* 868 (AAU); *A.F.G. Kerr* 8393 (BM, K); *K. Larsen & S.S. Larsen* 33266 (L); *K. Larsen, S.S. Larsen, A.S. Barfod, W. Nanakorn, W. Ueachirakan & P. Sirirugsa* 41462 (AAU); *A. Marcan* 45 (BM); *J.F. Maxwell* 71-107 (AAU, BK, L), 75-824 (AAU, BK, L), 86-636 (AUU, BKF, L), 86-911 (BKF, L); *D.J. Middleton, V. Chamchamroon, S. Lindsay, M. Phuphat & R. Pooma* 3463 (E); *Y. Paisooksantivatana* 1433-84 (BK); *P. Palee* 265 (BKF, CMU, L); *T. Piyakownclana* s.n. (BK); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & C. Niyomdham* 26302 (AAU, BKF, L); *Th. Sørensen, K.Larsen & B. Hansen* 436 (K), *E. Smith* 171 (BK); *J. Supapol* 164 (L); *S. Sutheesorn* 2275 (BK); *C.F. van Beusekom, C. Phengklai, R. Geesink & B. Wongwan* 3927 (L).

14. Strobocalyx

Spach, Hist. Nat. Veg. Phan. 10: 39. 1843.

Type: *Strobocalyx arborea* Sch.Bip.

Perennial plants. *Habit* arborescent or scandent. *Leaves* simple, alternate, usually petiolate; lamina elliptic or oblong, pubescent with uniseriate or flagellate hairs, margins serrate or entire, apex acute or acuminate, base cuneate, coriaceous. *Capitulescences* terminal or axillary. *Capitula* discoid, homogamous, pedunculate or sessile, florets bisexual and fertile. *Involucre* imbricate, 2 – 4 seriate, 2 – 4 mm long, hairy without glands. *Florets* purple to white, actinomorphic, lobes 5. *Anthers 5*, syngenesious. *Styles* purple, 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* turbinate, usually 10-ribbed, *ca.* 2 mm long, hairy with glands, carpopodium present. *Pappus* 2 seriate of bristles. *Pollen* echinate, subechinolophate or echinolophate, 3-colporate, with micropuncta.

Two species are recognized in Thailand.

KEY TO THE SPECIES

1. Tree; capitulescences thyrsoid paniculate; achenes with 3 – 4 angles **1. S. arborea**

1. Scandent or shrub; capitulescences corymbose; achenes with 10 ribs **2. S. solanifolia**

1. Strobocalyx arborea (Buch.-Ham.) Sch.Bip., Jahresber. Pollichia 18: 171. 1861. Type: as *Vernonia arborea* Buch.-Ham., Figures 2.50, 2.78 A. & B.

Conyza arborea Wall. List [Wallich] no. 2. *nom. nud.*

Vernonia arborea Buch.-Ham., Trans. Linn. Soc. 14: 218. 1825. Type: Nepal, *S.N.* (E!).

Vernonia javanica DC., Prodr. 5: 22. 1836.

Tree, 5 – 20 m tall. *Stem* arborescent, rounded, inconspicuously ribbed, branches ferruginuous pubescent. *Leaves* 8 – 20 by 4 – 10 cm, elliptic to oblong, margins entire, apex acuminate or caudate, base cuneate or oblique, coriaceous; both surfaces puberulous with filiform hairs and capitate glands; lateral veins 10 – 15-paired; petioles up to 3 cm long. *Capitulescences* terminal or axillary, thyrsoid paniculate. *Capitula* narrowly campanulate, shortly pedunculate. *Receptacle* flat, glabrous. *Phyllaries* 3 – 4-seriate, imbricate, narrowly campanulate or slightly oblong-cylindrical, green or purple, 2 – 3 mm long, margins filiferous, outer surface puberulous without glands; the outer ovate, apex obtuse or rounded; the inner ones ovate-lanceolate or oblong, apex obtuse. *Florets* 3 – 6, infundibular, purple to white, glandular; corolla tube 6 – 7 mm long; corolla lobes *ca.* 2 mm long. *Anthers ca.* 2.5 mm long, apical appendage acute, base obtuse. *Styles* purple. *Achenes* turbinate, *ca.* 2 mm long, 3 – 4-angled and inconspicuously ribbed, pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6 – 7 mm long. *Pollen* subechinolophate, 3-colporate, with micropuncta.

Thailand.– NORTHERN: Nan; NORTH-EASTERN: Loei; PENINSULAR: Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Pattani, Yala, Narathiwat.

Distribution.– India, Sri Lanka, Myanmar, Thailand, Malay Peninsula, Vietnam, New Guinea.

Ecology.– Evergreen forest, alt. 50 – 300 m; flowering July to February.

Vernacular.– Ka Ton Rok (กะท้อนรอก), Ka Puam Ma Prao (กะพวมมะพร้าว), Kra Phee Kao (กระพี้ขาว), Ko Ta Ba Ru (โกตาบารู), Kee Aon (ขี้อ้น), Torn Lor (ตอนเลาะ), Baa Hor (แบหอ), Smong Kung (สมองกุ้ง), Ai Nieaw Maa (อ้ายเหนียวหมา), Ta Kuam (ตะกวม), Nuang Chang (งวงช้าง).

Note.– *S. arborea* is distinguished by its big tree, 3 – 4-angled achenes and obtuse phyllaries.

Specimens examined.– *A.F.G. Kerr* 7276 (BM, K, L), 13034 (AAU, BK, BM, K, L), 15847 (BK, BM, K), 16477 (BK, BM, K); *K. Larsen, S.S. Larsen, A.S. Barfod, W. Nanakorn, W. Ueachirakan & P. Sirirugsa* 40943 (AAU, BKF, P, PSU), 41268

(AAU, BKF, PSU); *K. Larsen, S.S. Larsen, I. Nielsen & T. Santisuk* 30935 (AAU, BKF, K, L); *J.F. Maxwell* 75-739 (AAU, BK, L), 84-176 (BKF, PSU), 86-520 (BKF, CMU, L, P, PSU), 86-681 (BKF, CMU, L, PSU); *W. Nanakorn et al.* 7163 (QBG); *C. Niyomdham et al.* 358 (AAU, BKF, E, K, L, P), 5137 (BKF); *M. Norsangsri* 1052 (QBG); *Pochanart* 427 (BKF, K, P); *D. Prapat* 54 (AAU, BKF, L), s.n. (BKF); *Prayad* 494 (BK, US); *Put* 3655 (BK, BM, E, K); *P. Puudjaa* 311 (BKF); *Rabil* 188 (BK, BM, E, K); *Sanan* 333 (US), 768 (BKF, US); *B. Sangkhachand* 885 (BKF, K, L, P), 886 (BKF), 1010 (K), 1300 (BKF); *B. Sangkhachand & B. Nimanong* 1306 (BKF); *B. Sangkhachand & T. Smitinand* 1010 (BKF, L), 11936 (PSU); *T. Santisuk* 1249 (BKF, PSU); *T. Shimizu, N. Fuguoka & A. Nalampoon* T-8176 (BKF); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & C. Niyomdham* T-26360 (BKF, L), T-26501 (BKF), T-26502 (BKF), T-26503 (BKF); *T. Smitinand* 1722 (BKF), 2860 (BKF, US); *P. Suvarnakoset* 271 (BKF), 865 (BKF, US); *Th. Wongprasert* 997-72 (BKF).

2. Strobocalyx solanifolia Sch.Bip., Jahresber. Pollichia 18-19: 171. 1861. Type: as *Vernonia solanifolia* Benth., Figures 2.51, 2.78 C. & D.

Vernonia solanifolia Benth., Lond. Journ. Bot. 1: 486. 1842. Type: Hong Kong: *Hinds* s.n. (K!).

Climbing shrubs or scandents, 2 – 10 m tall. *Stem* nconspicuously ribbed, ferruginous tomentose. *Leaves* 8 – 20 by 4 – 10 cm, ovate or elliptic, margins serrate or entire, apex acute or acuminate, base cuneate, subcoriaceous; upper surface puberulous without glands; lower surface tomentose with filiform hairs, flagellate hairs and capitate glands; lateral veins 5 – 7-paired; petioles up to 3.5 cm long. *Capitulescences* terminal and axillary, thyrsoid paniculate. *Capitula* narrowly campanulate, 8 – 10 mm long, pedunculate. *Receptacle* flat, 2 – 2.5 mm diam., hairy. *Phyllaries* 2 – 3 seriate, imbricate, narrowly campanulate or slightly oblong-cylindrical, 3.5 – 4 mm long, 3 – 4 mm diam., margins filiferous, outer surface tomentose without glands; the outer and the middle ones ovate, apex obtuse; the inner ones obovate, apex obtuse. *Florets* 5 – 7, infundibular, purple, puberulous, glands

capitates; corolla tube 4.5 – 6 mm long; corolla lobes 1.5 – 2.5 mm long. *Anthers* 2 – 2.5 mm long, apical appendage acute, base acute. *Styles* purple, 5 – 6.5 mm long, branches 2 – 2.5 mm long. *Achenes* turbinate, *ca.* 2 mm long, 10-ribbed, covered with sparse hairs and capitate glands, carpopodium present. *Pappus* 2 seriate of bristles, the inner ones 5 – 6 mm long. *Pollen* echinate, 3-colporate, with prominent micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Nan, Lampang, Phitsanulok; NORTH-EASTERN: Phetchabun, Loei, Sakon Nakhon; EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH-WESTERN: Kanchanaburi; CENTRAL: Nakhon Nayok.

Distribution.– Hong Kong, Myanmar, Thailand, Vietnam, Laos, Cambodia.

Ecology.– Hill evergreen or pine-oak forest, alt. 900 – 1,250 m; flowering February to May.

Vernacular.– Cha Kua (ชะเคือ จ้าเขือ).

Note.– *S. solanifolia* is distinguished by scandent habits, corymbose capitulescences and tomentose leaf surfaces.

Specimens examined.– *Adisai* 382 (BK); *A. Boonkongchart* 47 (BKF, CMU); *S. Bunwong* 68 (KKU), 70 (KKU); *P. Chantaranothai, J. Parnell, D. Middleton & D. Simpson* 1079 (BKF); *Kasem* 444 (BK, US); *A.F.G. Kerr* 4982 (BK, BM, K), 8816 (BK, BM, E, K), 20129 (BK, BM, K, L), 20226 (BK, BM, K); *W. Nanakorn* 391 (BKF); *B. Nimanong & S. Phusomsaeng* 1813 (BKF, PSU); *Pradit* 846 (BK); *P. Puudjaa* 198 (BKF); *T. Smitinand* 1152 (BKF), 2495 (US), 2639 (BKF); *P. Srisanga* 572 (QBG); *Winit* 1262 (BK, BKF, K).

14. Tarlmounia

H.Rob., S.C.Keeley, Skvarla & R.Chan., Proc. Biol. Soc. Wash. 121(1): 31. 2008.
Type: *Vernonia elliptica* DC.

Perennial plants. *Stem* rounded, white, sericeous. *Leaves* simple, alternate, petiolate, sericeous with long horn-shaped hairs, lamina elliptic, margins entire or serrate, apex acute rounded, base rounded, subcoriaceous. *Capitulescences* terminal or

axillary. *Capitula* discoid, homogamous, pedunculate, florets bisexual and fertile. *Involucre* imbricate, 3 – 4 seriate, 3 – 4 mm long, glandular without hairs. *Florets* purple to white, actinomorphic, lobes 5. *Anthers 5*, syngenesious. *Styles* 2-branched, inner surface covered with stigmatic papillae, outer surface covered with sweeping hairs on the outer surface reaching below style bifurcation. *Achenes* turbinate, 4 – 7-ribbed, *ca.* 2 mm long, glandular without hair, carpopodium present. *Pappus* bristles, 2-seriate. *Pollen* echinate, 3-colporate, with micropuncta.

One species is recognized in Thailand.

1. Tarlmounia elliptica (DC.) H.Rob., S.C.Keeley, Skvarla & R.Chan, Proc. Biol. Soc. Wash. 121(1): 32. 2008. Type: as *Vernonia elliptica* DC. Figures 2.52, 2.79 C. & D.

Vernonia elliptica DC. in Wight, Contrib. Bot. Ind. 5. 1834. Type: India, Nilgherry, *Wight* 1377 (E!).
Vernonia elaeagnifolia DC., Prod. 5: 22. 1836.

Climbing shrubs or scandents. *Stem* caulescent, young branches inconspicuously ribbed, white sericeous. *Leaves* 5 – 12 by 3 – 6 cm, elliptic, margins entire or serrate, apex acute or obtuse, base rounded, subcoriaceous; upper surface puberulous without glands; lower surface sericeous with T-shaped hairs; lateral veins 7 – 11-paired; petioles up to 1 cm long. *Capitulescences* terminal and axillary, thyrsoid paniculate. *Capitula* narrowly campanulate, 10 – 15 mm long. *Receptacle* convex, *ca.* 1 mm diam., glabrous. *Phyllaries* 3 – 4-seriate, imbricate, narrowly campanulate or slightly oblong-cylindrical, green or purple apically, 3 – 4 mm long, *ca.* 3 mm diam., margins filiferous, outer surface arachnoid glandular; the outer and the middle ones ovate, obtuse to rounded; the inner ones obovate, apex acute or obtuse. *Florets* 4 – 5, infundibular, purple or white, glandular, corolla tube 4.5 – 5.5 mm long; corolla lobes 2 – 3 mm long. *Anthers* 3 – 3.5 mm long, apical appendage acute, base obtuse. *Styles* purple, 5.5 – 7 mm long, branches *ca.* 2 mm long. *Achenes* turbinate, *ca.* 2 mm long, 4 – 7-ribbed, covered with sparse hairs and capitate glands,

carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 5 – 6 mm long, persistent. *Pollen* echinate, 3-colporate, with prominent micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai, Phitsanulok; NORTH-EASTERN: Loei, Nong Bua Lum Phu, Udon Thani; ESTERN: Chaiyaphum, Nakhon Ratchasima, Roi Et, Si Sa Ket; SOUTH-WESTERN: Ratchaburi, Phetchaburi; CENTRAL: Saraburi, Phra Nakhon Si Ayutthaya, Nakhon Nayok, Nonthaburi, Bangkok; SOUTH-EASTHERN: Prachin Buri, Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Chumphon, Surat Thani, Nakhon Si Thammarat.

Distribution.– America, Africa, Asia.

Ecology.– Open area in wetland, alt. 0 – 100 m; flowering October to May.

Vernacular.– Kiew Darn (เขี้ยวดาน), Sar Muk Lord (ซ้าหมักหลอด), Tanmon (ตานหม่อน), Tao Kee Tao (เถาขี้เต่า), Lee Kuan Yuu (ลีกวนยู), Tao Wan Lek (เถาวัลย์เหล็ก), Khud Mon (คัดมอญ), Tarlmoun (ตาลหม่น).

Note.– *T. elliptica* is characterized by having appressed T-shaped hairs on leaf surfaces, scandent habits and involucre without glands.

Specimens examined.– *Adisai* 123 (BK); *S. Bunwong* 69 (KKU), 390 (KKU, US); *D.J. Collins* 80 (E, K), 325 (K), 1769 (BK, K); *Dee* 34 (BKF); *Din* s.n. (BKF); *P. Guptavanija* 26 (BK); *K. Iwatzuki & N. Fukuoka* T-7314 (BKF), T-7373 (BKF); *T. Jonganuruk* 288 (BCU); *A.F.G. Kerr* 1693 (AAU, BM, C, K, L), 4010 (BM, K), 12344 (BK, BM, K), 19950 (BK, BM, E, K); *F. Konta, W. Nanakorn & Th. Wongprasert* 49085 (BKF, K, L); *H. Koyama & H. Terao* T-32866 (C, BKF), T-33716 (BKF), T-33717 (BKF); *M.C. Lakshanakara* 308 (AAU, BK, K), s.n. (BK); *A. Marcan* 62 (BM), 2462 (BK, BM); *J.F. Maxwell* 71-162 (AAU, BK, L), 75-152 (AAU, BK, L), 92-57 (E); *C. Niyomdham* 531 (BKF); *Y. Paisooksantivatana* 1182-82 (BK); *P. Prasomsuke* s.n. (BCU); *Prayad* 228 (BK, US); *C. Prosakha* 16 (BCU); *Put* 2771 (BK, BM, E, K), s.n. (BM); *Sanan* 13 (E, BKF, US), 180 (BKF, US), 1002 (BKF, US); *B. Sangkhachand* 417 (BKF, US); *J. Schmidt* 481 (C); *R. Schomburgk* 1859 (K); *P. Sirirugsa* 173 (PSU); *E. Smith* 268 (BK), 298 (BK, BM); *P. Suvarnakoset* 1300 (BKF, US); *Th. Sørensen, K. Larsen & B. Hansen* 531 (C, K), 2164 (BKF, C, K); *S. Sutheesorn* 371 (BK, US), 2980 (BK); *Vacharapong* 8 (BK,

US); *K. Wangwasit, M. Norsaengsri & C. Lakoet* 70320-25 (QBG); *K. Wertsawang* 179 (QBG); *Th. Wongprasert* s.n. (BKF); *R. Zimmermann* 1899 (B, BM, G, K, L, P, US).

Uncertain species

1. Vernonia birmanica (O.Ktz.) Merr., Brittonia 2: 200. 1936. Type: Myanmar, Moulmein, *O. Kuntze* 6271 (K!). Figures 2.53, 2.80 A. & B.

Cacalia birmanica O.Ktz., Rev. Gen. P1. 323. 1891.

Annual, 1 – 2 m tall. *Stem* erect, inconspicuously ribbed, puberulous. *Leaves* cauline, 5 – 20 by 1 – 5 cm, lanceolate, margins serrate, apex acuminate, base attenuate, chartaceous; upper surface scabrous, lower surface puberulous, lateral veins 8 – 12-paired; petioles up to 2 cm long. *Capitulescences* terminal, loosely paniculate. *Capitula* campanulate, 10 – 12 mm long, pedunculate. *Receptacle* convex, glabrous. *Phyllaries* 4 – 5-seriate, imbricate, subglobular, *ca.* 7 mm long, outer surface arachnoid; the outer and the middle ones ovate or elliptic, apex obtuse; the inner ones broadly oblong, apex obtuse. *Florets ca.* 55, infundibular, white or purple, puberulous without glands. *Achenes* subterete, *ca.* 4 mm long, 10-ribbed, aculeate between ribs, carpopodium absent. *Pappus* bristles, 2-seriate, the inner ones *ca.* 7 mm long, persistent.

Thailand.– NORTHERN: Lampang; SOUTH-WESTERN: Kanchanaburi.

Distribution.– Myanmar, Thailand.

Ecology.– Under dense canopy on the top of limestone mountain, alt. 650 – 1,000 m; flowering September to December.

Note.– *V. birmanica* is distinguished by its long and slender pedicel in a loose panicle, phyllaries are mostly obtuse with thickened tips and cup-shaped involucre.

Specimens examined.– *K. Larsen* 8492 (K), *J.F. Maxwell* 96-1490 (BKF).

2. Vernonia cinerea var. **montana** (C.B.Clarke) Koster, Blumea 1: 416. 1935. Type: Assam, Khasia hill (not located). Figures 2.54, 2.80 C. & D.

Annual, 1 – 2 m tall. *Stem* erect, conspicuously ribbed, pilose-villose. *Leaves* 7 – 8 by 2 – 4 cm, ovate or ovate-lanceolate, margins serrate or dentate, apex acute, base attenuate, chartaceous; upper surface puberulous glandular; lower surface villose with whip-shaped hairs, T-shaped hairs and capitate glands; lateral veins 5 – 7-paired; petioles up to 2 cm long. *Capitulescences* terminal or axillary, paniculate. *Capitula* narrowly campanulate, 5 – 7 mm long, pedunculate. *Receptacle* flat, 2 – 2.5 mm diam., glabrous. *Phyllaries* 3 – 4 seriate, imbricate, narrowly campanulate, 5 – 6 mm long, 3 – 4 mm diam., margins filiferous, outer surface hirsute without glands; the outer and the middle ones lanceolate, acuminate; the inner ones lanceolate to oblong, apex acuminate. *Florets* 20 – 30, infundibular, purple, corolla tube 4 – 5 mm long; corolla lobes *ca.* 2 mm long. *Anthers* 0.5 – 2 mm long, apical appendage acute, base obtuse. *Styles* purple, 5 – 6 mm long, branches 1 – 2 mm long. *Achenes* clavate, 1.5 – 2 mm long, 5 – 8-ribbed, densely pubescent with twin hairs and capitate glands, carpopodium present. *Pappus* 2 seriate of bristles, the inner ones 5 – 6 mm long. *Pollen* echinolophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Mai, Nan; NORTH-EASTERN: Loei, Khon Kaen; EASTERN: Nakhon Ratchasima, Ubon Ratchathani.

Distribution.– Thailand, Laos, Cambodia, Vietnam, Sumatra.

Ecology.– Hill evergreen or pine-oak forest, alt. 500 – 1000 m; flowering October to March.

Note.– *V. cinerea* var. *montana* should be transferred to a species of *Cyanthillium*

Specimens examined.– *S. Bunwong* 16, (KKU), 62 (KKU), 371 (KKU, US); *C. Chermsirivathana* 56 (BKF), 437 (BK); *H.B.G. Garrett* 922 (AAU, BKF E, L, P); *B. Hansen, G. Siedenfaden & T. Smitinand* 11001 (C); *A.F.G. Kerr* 8848 (AAU, BM); *H. Koyama, S. Mitsuta & H. Nagamasu* T-39848 (BKF); *H. Koyama & C. Phengklai* T-40069 (BKF, L); *H. Koyama, H. Terao & Th. Wongprasert* T-31213 (BKF), T-31565 (BKF), T-31743 (BKF), T-31749 (BKF), T-32285 (BKF), T-32307 (BKF), T-

32820 (BKF), T-33275 (BKF), T-33614 (AAU, BKF), T-32800 (BKF) ; *J.F. Maxwell* 88-31 (CMU), 88-213 (CMU), 90-10 (CMU, E, L), 95-202 (BKF, L), 96-172 (BKF, L); *W. Nanakorn et al.* 1616 (QBG), 8087 (QBG); *P. Palee* 171 (L); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & C. Niyomdham* T-22031 (BKF), T-22617 (BKF); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahama & T. Santisuk* T-20676 (BKF); *P. Srisanga* 2621 (QBG); *P. Srisanga, S. Sasirat, W. Pongamornkul, S. Sukiam & P. Panyachan* 2486 (QBG); *S. Sukkri* 90 (L); *Th. Sørensen, K. Larsen & B. Hansen* 1783 (C), 3704 (C), 3736 (C), 6588 (C) ; *H. Takahashi & M.N. Tamura* T-63331 (BKF).

3. Vernonia curtisii Craib et Hutchinson, Bull. Misc. Inform., Kew 1910: 22. 1910. Type: Malay Peninsula, Kedah, Langawi, *Curtis* 2127 (K!). Figures 2.55, 2.81 A. & B.

KEY TO THE VARIETIES

1. Lower surface of leaves puberulous	**1. var. curtisii**
1. Lower surface of leaves tomentose	**2. var. tomentosa**

3.1 var. curtisii

Succulent herbs, 20 – 100 cm tall. *Stem* erect, conspicuously ribbed, puberulous with glands. *Leaves* 5 – 15 by 2 – 7 cm, ovate or elliptic, margins serrate, apex acute to acuminate, base attenuate, chartaceous; both surfaces puberulous with whip-shaped hairs and capitate glands; lateral veins 7 – 12-paired; petioles up to 4 cm long. *Capitulescences* terminal, solitary or loosely paniculate. *Capitula* campanulate, 15 – 20 mm long, pedunculate. *Receptacle* flat, glabrous. *Phyllaries* 6 – 7-seriate, imbricate, campanulate, light green or purple apex, 7 – 10 mm long, 8 – 15 mm diam., margins entire, outer surface puberulous; the outer and the middle ones ovate to lanceolate, apex acuminate with reflexed, the inner ones lanceolate to oblong, apex caudate. *Florets ca.* 60, infundibular, purple, pubescent with soft hairs and capitate glands; corolla tube 7 – 10 mm long; corolla lobes 2 – 3 mm long. *Anthers* 2.8 – 3 mm long, apical appendage acute, base obtuse. *Styles* purple, sweeping hairs on the

outer surface reaching below style bifurcation. *Achenes* clavate, 3 – 3.5 mm long, 10-ribbed, sparsely glandular, carpopodium absent. *Pappus* bristles, 1-seriate, the inner ones 2 – 8 mm long, deciduous. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Lampang; NORTH-EASTERN: Phetchabun; SOUTH-WESTERN: Kanchanaburi; CENTRAL: Saraburi; PENINSULAR: Patthalung, Trang, Satun, Songkla.

Distribution.– India, Thailand, Laos, Cambodia, Vietnam, Malay Peninsula, Malay islands.

Ecology.– Limestone mountain, alt. 100 – 500 m; flowering November to April.

Vernacular.– Chang Nga Pha (ช้างงาผา).

Note.– *V. curtisii* is similar to *Koyamasia calcarea* in having solitary or loosely paniculate capitulescences and reflexed phyllaries but differs in a small capitula and pappus. Both of them are found on limestone mountain.

Specimens examined.– *Adisai* 965 (BK); *C. Chermsirivathana* 1477 (BK, L); *G. Congdon* 44 (AAU, PSU); *Kasem* 548 (BK); *A.F.G. Kerr* 3612 (BM, K); *F. Konta, Th. Wongprasert & B. Sangkhachand* T-29668 (BKF, L); *A. Marcan* 2348 (BM, K, P); *J.F. Maxwell* 87-24 (CMU, L, PSU); *G. Murata, K. Iwatsuki & C. Phengklai* T-14893 (L); *Put* 1780 (AAU, BK, K, L, P), 1877 (BK), 1879 (AAU, BK, BM, E, K, P), 4019 (AAU, BK, BM, K, P); *Rabil* 310 (BK, BM, K); *T. Smitinand & H. Sleumer* 1372 (K, L); *Winit* 757 (K).

3.2 var. tomentosa Kerr, Fl. Siam. Enum. 2(3): 238. 1936. Type: Thailand, *A.F.G. Kerr* 8997 (BK!, BM!, K!). Figures 2.81 C. & D.

Succulent herbs, 20 – 100 cm tall. *Stem* erect, conspicuously ribbed, tomentose or villose. *Leaves* 5 – 10 by 2 – 6 cm, ovate or elliptic, margins serrate, apex acute to acuminate, base attenuate, chartaceous; upper surface scabrous; lower surface tomentose; lateral veins 7 – 12-paired; petioles up to 4 cm long. *Capitulescences* terminal, solitary or paniculate. *Capitula* campanulate, 11 – 13 mm long, pedunculate. *Receptacle* flat, glabrous. *Phyllaries* 6 – 7-seriate, imbricate, campanulate, green with

purple apex, 7 – 8 mm long, 8 – 10 mm diam., margins filiferous, outer surface puberulous; the outer and the middle ones ovate to lanceolate, caudate, upper half strongly reflexed; the inner ones lanceolate to oblong, apex acute to acuminate. *Florets ca.* 60, infundibular, purple; corolla tube 7 – 8 mm long; corolla lobes 2 – 2.5 mm long. *Anthers* 2.8 – 3 mm long, apical appendage acute, base obtuse. *Styles* purple. *Achenes* clavate, 3 – 3.5 mm long, 10-ribbed, sparsely glandular, carpopodium absent. *Pappus* bristles, 2-seriate, the inner ones 5 – 6 mm long, deciduous. *Pollen* lophate, 3-porate, without micropuncta.

Thailand.– NORTHERN: Chiang Rai; SOUTH-WESTERN: Kanchanaburi, Ratchaburi.

Distribution.– Endemic to Thailand.

Ecology.– Limestone mountain, alt. 200 – 1,600 m; flowering June to August.

Vernacular.– Hua Chai Wai Yarap (หัวใจไวยราพณ์).

Note.– This plant differs from the typical variety by having dense hairs on the lower leaf surfaces.

Specimens examined.– *H. Banziger* 702 (CMU); *C. Phengklai, B. Sangkhachand & B. Nimanong* 2986 (K); *A. Marcan* 1736 (BM); *J.F. Maxwell* 86-396 (CMU, PSU); *S. Pumicong* 443 (QBG); *S. Watthana* 875 (AAU, QBG).

4. Vernonia kerrii Craib, Bull. Misc. Inform., Kew 1914: 7. 1914. Type: Thailand, Nan, Sop Ngao, *Kerr* 2404 (K!, BM!). Figures 2.82 A. & B.

Perennial herbs, *ca.* 30 cm tall. *Stem* erect, basal branching, inconspicuously ribbed, puberulous. *Leaves* cauline, 4 – 6 by 1 – 2.5 cm, oblanceolate or elliptic, margins slightly serrate, apex acute or obtuse, base cuneate, chartaceous; both surfaces pubescent; lateral veins 7 – 10-paired; petioles up to 3 mm long. *Capitulescences* terminal or axillary, solitary or in loose panicled. *Capitula* campanulate, 10 – 11 mm long, subsessile or pedunculate. *Phyllaries* 4 – 5-seriate, imbricate, campanulate, 7 – 8 mm long, margins filiferous, outer surface nearly glabrous; the outer and the middle ones ovate, apex acute; the inner ones ovate-lanceolate, apex acute. *Florets* 20 – 25, infundibular, purple, glandular, corolla tube

6.5 – 7 mm long; corolla lobes 2 – 3 mm long. *Achenes* narrowly turbinate, *ca.* 3 mm long, 10-ribbed, puberulous, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 6 – 7 mm long.

Thailand.– NORTHERN: Chiang Mai, Nan.

Distribution.– Endemic to Thailand

Ecology.– Rock cliff by river in hill evergreen forest, alt. 700 – 1,400 m; flowering February.

Note.– *V. kerrii* is similar to *Acilepis* spp. Its distinct character is the subsessile capitula in axillary leaves.

Specimens examined.– *Kerr* 2404 (K, BM); *Th. Sørensen, K. Larsen & B. Hansen* 1602 (K).

5. Vernonia pseudobirmanica H.Koyama, Bull. Natl. Sci. Mus., Tokyo, B. 29(1): 16. 2003. Type: Thailand, Tak, Khao Phra War, *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahara & T. Santisuk* T-18505-bis (KYO!). Figures 2.56, 2.82 C. & D.

Perennial herbs, 20 – 40 cm tall. *Stem* erect, conspicuously ribbed, puberulous. *Leaves* cauline, 3 – 12 by 1 – 3 cm, elliptic or obovate, margins serrate, apex acuminate, base attenuate, chartaceous; upper surface glabrate or scabrous; lower surface glabrate or pubescent; lateral veins 7 – 12-paired; petioles up to 1 cm long. *Capitulescences* terminal, loosely corymbose. *Capitula* broadly campanulate, 5 – 6 mm long, pedunculate. *Receptacle* glabrous. *Phyllaries* 4 – 5-seriate, imbricate, broadly campanulate, *ca.* 5 mm long, margins filiferous, outer surface nearly glabrous; the outer and the middle ones linear-oblong, apex acute; the inner ones ovate-lanceolate to oblong, apex obtuse. *Florets ca.* 20, infundibular, purple, glabrous. *Achenes* fusiform, *ca.* 3 mm long, 10-ribbed, glabrous, carpopodium absent. *Pappus* bristles, 2-seriate, the inner ones *ca.* 5 mm long.

Thailand.– NORTHERN: Tak; SOUTH-WESTERN: Kanchanaburi.

Distribution.– Endemic to Thailand.

Ecology.– Limestone mountain, alt. 700 – 900 m; flowering November to December.

Note.– *V. pseudobirmanica* differs from *V. birmanica* by its smaller capitula with approximately 20 florets. Its phyllaries margins are filiferous and the outer surfaces are nearly glabrous.

Specimens examined.– *K. Larsen* 8794 (E, K), 8890 (K); *C. Phengklai* 346 (K); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahara & T. Santisuk* T-18505-bis (KYO); *C.F. van Beusekom, C. Phengklai, R. Geesink & B. Wongwan* 3746 (BKF, K, L, P).

6. Vernonia pulicarioides Gagnep., Fl. Indo-Chine 3: 482. 1924. Type: Annam (not located). Figures 2.57, 2.83 A. & B.

Pulicaria annamica Gagnep., Bull. Soc. Bot France. 68: 121. 1921.

Perennial herbs, 20 – 40 cm tall. *Stem* erect, conspicuously ribbed, villose. *Leaves* 5 – 10 by 1.5 – 2 cm, oblong or oblanceolate, margins subentire, apex acute or truncate, base cuneate, subcoriaceous; upper surface scabrous without glands; lower surface scabrous with whip-shaped hairs and capitate glands; lateral veins 4 – 8-paired; petioles sessile. *Capitulescences* terminal, solitary or few. *Capitula* hemispherical, 10 – 15 mm long, pedunculate. *Receptacle* glabrous. *Phyllaries* 5 – 6-seriate, imbricate, hemispherical, green or purple apically, 10 – 15 mm long, 10 – 15 mm diam., margins filiferous, outer surface sericeous without glands; the outer and the middle ones lanceolate, apex acuminate; the inner ones lanceolate, apex acuminate or aristate. *Florets ca.* 70, narrowly infundibular, purple, pubescent with hairs and glands; corolla tube 6 – 7 mm long; corolla lobes 2 – 2.5 mm long. *Anthers* 3.5 – 4 mm long, apical appendage acute, base acute. *Styles* purple, 6 – 6.5 mm long, branches 2 – 2.5 mm long, sweeping hairs on the outer surface reaching at style bifurcation. *Achenes* subterete, 2 – 2.5 mm long, inconspicuously ribbed, pubescent with densely twin hairs without glandss, carpopodium present. *Pappus* bristles, 2-seriate, the inner ones 8 – 9 mm long. *Pollen* lophate, without micropuncta.

Thailand.– NORTHERN: Mae Hong Son, Chiang Mai.

Distribution.– Myanmar, Thailand, Laos, Vietnam.

Ecology.– Evergreen forest, alt. 780 – 1600 m; flowering October to February.

Note.– This species is distinguished by having hemispherical capitula, sericeous phyllaries without glands and lophate pollen with small lacuna and indistinct apertures.

Specimens examined.– *P. Suksathan* 1932 (QBG).

8. Conclusion

8.1 Taxonomy and distribution

8.1.1 Subtribal classification

The tribe Vernonieae studying in Thailand consists of 16 genera and 48 species in five subtribes (Table 2.2). The subtribal classifications based on Robinson (1999b) are as follows:

Subtribe Centrapalinae H.Rob. Seven species of *Camchaya* and one variety: *C. gracilis, C. kampotensis, C. loloana, C. loloana* var. *mukdahanensis, C. pentagona, C. spinulifera, C. tenuiflora* and *Camchaya* sp.

Subtribe Elephantopinae Less. Two species of *Elephantopus* and one variety: *E. mollis, E. scaber, E. scaber* var. *penicillatus* and one species of *Pseudelphantopus*: *P. spicatus*.

Subtribe Erlangeinae H.Rob. Sixteen species of *Acilepis*, two *Cyanthillium* and one each of *Ethulia*, *Iodocephalopsis* and *Koyamasia*: *A. attenuata, A. chiangdaoensis, A. divergens, A. doichangensis, A. kingii, A. namnaoensis, A. ngaoensis, A. peguensis, A. principis, A. pseudosutepensis, A. saligna, A. silhetensis, A. squarrosa, A. sutepensis, A. tonkinensis, A. virgata, C. cinereum, C. hookerianum, E. conyzoides, I. eberhardtii* and *K. calcarea.*

Subtribe Gymnantheminae H.Rob. Three species of *Decaneuropsis*: *D. cumingiana, D. eberhardtii* and *D. garrettiana*; two each of *Monosis* and *Strobocalyx*: *M. parishii, M. volkameriifolia, S. arborea* and *S. solanifolia,* and one each of *Gymnanthemum* and *Tarlmounia*: *G. cylindriceps* and *T. elliptica.*

Subtribe Vernoniinae Cass. ex Dumort. One species, *Sparganophoros sparganophora.*

Uncertain species; the remaining seven taxa are unrevised and therefore can not be placed into any of the known subtribes of Robinson (1999b). These are *Kuerziella gymnoclada, Vernonia birmanica, V. cinerea* var. *montana, V. curtisii, V. curtisii* var. *tomentosa, V. pseudobirmanica* and *V. pulicarioides.*

8.1.2 Taxonomic notes

One of the species, *Camchaya gracilis,* is a new record for Thailand (Bunwong *et al.,* 2009). It is otherwise known elsewhere within Indo-China, (Gagnepain, 1924). Another species, *Pseudelephantopus spicatus*, is also newly reported from northern, northeastern and eastern Thailand in those provinces close to the Me Khong River. It is often found in open areas in dry dipterocarp forest or along the main rivers. In addition, this species has never been recorded in any of the neighboring countries, i.e., Myanmar, Cambodia and Laos except Java (Backer & Bakhuizen, 1965). There are 15 species of endemic Thai Vernonieae (Koyama, 1984, 1993, 1997, 1998, 2003, 2004, 2005). These are *Acilepis chiangdaoensis, A. doichangensis, A. namnaoensis, A. ngaoensis, A. principis, A. pseudosutepensis, A. sutepensis, Camchaya pentagona, C. spinulifera, C. tenuiflora, C.* sp., *Koyamasia calcarea, Vernonia curtisii* var. *tomentosa, V. kerii* and *V. pseudobirmanica.*Two new genera, *Iodocephalopsis* S.Bunwong & H.Rob. (Bunwong *et al.,* 2009), and *Kurziella* H.Rob. & S.Bunwong (Robinson *et al.,* 2010), are described as well as the transfer of *Iodocephalus gracilis* Gagnep. to *Camchaya gracilis* (Gagnep.) S.Bunwong & H.Rob.

The new taxa described by Bunwong and Robinson, and included in this treatment were originally described as species of *Iodocephalus* Gagnep. (Gagnepain, 1920). However, they are not congeneric as the type of the genus is here reduced to synonymy with *Camchaya* Gagnep. Hence the new combination *Camchaya gracilis* (Gagnep.) S.Bunwong & H.Rob. is proposed. A new genus, *Iodocephalopsis* S.Bunwong & H.Rob., was also established for the second species originally placed in *Iodocephalus*, with both *Iodocephalus glandulosus* Kerr and *Camchaya eberhardtii* (Gagnep.) Kitam. were placed in synonymy with the name *Iodocephalopsis eberhardtii* (Gagnep.) S. Bunwong & H. Rob. Additionally, a new genus, *Kurziella*, is named to accommodate in Myanmar and Thailand. *Vernonia gymnoclada* Coll. & Hemsl., a species often identified in herbaria as *Vernonia juncea* Kurz, nom. nud., is

reduced to a basionym of the new combination, *Kurziella gymnoclada* (Coll. & Hemsl.) H.Rob. & S.Bunwong (Robinson *et al.*, 2010).

8.1.3 Habitat and Distribution

The largest number of Vernonieae species in Thailand is found in the northern and northeastern parts of the country. Taxa are typically found in open areas within dipterocarp, deciduous, evergreen and pine-oak forests, from sea level to over 2,000 m (Figures 2.84–2.88). Five endemic taxa, *Acilepis pseudosutepensis, Koyamasia calcarea, Vernonia birmanica, V. curtisii* var. *tomentosa* and *V. pseudobirmanica*, are restricted to limestone rock in evergreen forests. Overall, the greatest numbers of endemic species are found across the Indo-Burma and Indo-China regions. A few, however, such as *Cyanthillium cinereum, Elephantopus scaber, E. mollis, Ethulia conyzoides, Pseudelephantopus spicatus, Sparganophoros sparganophora* are found widely throughout the tropics. Only five other species are also widespread and they are found distributed through Malay Peninsula. These are *Cyanthillium hookerianum, Decaneuropsis cumingiana, Strobocalyx arborea, Vernonia cinerea* var. *montana* and *V. curtisii.*

8.2 Key characters

8.2.1 Habit. Thai Vernonieae includes annual and perennial herbs, scandent and upright shrubs and trees. *Acilepis, Camchaya, Cyanthillium, Elephantopus, Ethulia, Iodocephalopsis, Koyamasia, Kurziella and Sparganophoros* are herbaceous while *Gymnanthemum, Monosis* and *Strobocalyx* are upright shrubs and trees. The scandent habit is found in *Decaneuropsis* and one species each in *Strobocalyx* and *Tarlmounia*. These differences are useful in broad generic separations, particularly at the subtribal level.

8.2.2 Leaves. Diverse in shape, texture, indumentum and length of petiole, leaves offer some of the most useful taxonomic characters. Among these is the chartaceous versus subcoriaceous character of the leaves, the latter particularly common in *Monosis, Strobocalyx, Decaneuropsis, Tarlmounia* and some species of *Acilepis.* This character also seems to be related to the woody habit of these taxa. Trichome type, combinations and density are also informative at both the genus and species levels. The six types of trichomes found on Thai Vernonieae leaves are:

whip-shape (Figures 2.3, 2.4A), cylindric (Figures 2.4, 2.5A), T-shaped (Figures 2.5B, 2.6), flagellate (Figures 2.7, 2.8), filiform (Figures 2.9) and capitate gland. Whip-shaped hairs are common in many taxa, but T-shaped hairs are restricted to *Camchaya*, *Cyanthillium* and *Tarlmounia*. Flagellate trichomes, on the other hand, are restricted to *Acilepis attenuata, A. pseudosutepensis, Monosis* spp. and *Strobocalyx solanifolia* and cylindrical hairs are present only in *Iodocephalopsis* and *Acilepis saligna.* Similarly, filiform hairs are unique to *Elephantopus* spp. among Thai Vernonieae. The amount of tomentum can also be diagnostic as only a few taxa are densely pilose, villose or tomentose, i.e., *Decaneuropsis cumingiana, Elephantopus* spp., *Monosis parishii, Strobocalyx solanifolia, Tarlmounia elliptica, Vernonia cinerea* var. *montana* and *V. curtisii* var. *tomentosa.*

8.2.3 Capitulescence. These are terminal or found in the axils of leaves, characteristic placements found throughout the tribe. However, the differences among genera allow this feature to be useful in separating taxa. The simplest arrangement is a cymose branch which can form compound cymiform (*Acilepis* and *Camchaya*), corymbiform (*Iodocephalopsis* and *Gymnanthemum*), paniculate (*Monosis*) inflorescences while others may reduced to solitary capitula, i.e. *Acilepis squarrosa.* Added to other reproductive characters capitulesence can provide sufficient information to discriminate between individual species.

8.2.4 Phyllaries. The apex of the phyllaries is reflexed only in *Acilepis attenuata*, *A. silhetensis*, *Koyamasia calcarea* and *Vernonia curtisii,* making this character while not widely applicable, a good discriminator for specific taxa. Phyllary seriate, on the other hand is largely useful in distinguishing *Elephantopus and Pseudelephantopus* from all other genera. In the former genus there are two distichous seriate while in the others they are imbricate in several to many seriate. Tomentum and shape are also variable, but must be used in combination with other characters to distinguish one taxon from the next.

8.2.5 Florets. The number of florets varies from as few as four to >100 correlated with this is the gradually increasing size of the capitulum. If there are a small number of florets, the capitulum is usually small and narrow. Conversely, a large number of florets occur in large, broad campanulate or globose shaped capitula.

Pink and purple florets dominate in the Thai Vernonieae, with only *Elelphantopus mollis* and *Pseudelephantopus spicatus* having white florets.

8.2.6 Achenes. Rib numbes is a significant character for separating taxa. For example, 10-ribbed achenes are the most common. Those few species with a lower number, i.e., *Camchaya gracilis*, *C. pentagona, Ethulia conyzoides, Sparganophoros sparganophora* and *Strobocalyx arborea* can be easily separated from all others and then distinguished from each other on the basis of other characters such as tomentum and capitulescence morphology. Usually the achene surfaces are also differentiated and these differences can be used to separate taxa. Glabrous achenes are found only *Camchaya* and *Koyamasia calcarea,* for example. Additionally, the carpopodium is important for generic classification. It is prominent in *Acilepis* (Figure 2.10), *Cyanthillium* (Figures 2.11G.-H.), *Decaneuropsis* (Figures 2.12 A.-C.), *Elephantopus* (Figures 2.12 D.-E.), *Gymnanthemum* (Figure 2.12 F.), *Kurziella* (Figure 2.13 A.), *Monosis* (Figures 2.13 B.-C.), *Pseudelephantopus* and *Tarlmounia* (Figure 2.13 F.), but it is inconspicuous in *Camchaya* (Figures 2.11 A.-F.), *Ethulia, Iodocephalopsis* (Figure 2.12 G.), *Koyamasia* (Figure 2.12 H.) and *Sparganophoros* (Figure 2.13 D.).

8.2.7 Pappus. Typically the pappus is formed of bristles in one or two seriate, the exception being *Sparganophoros* with a coroniform pappus. When there is a double seriate the outer one is shorter than the inner one and is typically more likely to be deciduous than the inner one. A single seriate pappus is known only from *Camchaya, Cyanthillium hookerianum, Elephantopus, Koyamasia, Kurziella, Pseudelephantopus, Sparganophoros* and *Vernonia curtisii.*

8.2.8 Pollen morphology. Thai Vernonieae have pollen of four main types; 1) echinate or subechinolophate 3-colporate, 2) lophate 3-colporate, 3) lophate 3-porate and 4) lophate 6-porate pollen (Figures 2.14, 2.15). Echinate or subechinolophate 3-colporate pollen (Figure 2.15 D.) is characteristic of woody taxa such as *Decaneuropsis*, *Strobocalyx* and *Tarlmounia.* The similarly woody *Monosis* has lophate 3-colporate pollen. The 3-porate pollens (Figures 2.14 A.-F.; 2.15 A., C., E.) are found in most annual other genera except for *Camchaya* which have distinct 6-porate pollen (Figure 2.15 B). These pollen morphologies correlate well with other characters that distinguish genera and species from each other.

Table 2.2 Ecological and distributional data of Thai Vernonieae. Key to abbreviations; 1. Endemic to Thailand, 2. Pantropics, 3. China and Japan, 4. India and Myanmar, 5. Indo-China, 6. Peninsular Malay, 7. Top of Limstone moutain, 8. Open area, dipterocarp or deciduous forest, 9. Evergreen forest, 10. Pine-oak forest, N. Northern, NE. North-eastern, E. Eastern, SW. South-western, C. Central, SE. South-eastern and PEN. Peninsular.

Current taxon	Geographical distribution						Flowering period	Ecology				Altitude (m)	Distribution in Thailand						
	1	2	3	4	5	6		7	8	9	10		N	NE	E	SW	C	SE	PEN
Acilepis attenuata	-	-	-	√	-	-	Oct - Feb	-	√	√	-	50 – 780	√	√	-	√	-	-	√
A. chiangdaoensis	√	-	-	-	-	-	Dec - Feb	-	√	-	√	600 – 800	√	-	-	-	-	-	-
A. divergens	-	-	√	√	√	-	Oct - Apr	-	√	√	-	300 – 1850	√	√	-	√	-	-	-
A. doichangensis	√	-	-	-	-	-	Sep - Jan	-	-	√	-	1000 – 1300	√	-	-	-	-	-	-
A. kingii	-	-	√	√	√	-	Jan - Mar	-	-	√	√	1000 – 1800	√	-	-	-	-	-	-
A. namnaoensis	√	-	-	-	-	-	Nov - Dec	-	√	√	-	*ca.* 800	-	√	√	-	-	-	-
A. ngaoensis	√	-	-	-	-	-	Dec - Jan	-	√	-	-	*ca.* 100	-	-	-	-	-	-	√
A. peguensis	-	-	-	√	√	-	Nov - Dec	-	√	√	-	*ca.* 800	-	√	-	-	-	-	-
A. principis	√	-	-	-	-	-	Dec - Mar	-	-	√	-	600 – 1400	√	-	-	-	-	-	-
A. pseudosutepensis	√	-	-	-	-	-	Dec - Feb	√	-	√	-	200 – 400	√	-	-	√	-	-	-
A. saligna	-	-	√	√	√	-	Nov - Dec	-	-	-	√	1100 – 1400	√	-	-	-	-	-	-
A. silhetensis	-	-	√	√	√	-	Aug - Jan	-	√	-	√	700 – 1350	√	√	-	-	-	-	-

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Current taxon	Geographical distribution						Flowering period	Ecology				Altitude (m)	Distribution in Thailand						
	1	2	3	4	5	6		7	8	9	10		N	NE	E	SW	C	SE	PEN
A. squarrosa	-	-	√	√	√	-	Sep - May	-	√	√	√	10 – 1200	√	√	√	√	√	√	-
A. sutepensis	√	-	-	-	-	-	Nov - Mar	-	-	√	√	1100 – 1500	√	-	-	-	-	-	-
A. tonkinensis	-	-	-	-	√	-	Jan - Feb	-	√	-	-	930 – 1200	√	-	-	-	-	-	-
A. virgata	-	-	-	-	√	-	Mar	-	-	√	-	*ca.* 180	-	-	-	-	-	-	√
Camchaya gracilis	-	-	-	-	√	-	Oct - Dec	-	√	-	-	*ca.* 150	-	-	√	-	-	-	-
C. kampotensis	-	-	-	-	√	-	Dec	-	-	√	-	700 – 900	-	-	-	√	-	-	-
C. loloana	-	-	√	-	√	-	Jul - Dec	√	√	√	√	400 – 1500	√	√	√	√	√	-	-
C. loloana var. *mukdahanensis*	-	-	-	-	√	-	Aug - Jan	-	√	-	-	250 – 400	-	√	√	-	-	-	-
C. pentagona	√	-	-	-	-	-	Oct - Dec	-	√	-	-	220 – 300	-	-	√	-	-	-	-
C. spinulifera	√	-	-	-	-	-	Sep - Dec	-	√	-	-	200 – 300	-	√	√	-	-	-	-
C. tenuiflora	√	-	-	-	-	-	Oct - Dec	-	-	√	-	*ca.* 700	√	√	√	-	-	-	-
C. sp.	√	-	-	-	-	-	Nov - Dec	-	√	-	-	*ca.* 300	-	√	-	-	-	-	-

Table 2.2 Ecological and distributional data of Thai Vernonieae. Key to abbreviations; 1. Endemic to Thailand, 2. Pantropics, 3. China and Japan, 4. India and Myanmar, 5. Indo-China, 6. Peninsular Malay, 7. Top of Limstone moutain, 8. Open area, dipterocarp or deciduous forest, 9. Evergreen forest, 10. Pine-oak forest, N. Northern, NE. North-eastern, E. Eastern, SW. South-western, C. Central, SE. South-eastern and PEN. Peninsular. (Cont.)

Current taxon	Geographical distribution						Flowering period	Ecology				Altitude (m)	Distribution in Thailand						
	1	2	3	4	5	6		7	8	9	10		N	NE	E	SW	C	SE	PEN
Cyanthillium cinereum	-	√	-	-	-	-	Jan - Dec	-	√	√	-	0 – 250	√	√	√	√	√	-	√
C. hookerianum	-	-	√	√	√	√	Aug - Feb	-	-	√	-	0 – 100	√	√	√	-	√	√	√
Decaneuropsis cumingiana	-	-	√	√	√	√	Nov - Apr	-	-	√	√	200 – 850	√	√	-	√	√	-	√
D. eberhardtii	-	-	-	-	√	-	Dec - Feb	-	-	√	-	500 – 800	√	√	√	√	-	-	-
D. garrettiana	-	-	-	√	-	-	Nov - Feb	-	√	√	√	400 – 800	√	-	-	√	-	-	-
Elephantopus mollis	-	√	-	-	-	-	Oct - Dec	-	-	√	-	0 – 100	-	-	√	-	-	-	√
E. scaber	-	√	-	-	-	-	Aug - Jan	-	√	√	√	0 – 400	√	√	√	√	-	√	√
E. scaber var. *penicillatus*	-	-	-	-	√	-	Aug - Jan	-	√	√	-	100 – 400	-	√	√	-	-	√	-
Ethulia conyzoides	-	√	-	-	-	-	May - Sep	-	-	√	-	200 – 400	√	√	-	-	-	-	-
Gymnanthemum cylindriceps	-	-	√	√	-	-	Dec - Apr	-	-	√	√	1000 – 2000	√	-	-	-	-	-	-
Iodocephalopsis eberhardtii	-	-	-	-	√	-	Aug - Dec	-	-	√	√	700 – 1700	√	√	√	√	√	-	-
Koyamasia calcarea	√	-	-	-	-	-	Oct - Dec	√	-	-	-	*ca.* 1300	√	-	-	-	-	-	-

Table 2.2 Ecological and distributional data of Thai Vernonieae. Key to abbreviations; 1. Endemic to Thailand, 2. Pantropics, 3. China and Japan, 4. India and Myanmar, 5. Indo-China, 6. Peninsular Malay, 7. Top of Limstone moutain, 8. Open area, dipterocarp or deciduous forest, 9. Evergreen forest, 10. Pine-oak forest, N. Northern, NE. North-eastern, E. Eastern, SW. South-western, C. Central, SE. South-eastern and PEN. Peninsular. (Cont.)

Current taxon	Geographical distribution						Flowering period	ecology				Altitude (m)	Distribution in Thailand						
	1	2	3	4	5	6		7	8	9	10		N	NE	E	SW	C	SE	PEN
Kurziella gymnoclada	-	-	-	√	-	-	Nov - Mar	-	√	-	-	40 – 200	√	-	√	√	√	-	-
Monosis parishii	-	-	√	√	√	-	Dec - Apr	-	-	√	√	250 – 800	√	-	-	√	-	-	-
M. volkameriifolia	-	-	√	√	√	-	Nov - Mar	-	-	√	√	500 – 1750	√	-	-	-	-	-	-
Pseudelephantopus spicatus	-	√	-	-	-	-	Oct - Dec	-	√	-	-	100 – 400	√	√	√	-	-	-	-
Sparganophoros sparganophora	-	√	-	-	-	-	Aug - Apr	-	√	√	-	50 – 400	√	√	-	√	√	-	√
Strobocalyx arborea	-	-	√	√	√	√	July - Feb	-	-	√	-	50 – 300	√	√	-	-	-	-	√
S. solanifolia	-	-	√	√	√	-	Feb - May	-	-	√	√	900 – 1250	√	√	√	√	√	-	-
Tarlmounia elliptica	-	√	-	-	-	-	Oct - May	-	√	-	-	0 – 100	√	√	√	√	√	√	√
Vernonia birmanica	-	-	-	√	-	-	Sep - Dec	√	-	-	-	650 – 1000	√	-	-	√	-	-	-
V. cinerea var. *montana*	-	-	-	-	√	√	Oct - Mar	-	-	√	√	500 – 1000	√	√	√	-	-	-	-
V. curtisii	-	-	-	√	√	√	Nov - Apr	√	-	-	-	100 – 500	√	√	-	√	√	-	√
V. curtisii var. *tomentosa*	√	-	-	-	-	-	Jun - Aug	√	-	-	-	200 – 1600	√	-	-	√	-	-	-

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Current taxon	Geographical distribution						Flowering period	ecology				Altitude (m)	Distribution in Thailand						
	1	2	3	4	5	6		7	8	9	10		N	NE	E	SW	C	SE	PEN
V. kerii	√	-	-	-	-	-	Feb	-	-	√	-	700 – 1400	√	-	-	-	-	-	-
V. pseudobirmanica	√	-	-	-	-	-	Nov - Dec	√	-	-	-	700 – 900	√	-	-	√	-	-	-
V. pulicarioides	-	-	-	√	√	-	Oct - Feb	-	-	√	-	780 – 1600	√	-	-	-	-	-	-

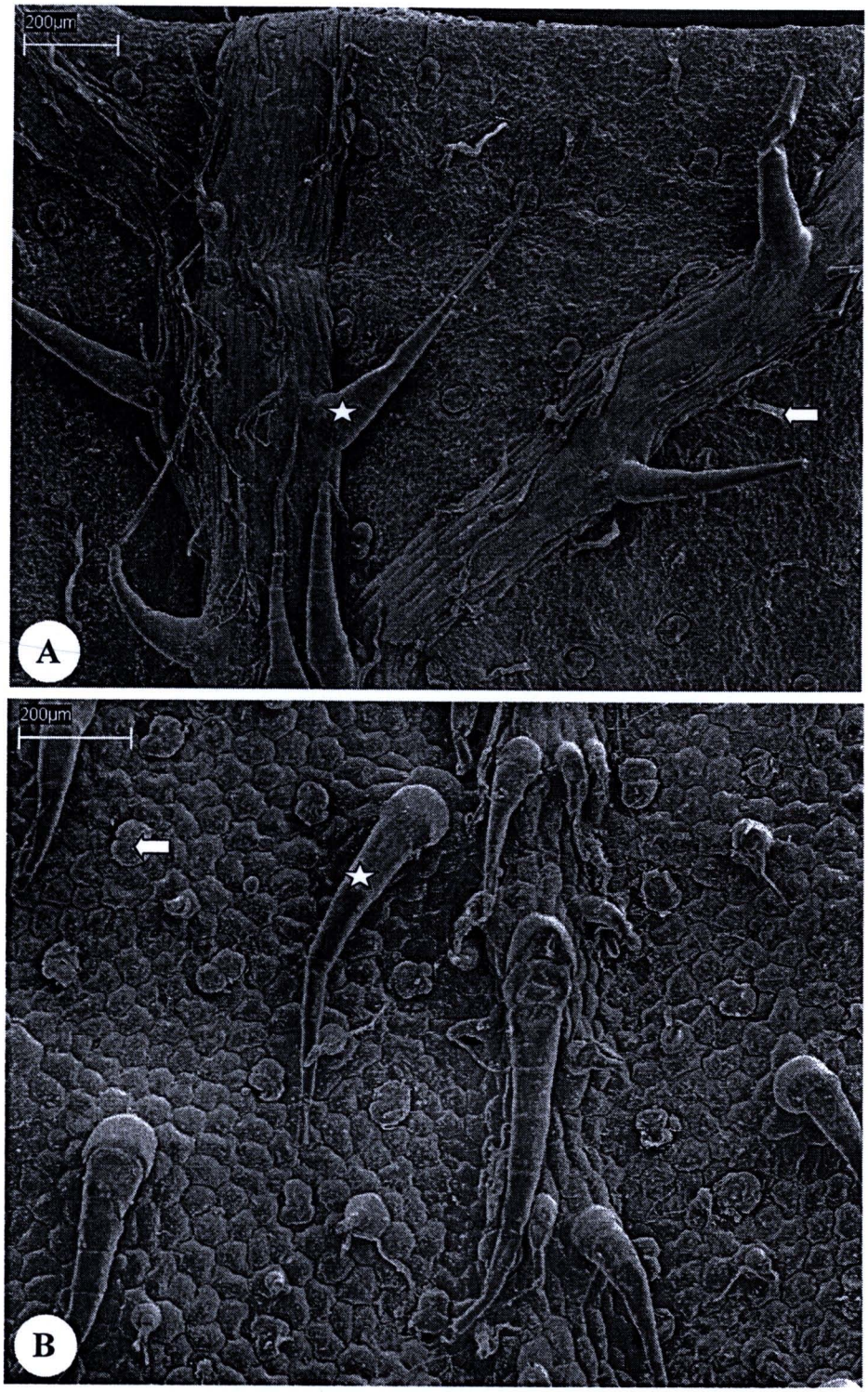


Figure 2.3 Scanning electron micrographs of leaf surfaces of *Camchaya*.

A. Whip-shaped hairs (star), cylindrical hairs (arrow) and capitate glands of *C. loloana* var. *mukdahanensis*.

B. Whip-shaped hairs (star) and capitate glands (arrow) of *Camchaya* sp.

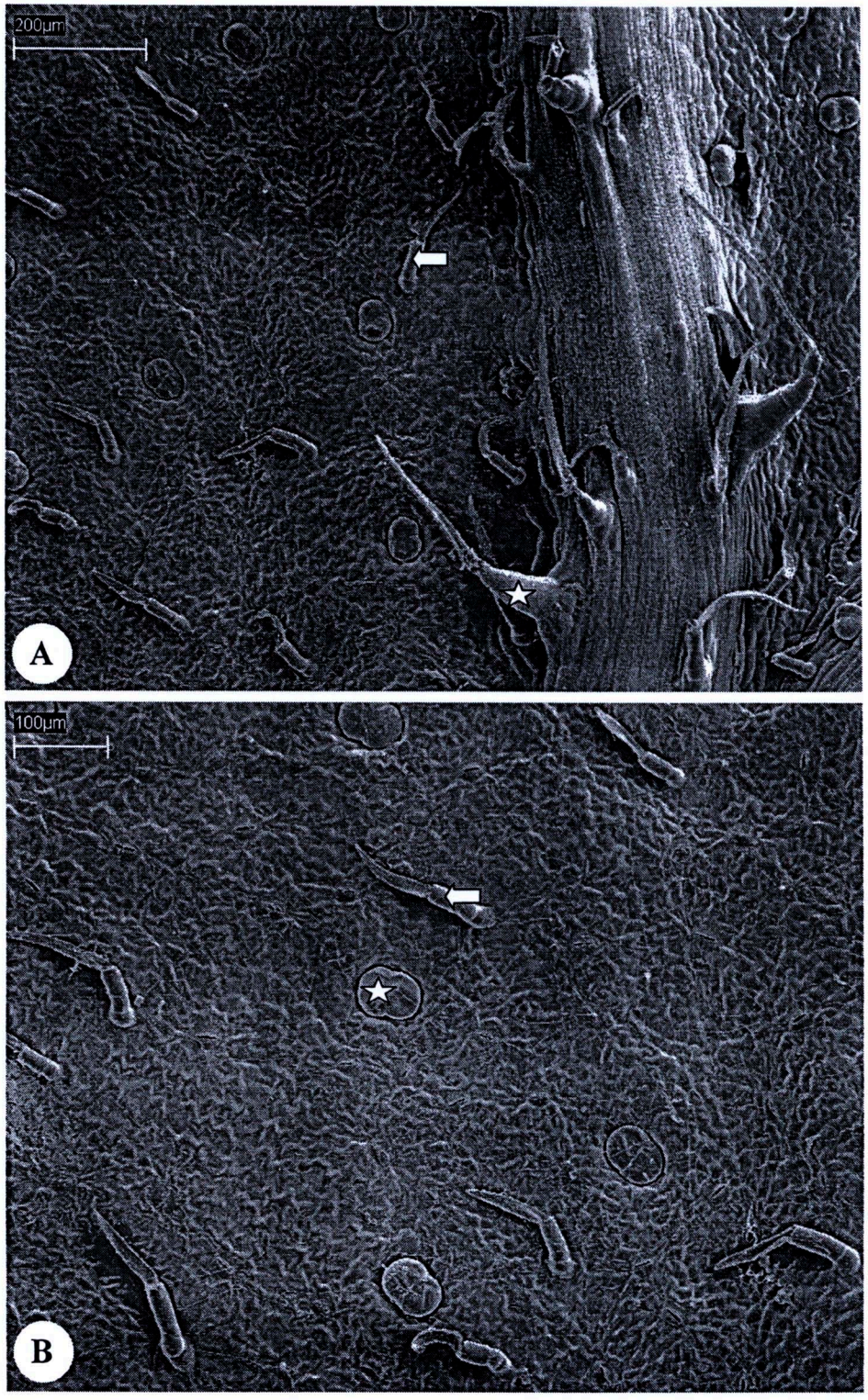


Figure 2.4 Scanning electron micrographs of leaf surfaces of *Iodocephalopsis*.

A. Whip-shaped hairs (star), cylindrical hairs (arrow) and capitate glands of *I. eberhardtii*

B. Cylindrical hairs (arrow) and capitate glands (star) of *I. eberhardtii.*

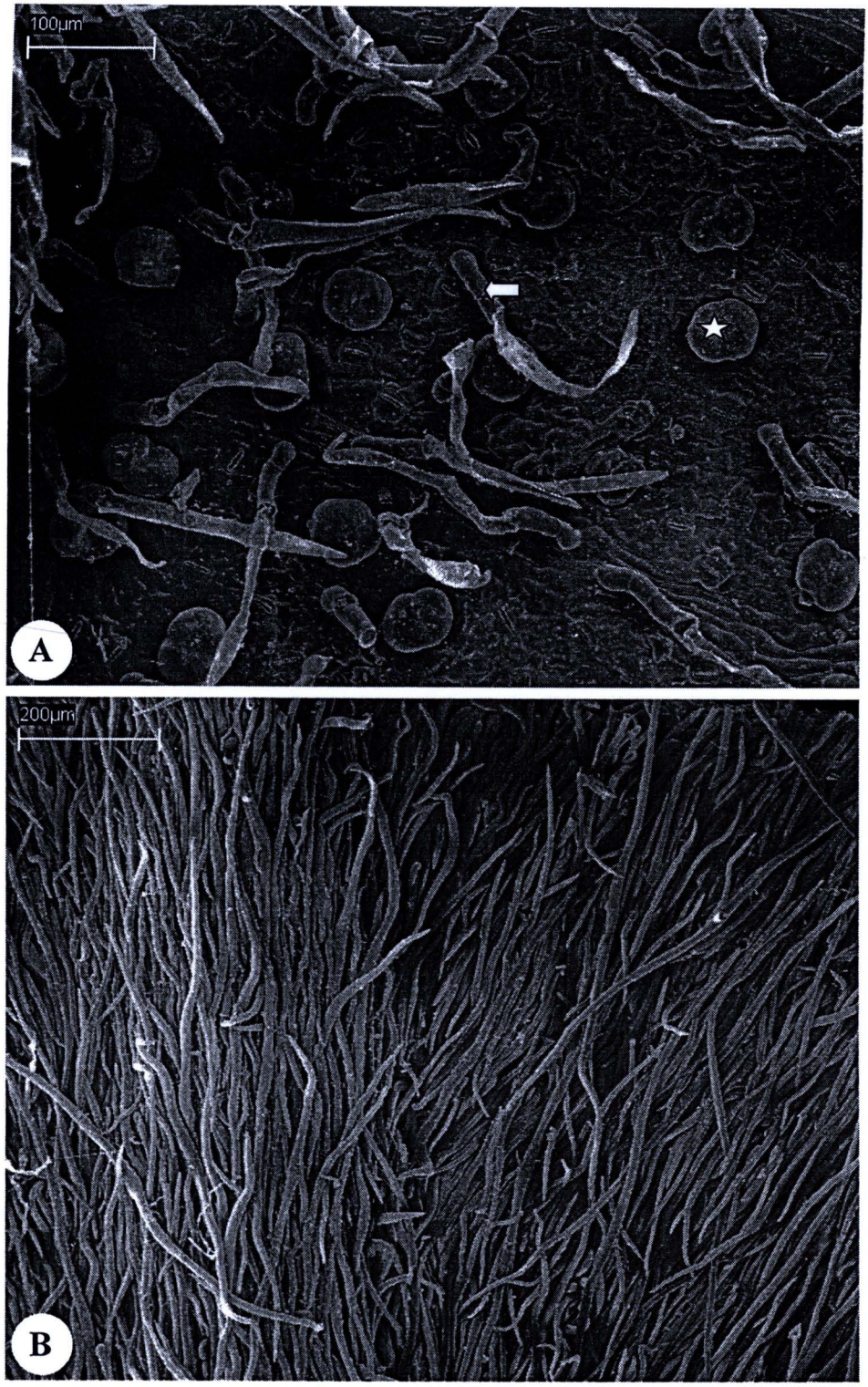


Figure 2.5 Scanning electron micrographs of leaf surfaces of *Acilepis* and *Tarlmounia.*

A. Cylindrical hairs (arrow) and capitate glands (star) of *A. saligna.*

B. T-shaped hairs of *Tarlmounia elliptica.*

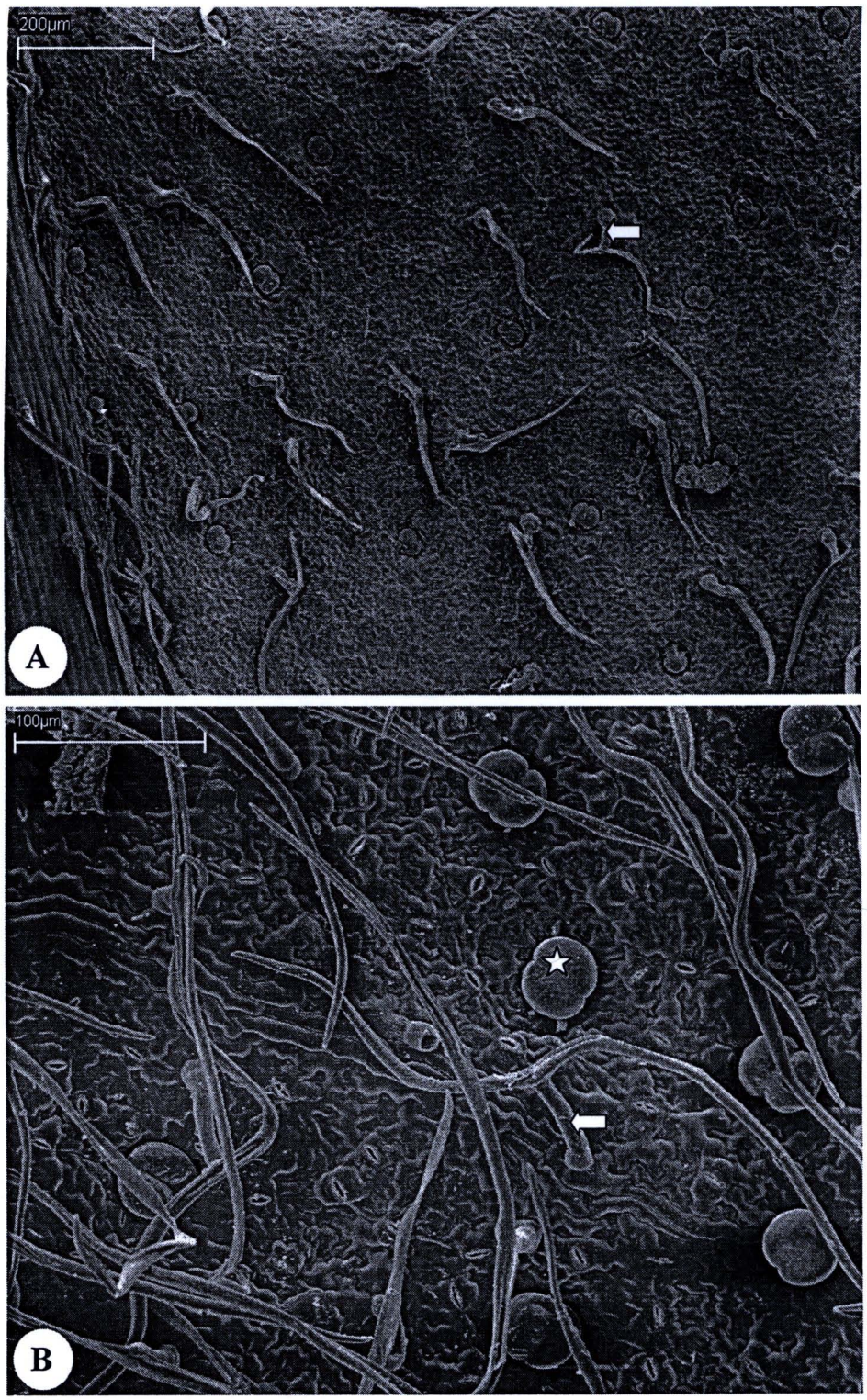


Figure 2.6 Scanning electron micrographs of leaf surfaces of *Cyanthillium*.

A. T-shaped hairs (arrow) and capitate glands of *C. cinereum*.

B. T-shaped hairs (arrow) and capitate glands (star) of *C. hookerianum*.

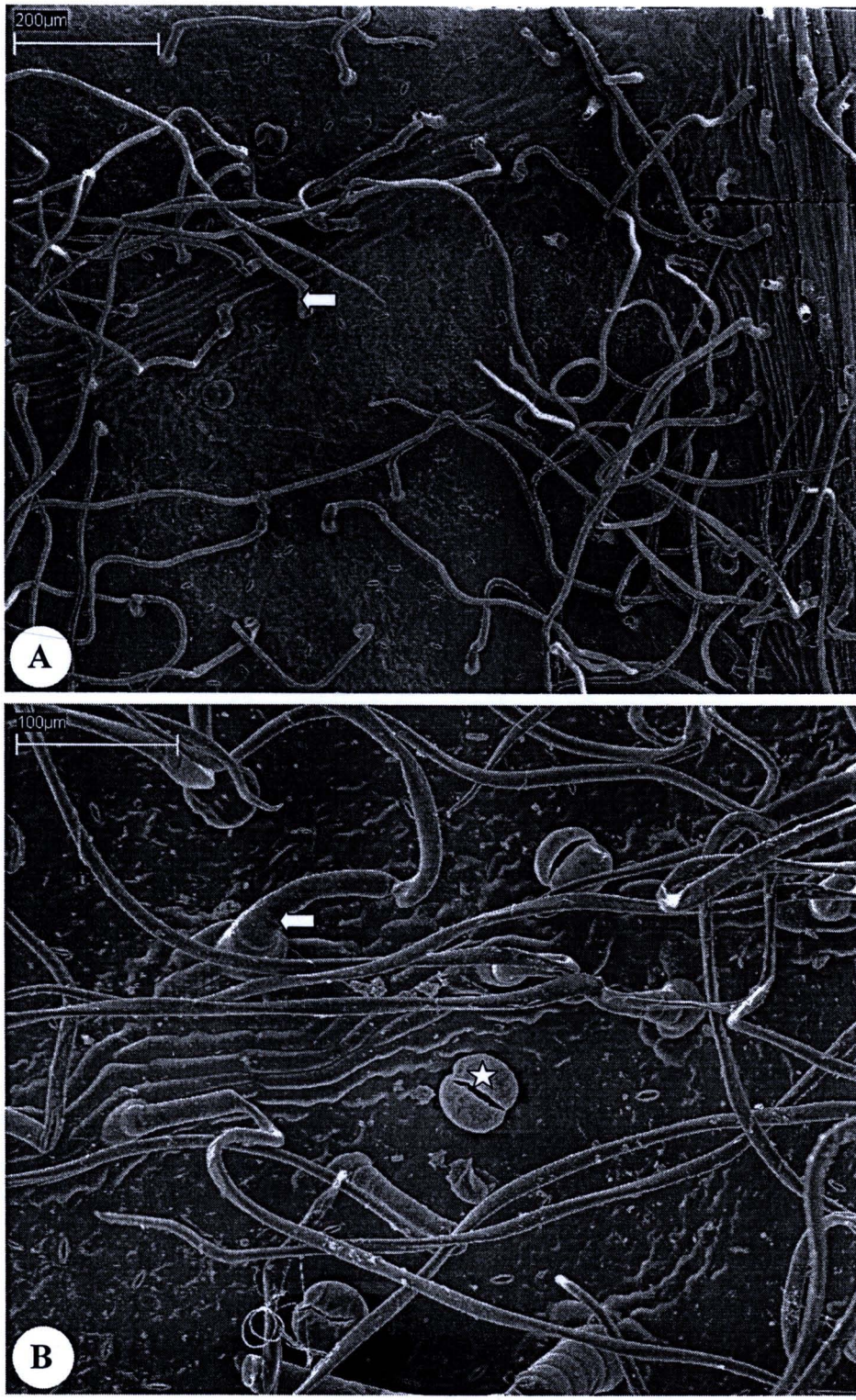


Figure 2.7 Scanning electron micrographs of leaf surfaces of *Acilepis*.

A. Flagellate hairs (arrow) and capitate glands of *A. attenuata*.

B. Flagellate hairs (arrow) and capitate glands (star) of *A. pseudosutepensis*.

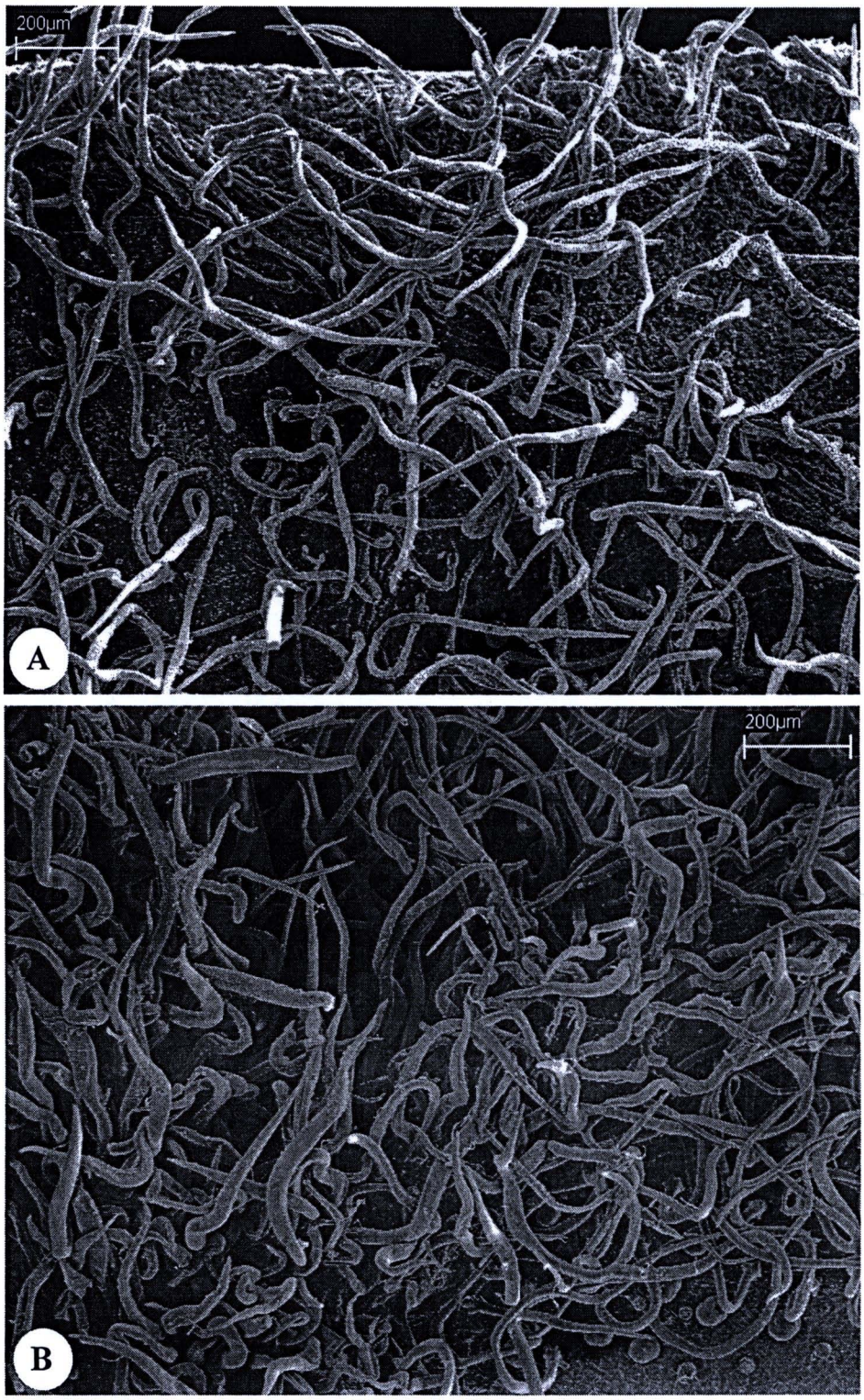


Figure 2.8 Scanning electron micrographs of leaf surfaces of *Monosis* and *Strobocalyx*.

A. Flagellate hairs and capitate glands of *M. parishii.*

B. Flagellate hairs and capitate glands of *S. solanifolia.*

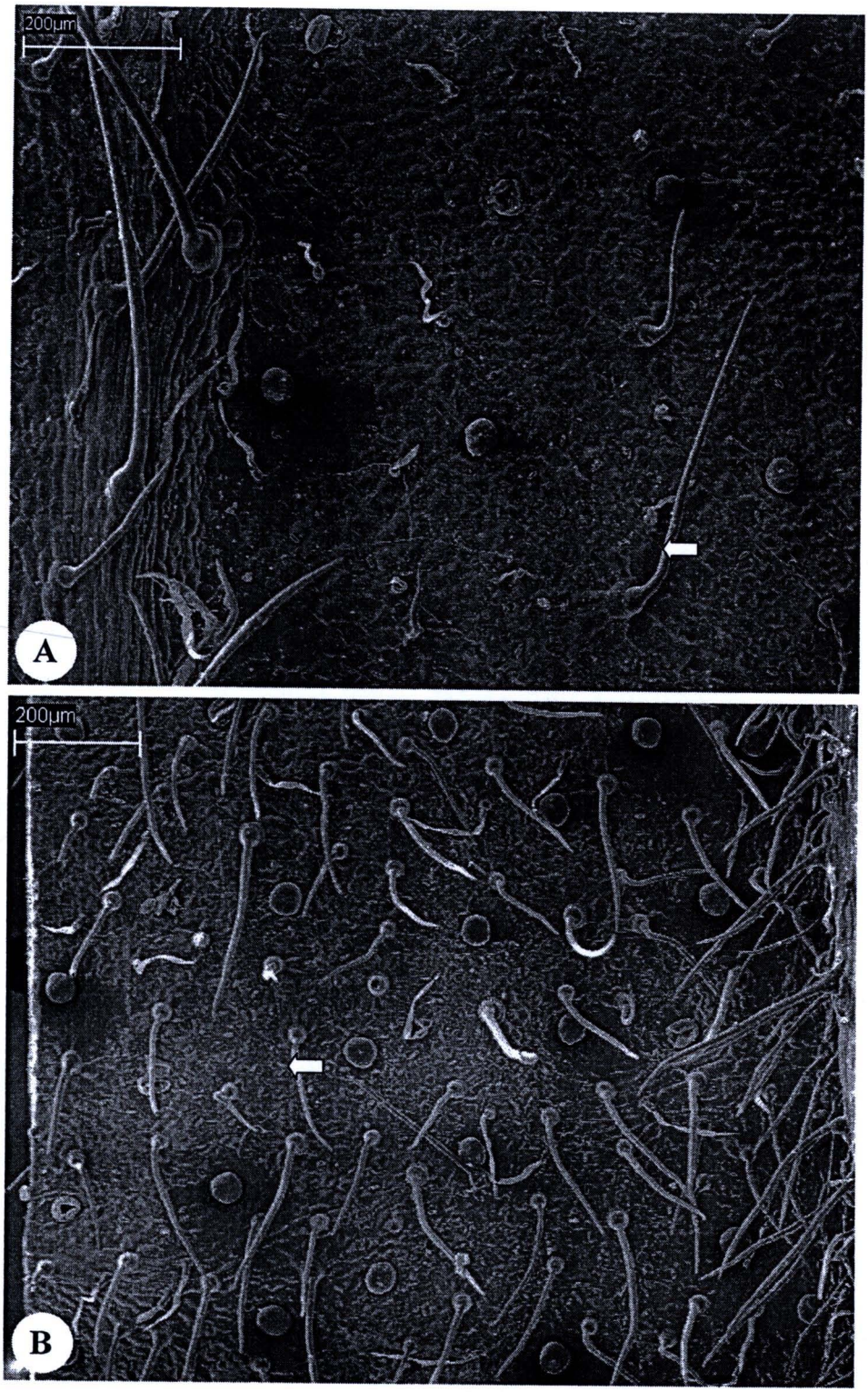


Figure 2.9 Scanning electron micrographs of leaf surfaces of *Elephantopus.* **A. & B.** Filiform hairs (arrow), cylindrical hairs and capitate glands of *E. mollis.*

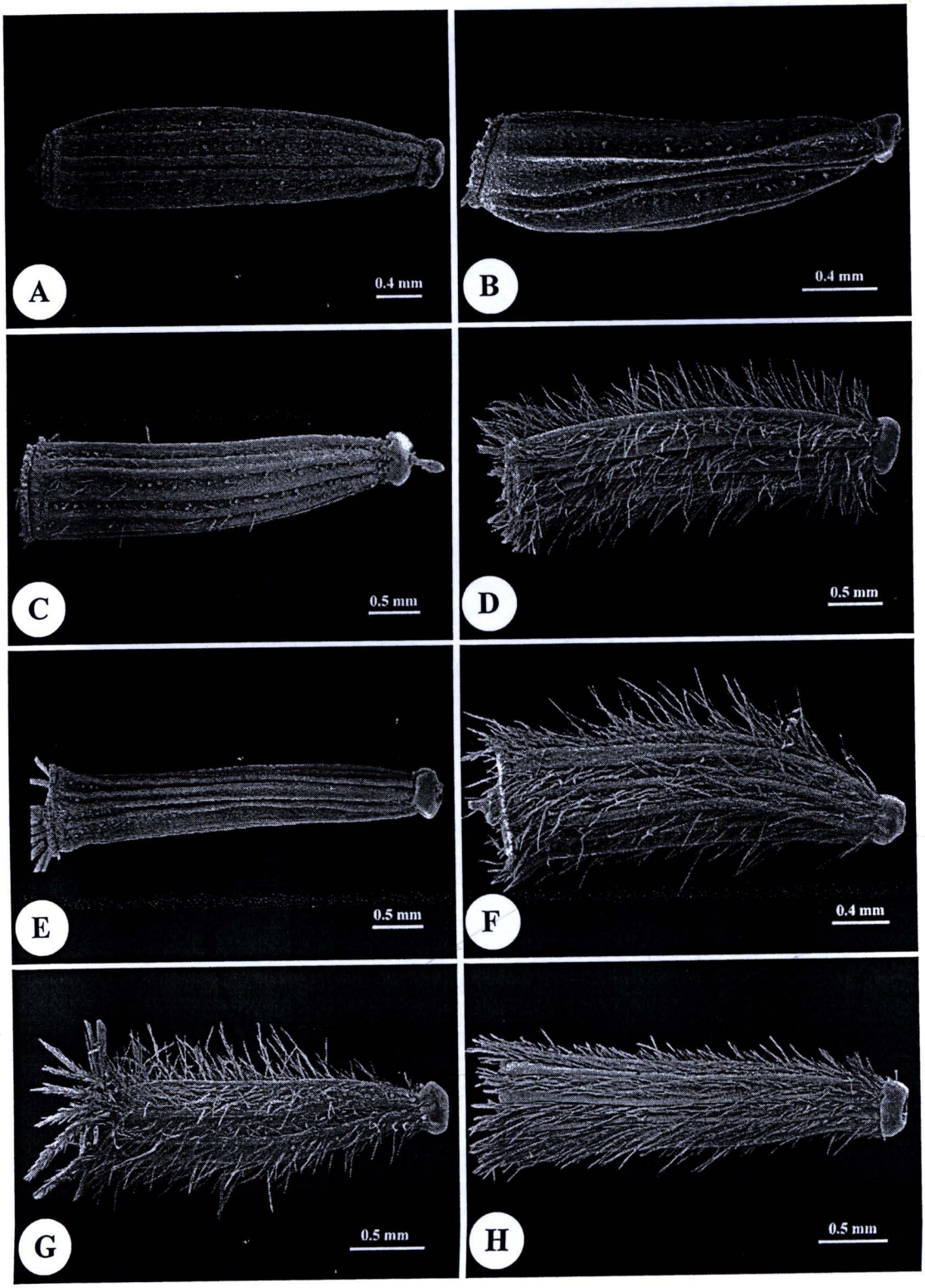


Figure 2.10 Achenes of *Acilepis*
A. *A. chiangdaoensis* **B.** *A. divergens* **C.** *A. namnaoensis*
D. *A. ngaoensis* **E.** *A. peguensis* **F.** *A. principis*
G. *A. pseudosutepensis* **H.** *A. squarrosa*

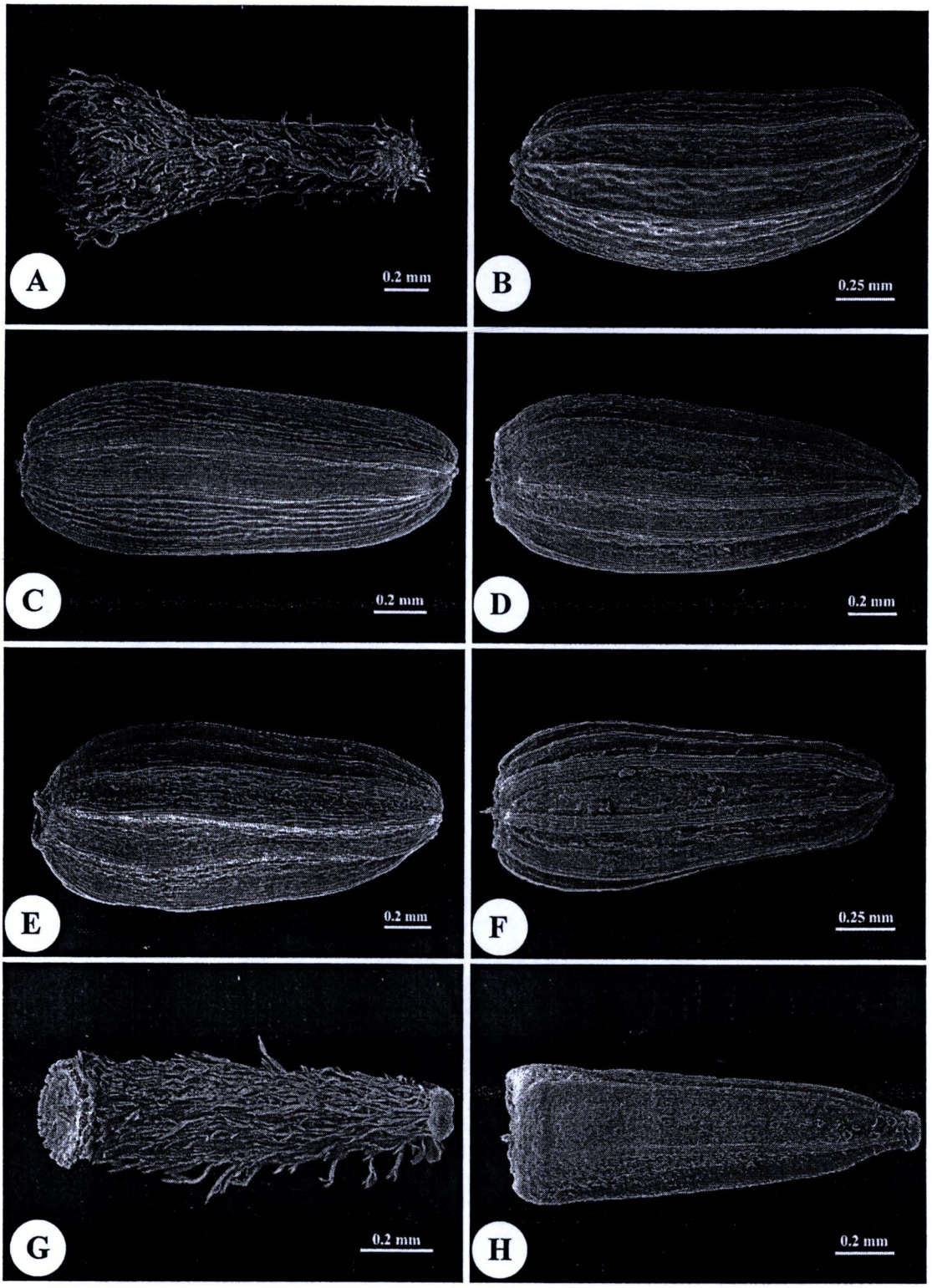


Figure 2.11 Achenes of *Camchaya* and *Cyanthillium*
A. *C. gracilis* **B.** *C. loloana* **C.** *C. pentagona*
D. *C. spinulifera* **E.** *C. tenuiflora* **F.** *Camchaya* sp.
G. *Cyanthillium cinereum* **H.** *Cyanthillium hookerianum*

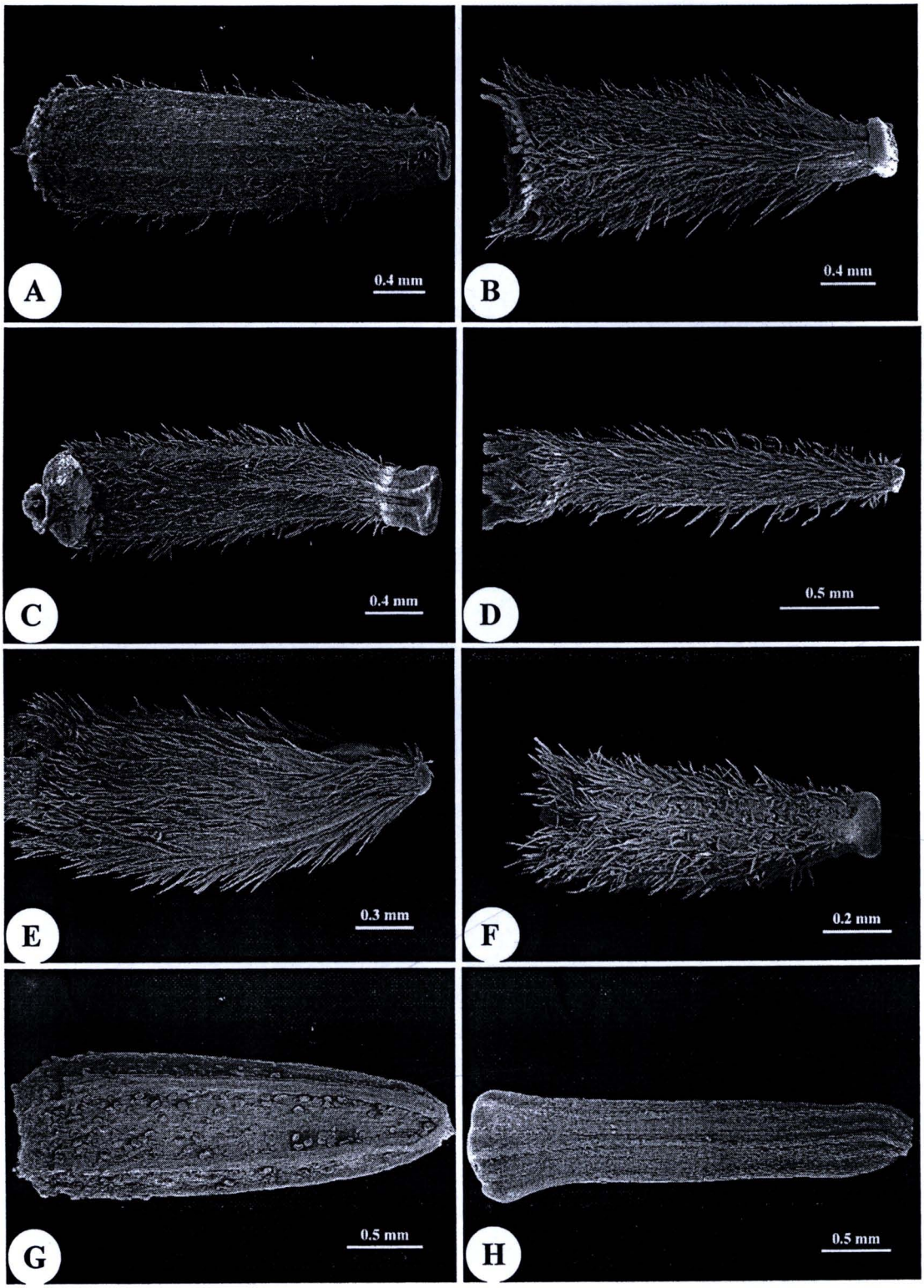


Figure 2.12 Achenes of *Decaneuropsis, Elephantopus, Gymnanthemum, Iodocephalopsis* and *Koyamasia.*

A. *D. cumingiana* **B.** *D. eberhardtii* **C.** *D. garrettiana*
D. *E. mollis* **E.** *E. scaber* var. *penicillatus*
F. *G. cylindriceps* **G.** *I. eberhardtii* **H.** *K. calcarea*

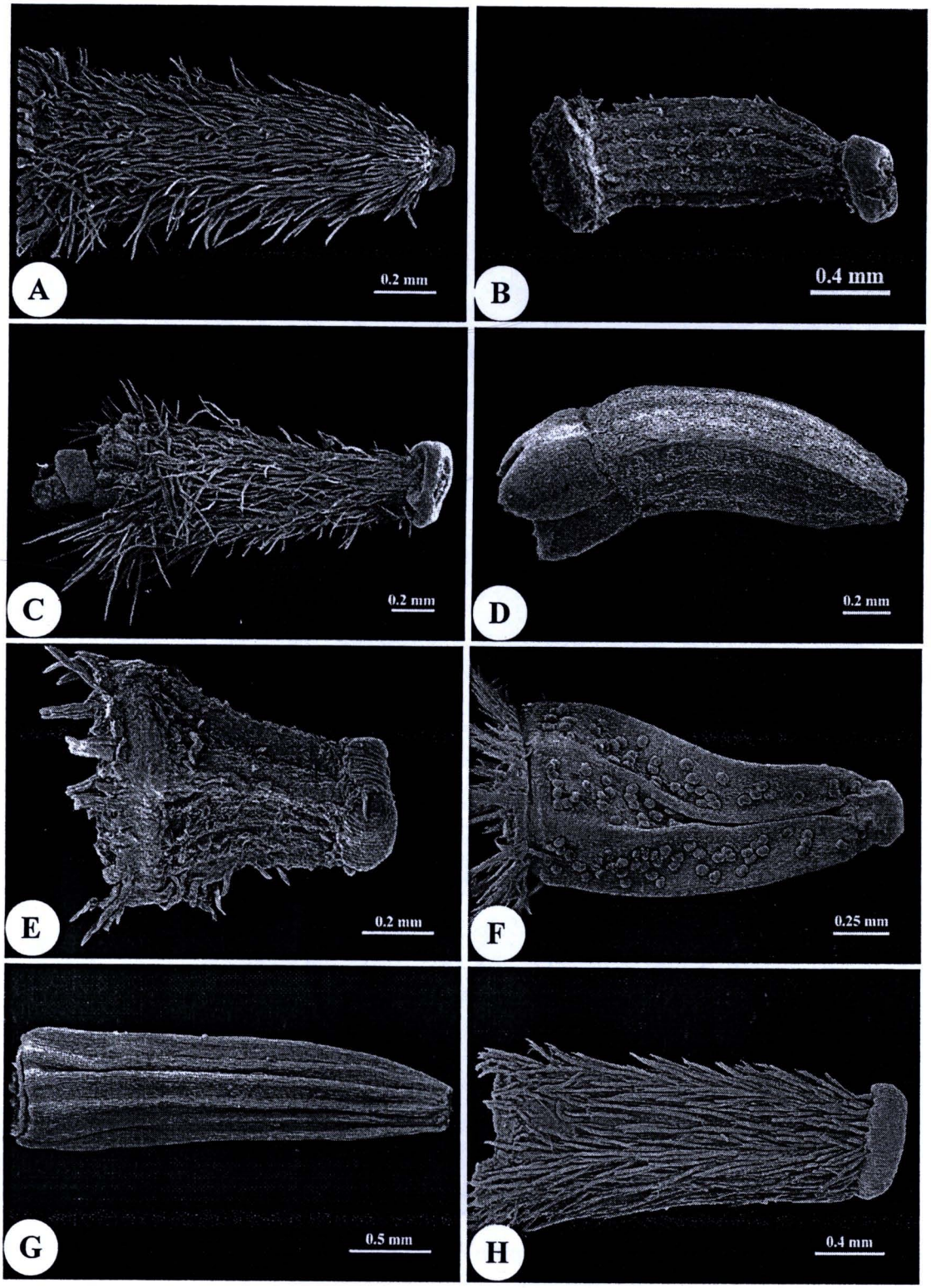


Figure 2.13 Achenes of *Kurziella, Monosis, Sparganophoros, Strobocalyx, Tarlmounia* and uncertain species.

A. *K. gymnoclada* **B.** *M. parishii* **C.** *M. volkameriifolia*
D. *Sparganophoros sparganophora* **E.** *Strobocalyx arborea*
F. *T. elliptica* **G.** *V. curtisii* **H.** *V. pulicarioides*

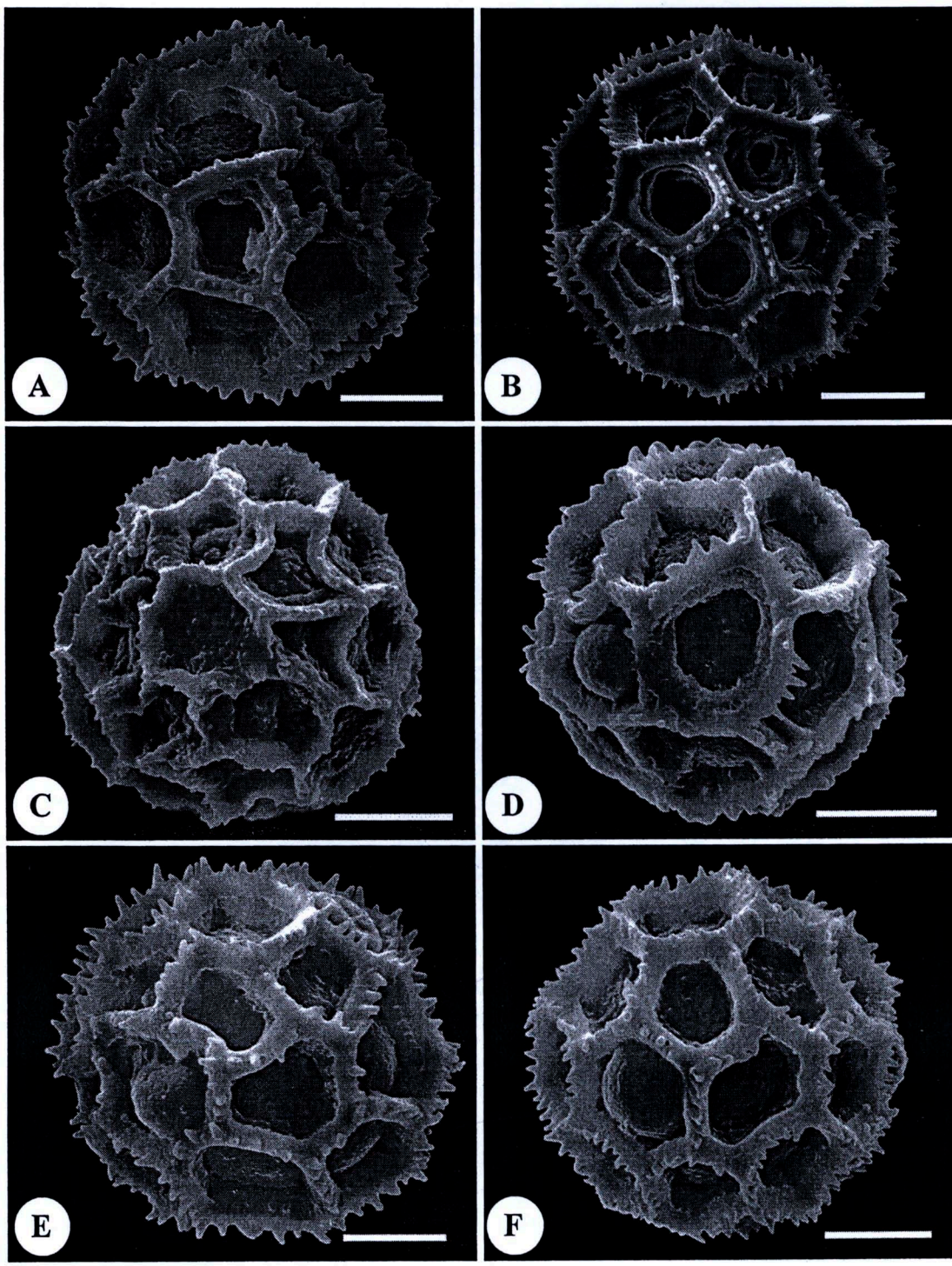


Figure 2.14 Unacetolyzed pollen of Thai Vernonieae; adding to Bunwong & Chantaranothai (2008). Scale bar = 10 μm.

A. *Acilepis chiangdaoensis* **B.** *A. namnaoensis*
C. *A. ngaoensis* **D.** *A. peguensis*
E. *A. principis* **F.** *A. pseudosutepensis*

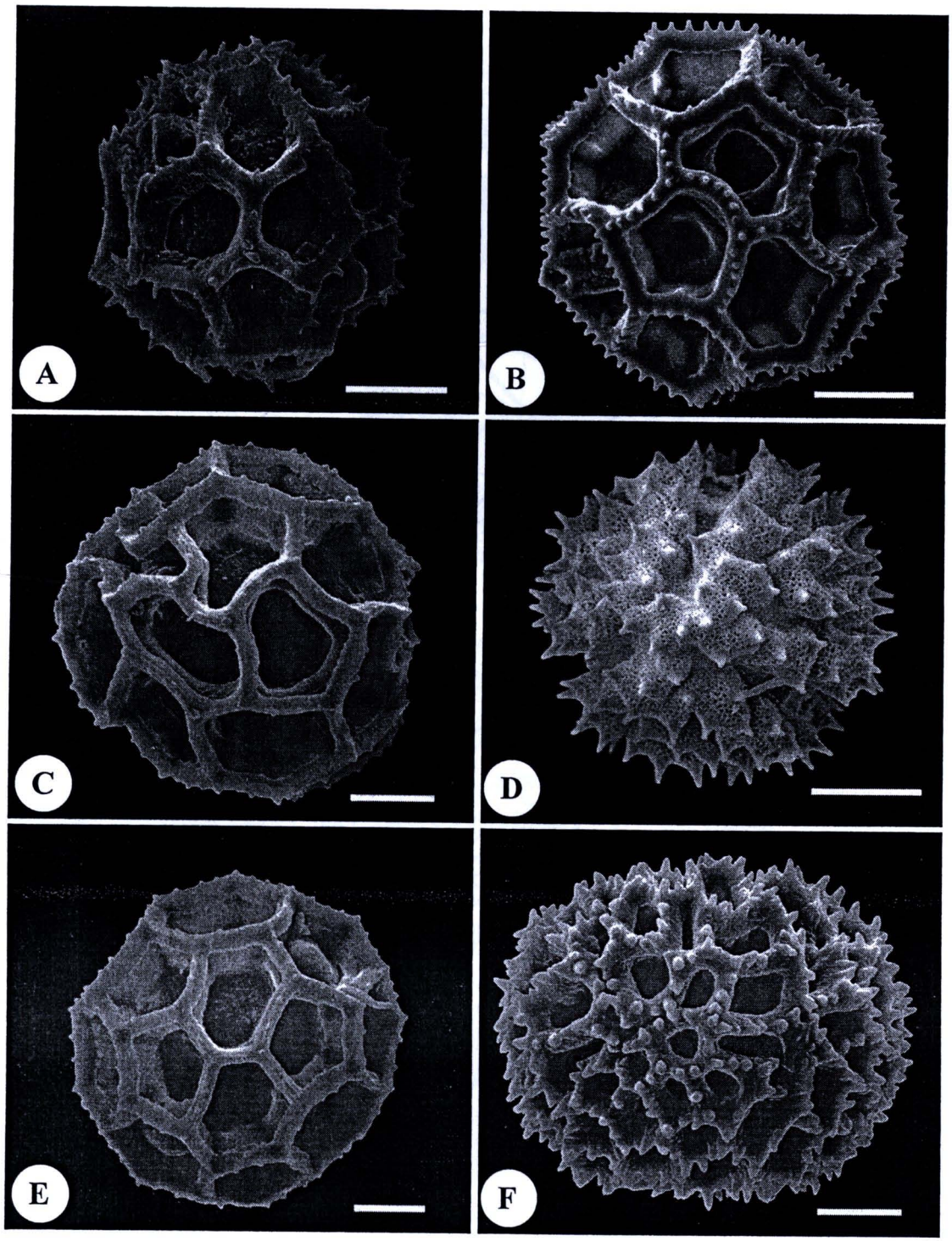


Figure 2.15 Unacetolyzed pollen of Thai Vernonieae; adding to Bunwong & Chantaranothai (2008). Scale bar = 10 μm.

A. *Acilepis saligna*
B. *Camchaya* sp.
C. *Koyamasia calcarea*
D. *Kurziella gymnoclada*
E. *Vernonia curtisii*
F. *V. pulicarioides*

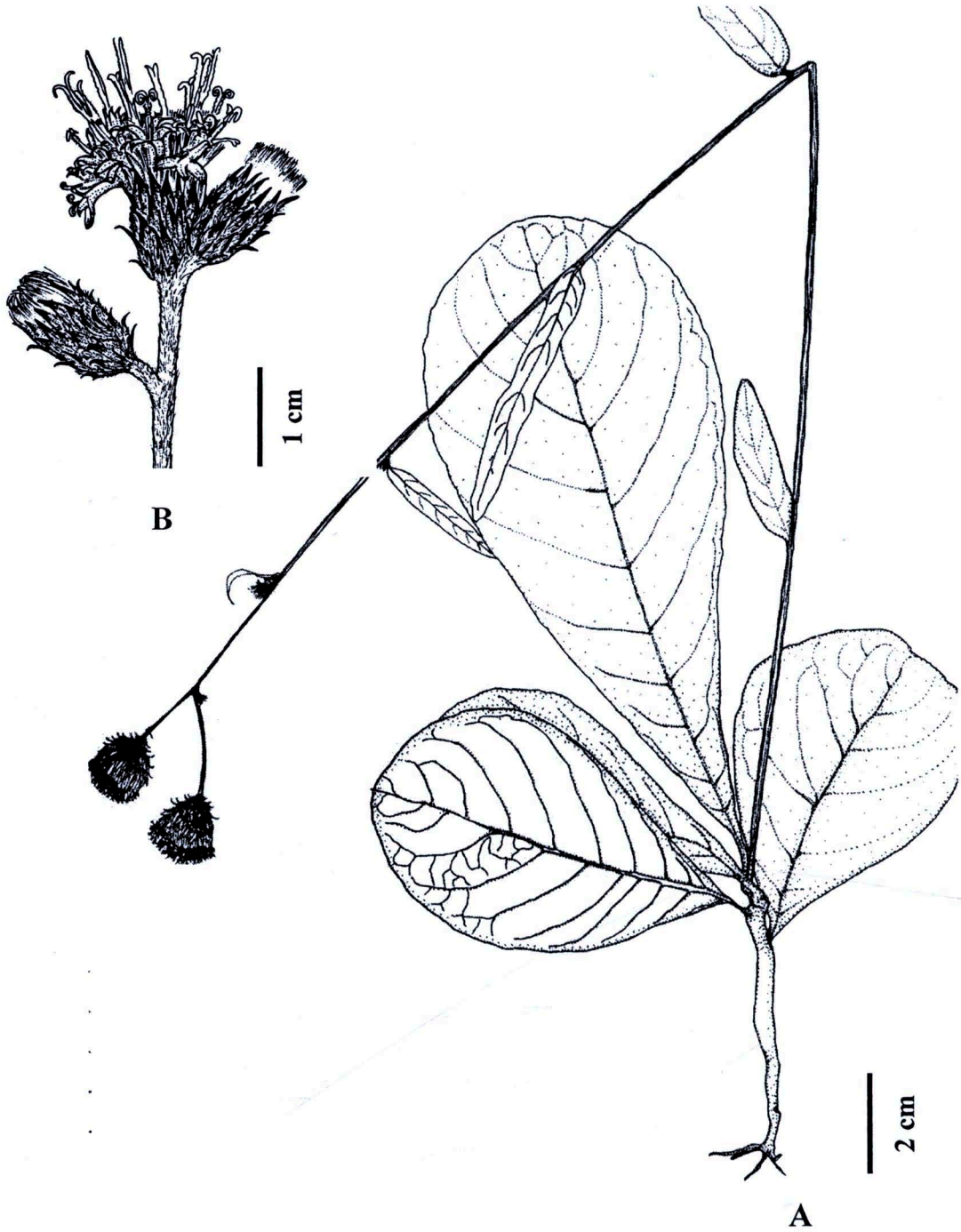


Figure 2.16 *Acilepis attenuata* **A.** habit **B.** capitula

Figure 2.17 *Acilepis chiangdaoensis*

Figure 2.18 *Acilepis divergens*

Figure 2.19 *Acilepis doichangensis*

Figure 2.20 *Acilepis kingii*

Figure 2.21 *Acilepis namnaoensis*

Figure 2.22 *Acilepis ngaoensis*

Figure 2.23 *Acilepis peguensis*

Figure 2.24 *Acilepis principis*

Figure 2.25 *Acilepis pseudosutepensis*

Figure 2.26 *Acilepis saligna*

Figure 2.27 *Acilepis silhetensis*; **A.** habit **B.** capitulum

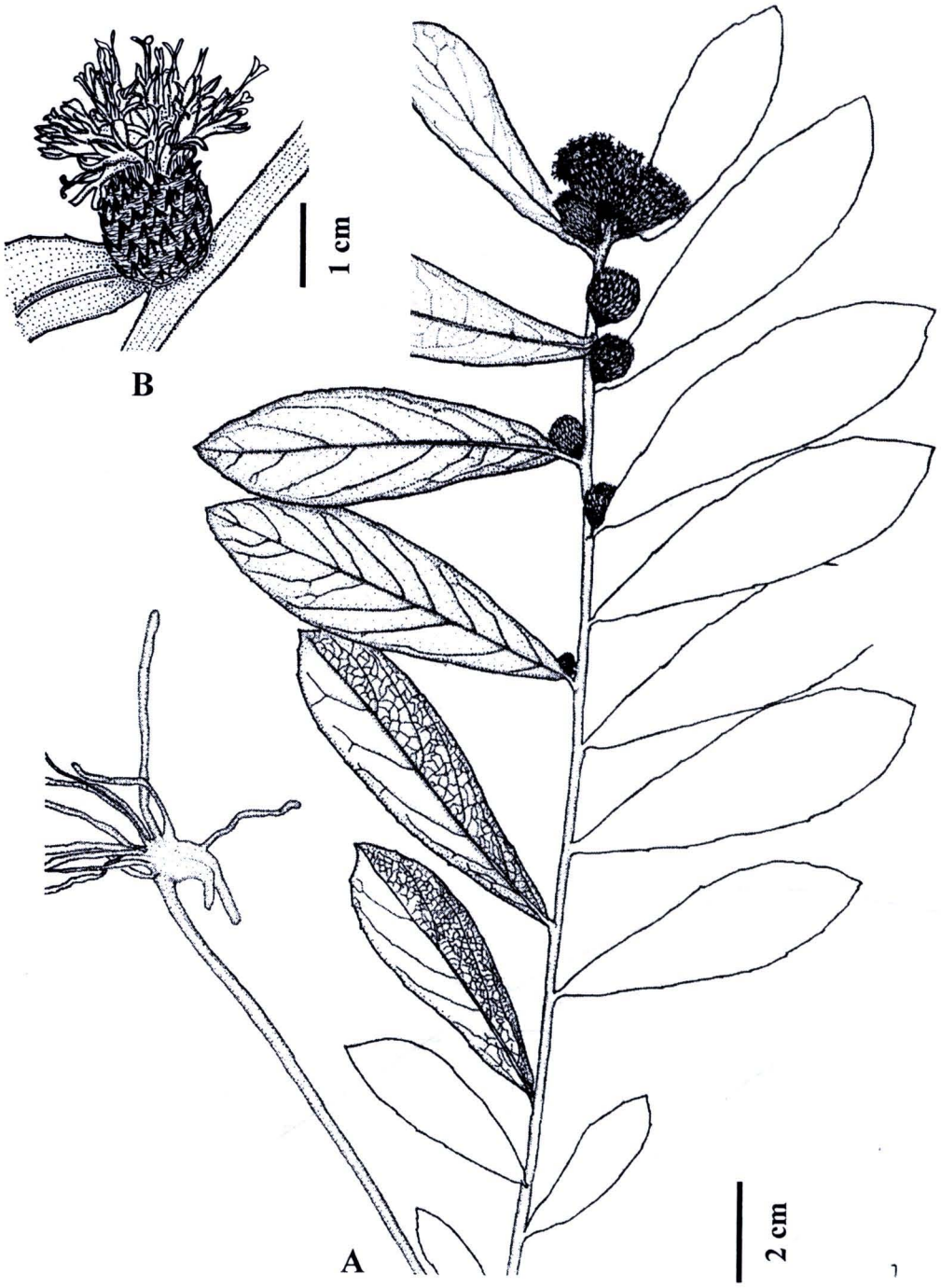


Figure 2.28 *Acilepis squarrosa*; **A.** habit **B.** capitulum

Figure 2.29 *Acilepis sutepensis*

Figure 2.30 *Camchaya gracilis*; **A.** habit **B.** capitulum

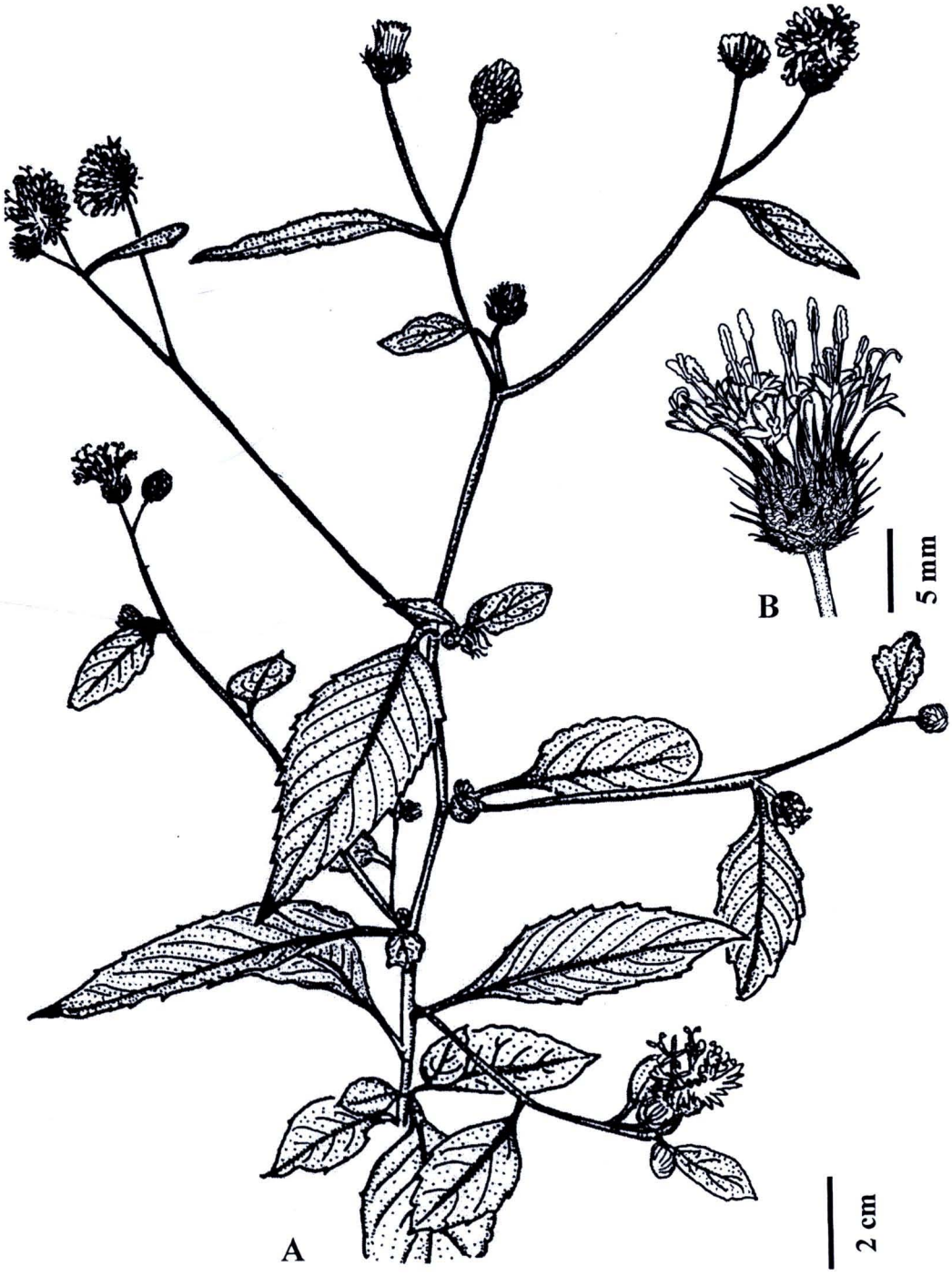


Figure 2.31 *Camchaya loloana* var. *mukdahanensis* **A.** habit **B.** capitulum

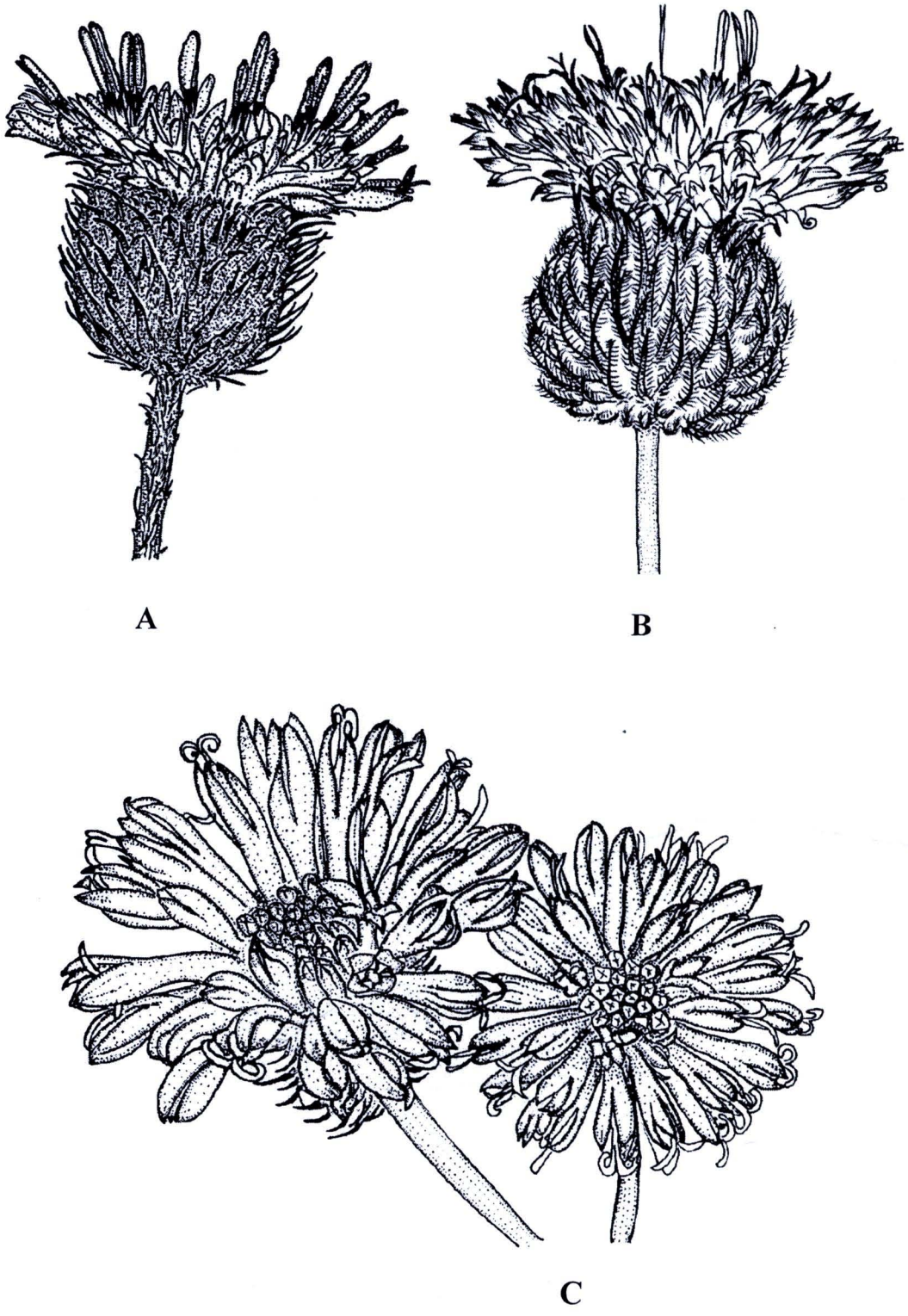


Figure 2.32 **A.** *Camchaya pentagona* **B.** *C. spinulifera* **C.** *C. tenuiflora*

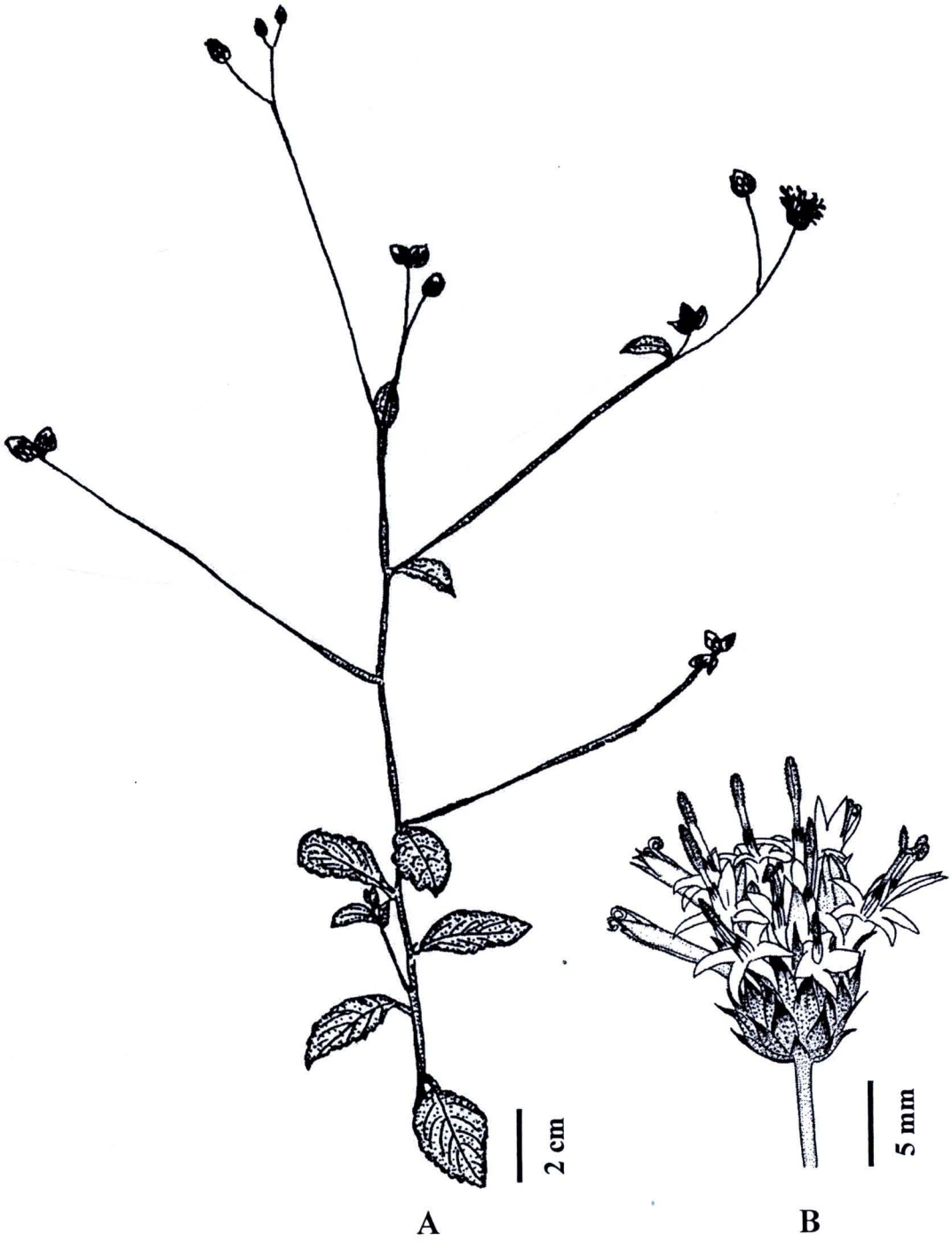


Figure 2.33 *Camchaya* sp. **A.** habit **B.** capitulum

Figure 2.34 *Cyanthillium hookerianum* **A.** habit **B.** capitulum

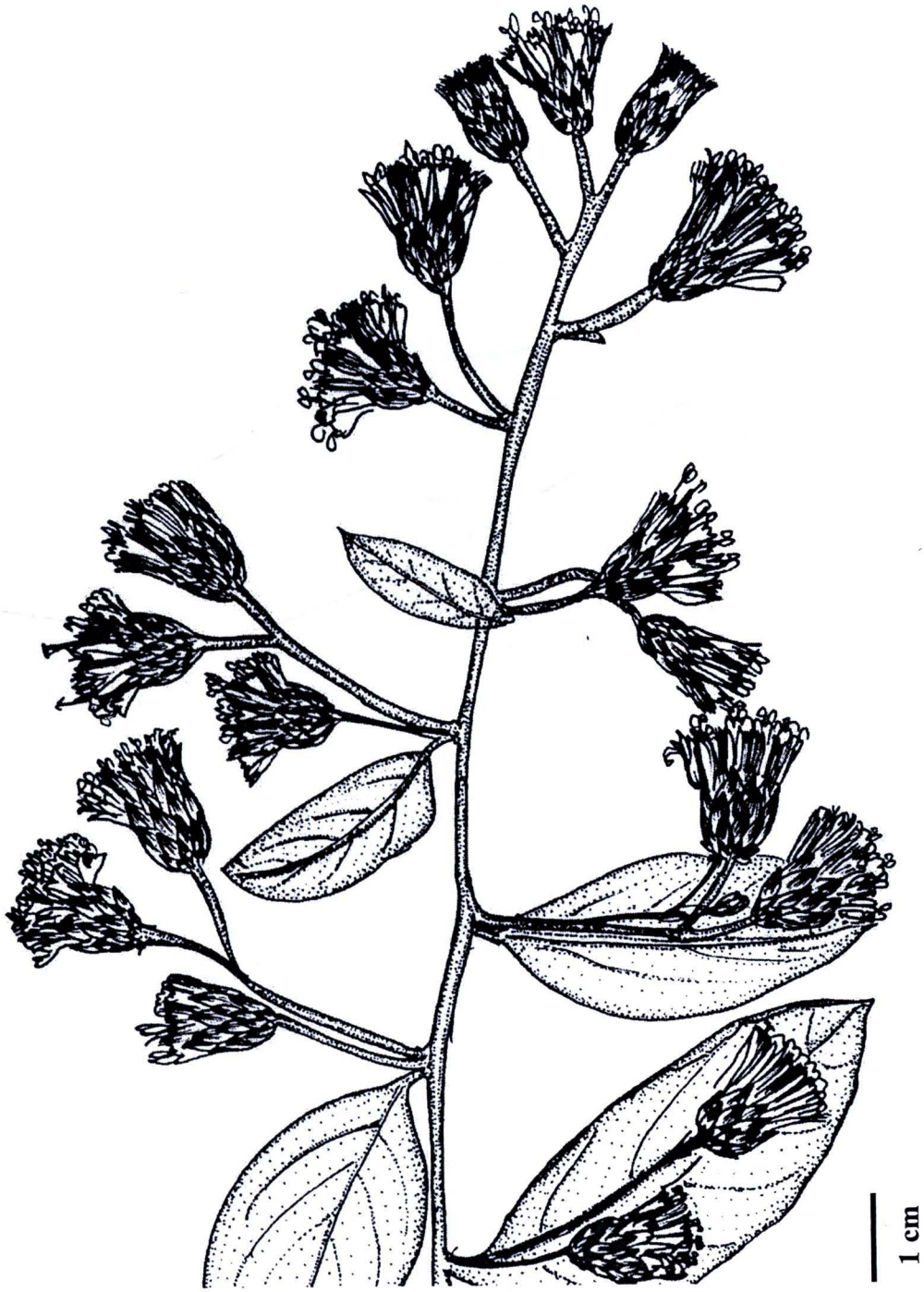


Figure 2.35 *Decaneuropsis cumiagiana*

Figure 2.36 *Decaneuropsis eberhardtii*

Figure 2.37 *Decaneuropsis garrettiana*; **A.** habit **B.** capitulum

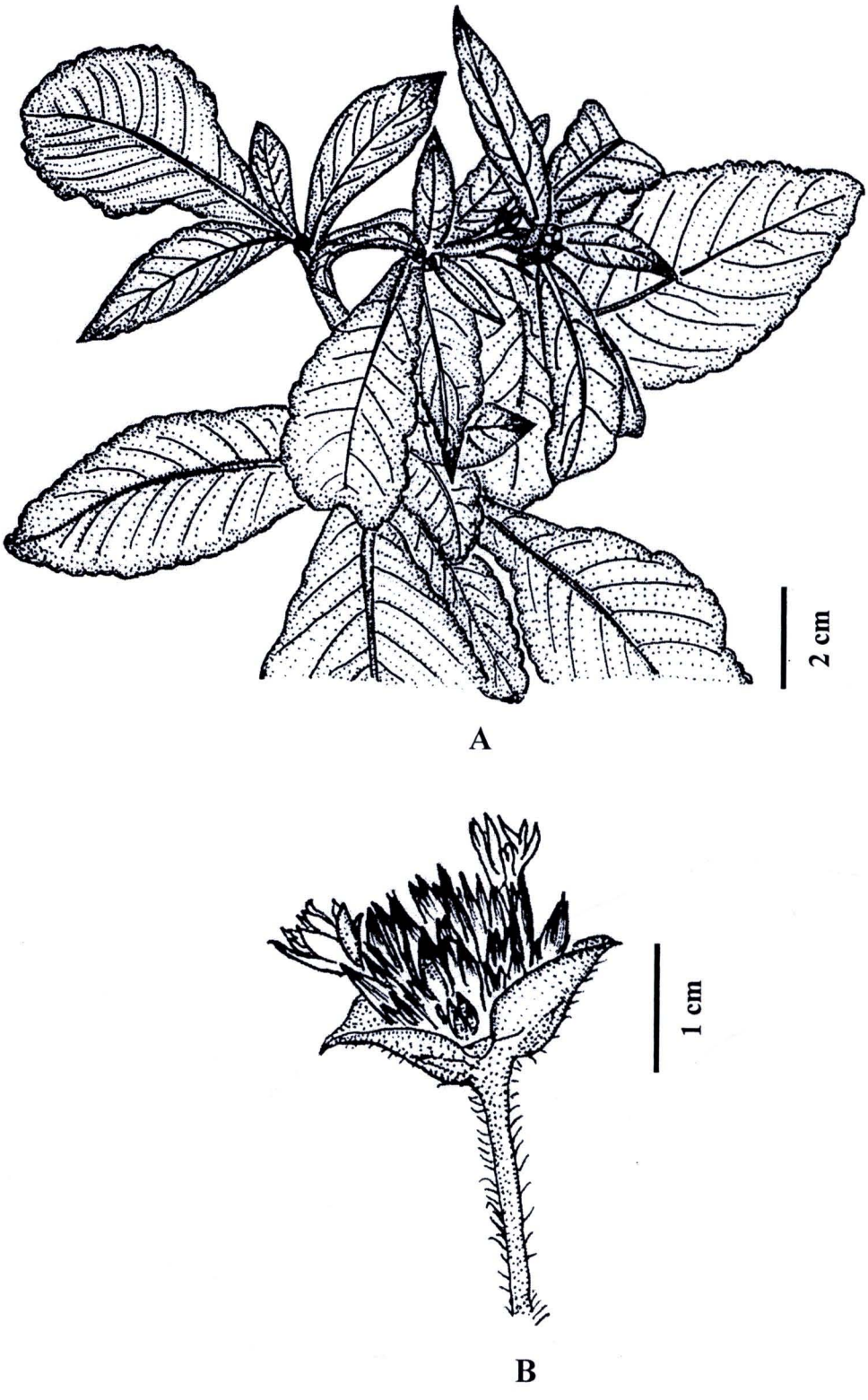


Figure 2.38 *Elephantopus mollis*; **A.** habit **B.** capitulum

Figure 2.39 *Elephantopus scaber*

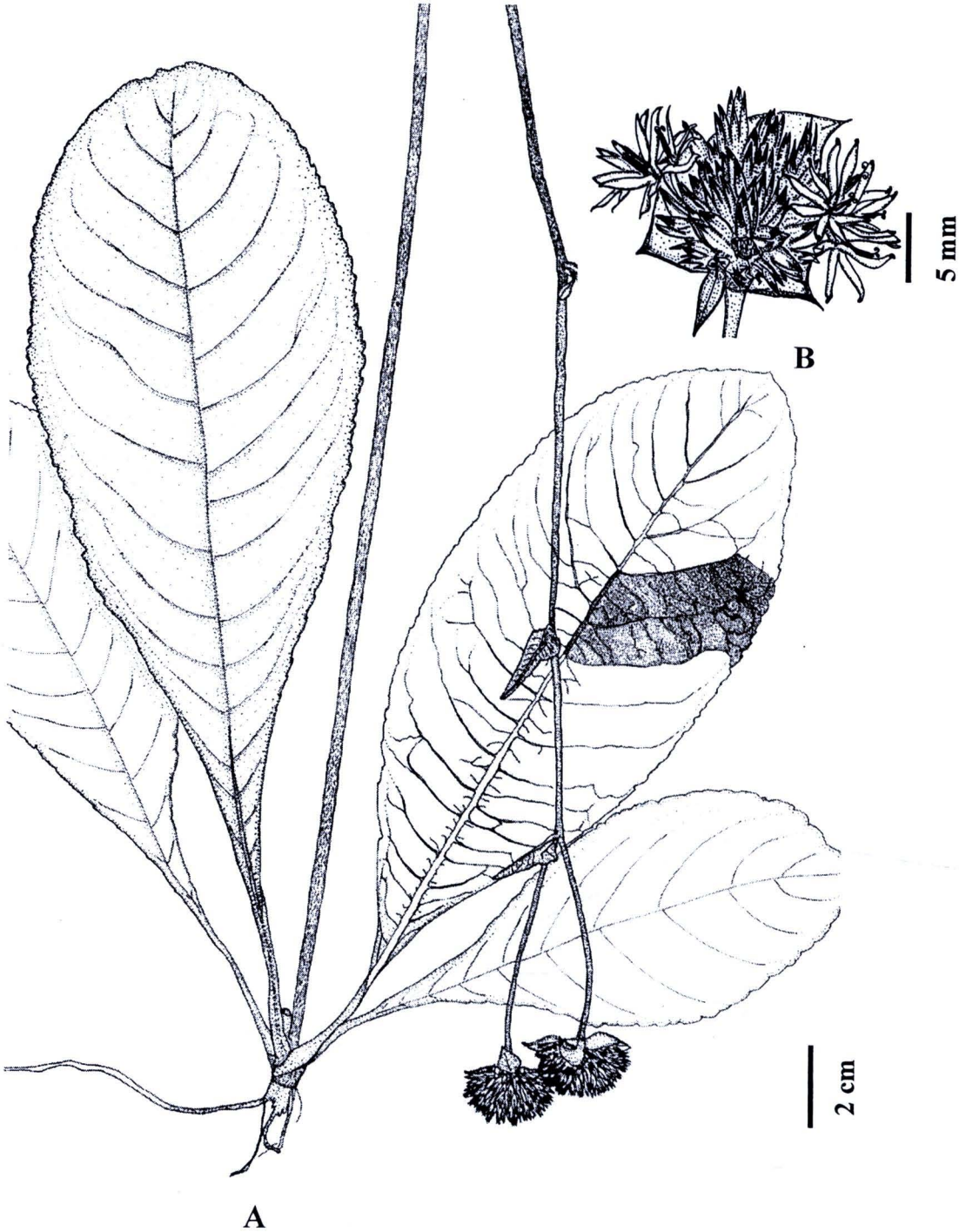


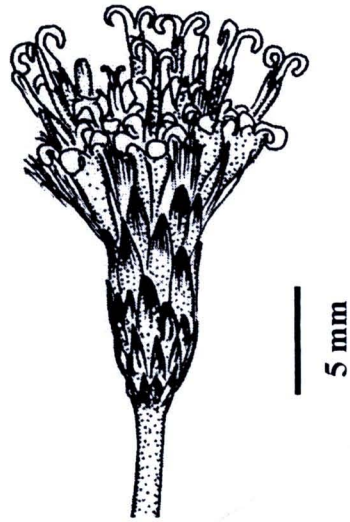
Figure 2.40 *Elephantopus scaber* var. *penicillatus*; **A.** habit **B.** capitulum

Figure 2.41 *Ethulia conyzoides*

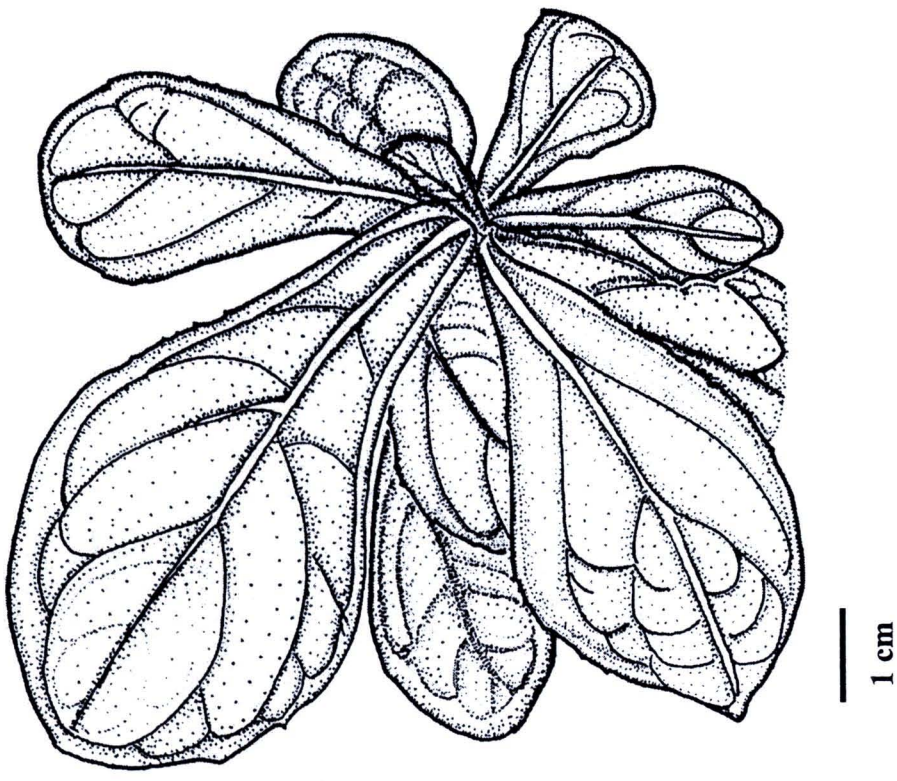
Figure 2.42 *Gymnanthemum cylindriceps*

Figure 2.43 *Iodocephalopsis eberhardtii*

Figure 2.44 *Koyamasia calcarea*



B



A

Figure 2.45 *Kurziella gymnoclada*; **A.** habit **B.** capitulum

Figure 2.46 *Monosis parishii*; **A.** habit **B.** capitulum

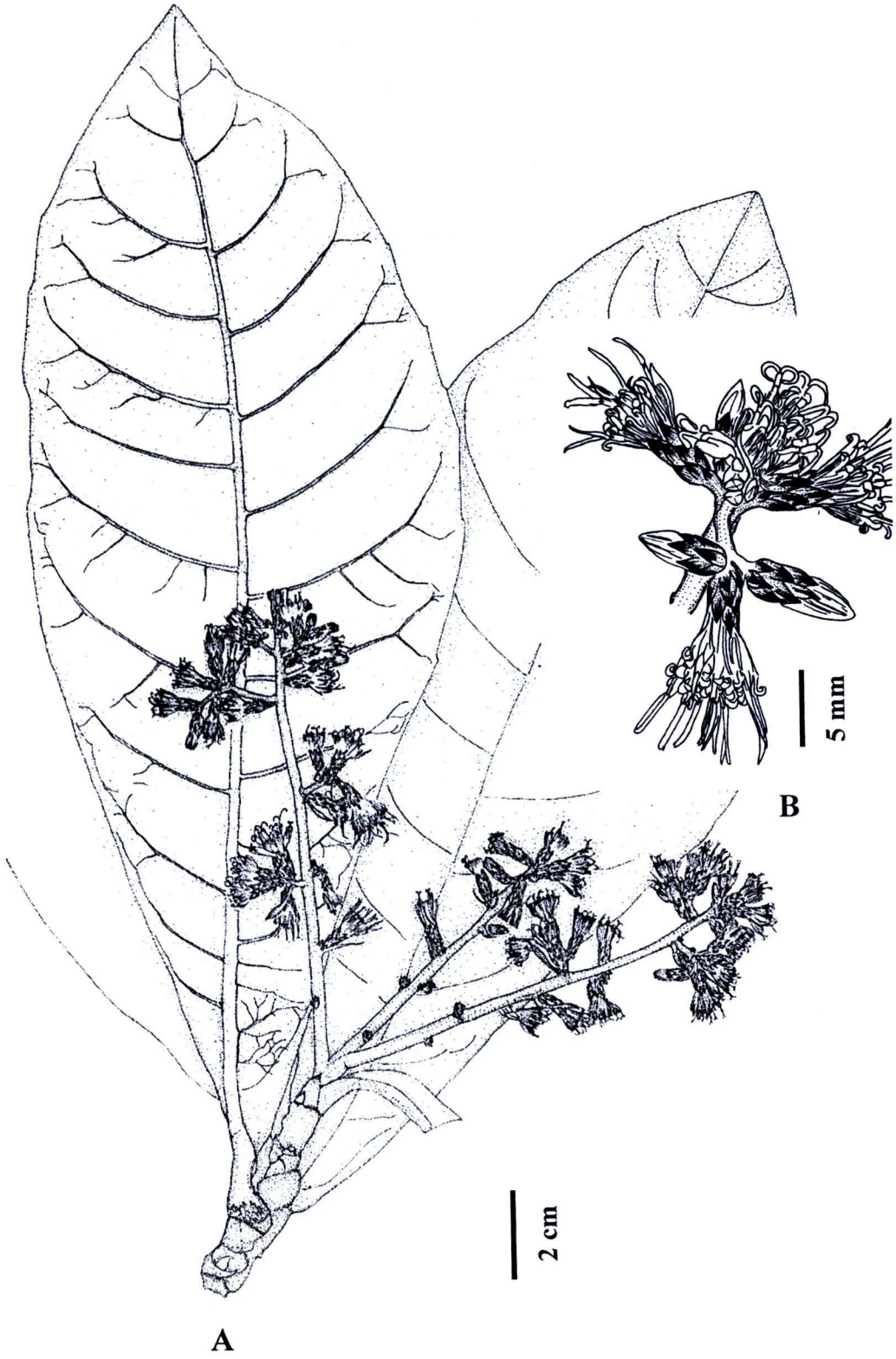


Figure 2.47 *Monosis volkameriifolia;* **A.** habit **B.** capitulum

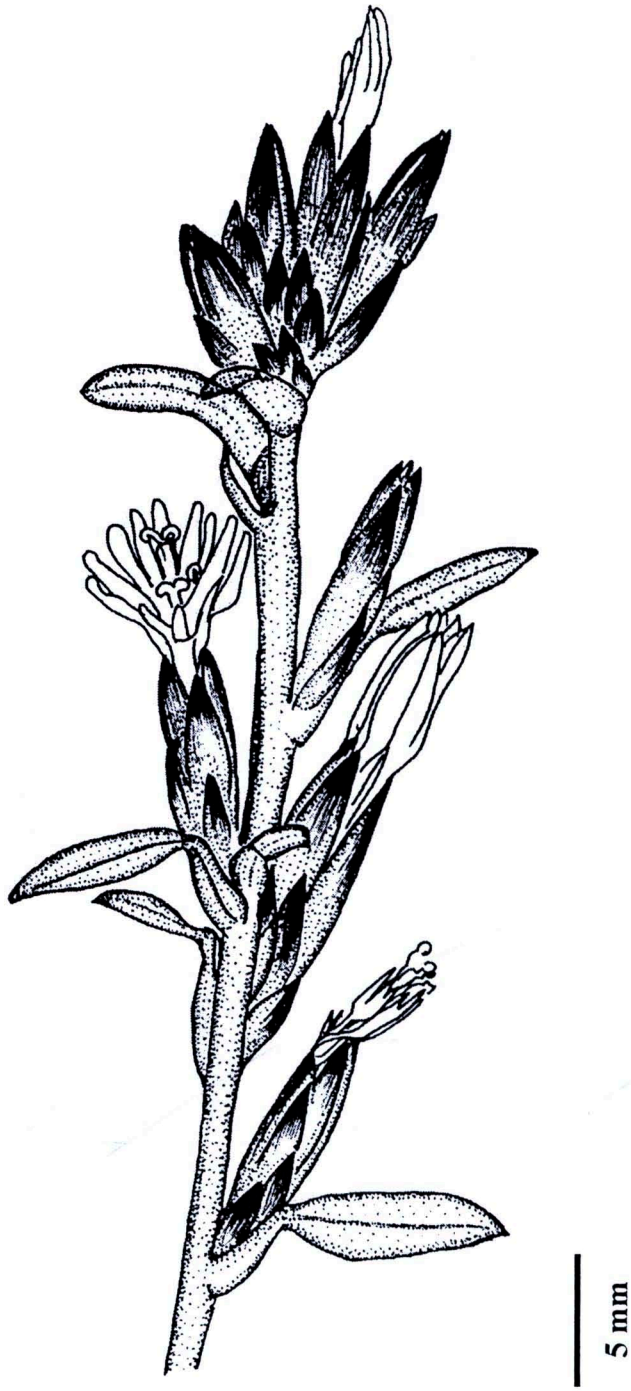


Figure 2.48 *Pseudelephantopus spicatus*

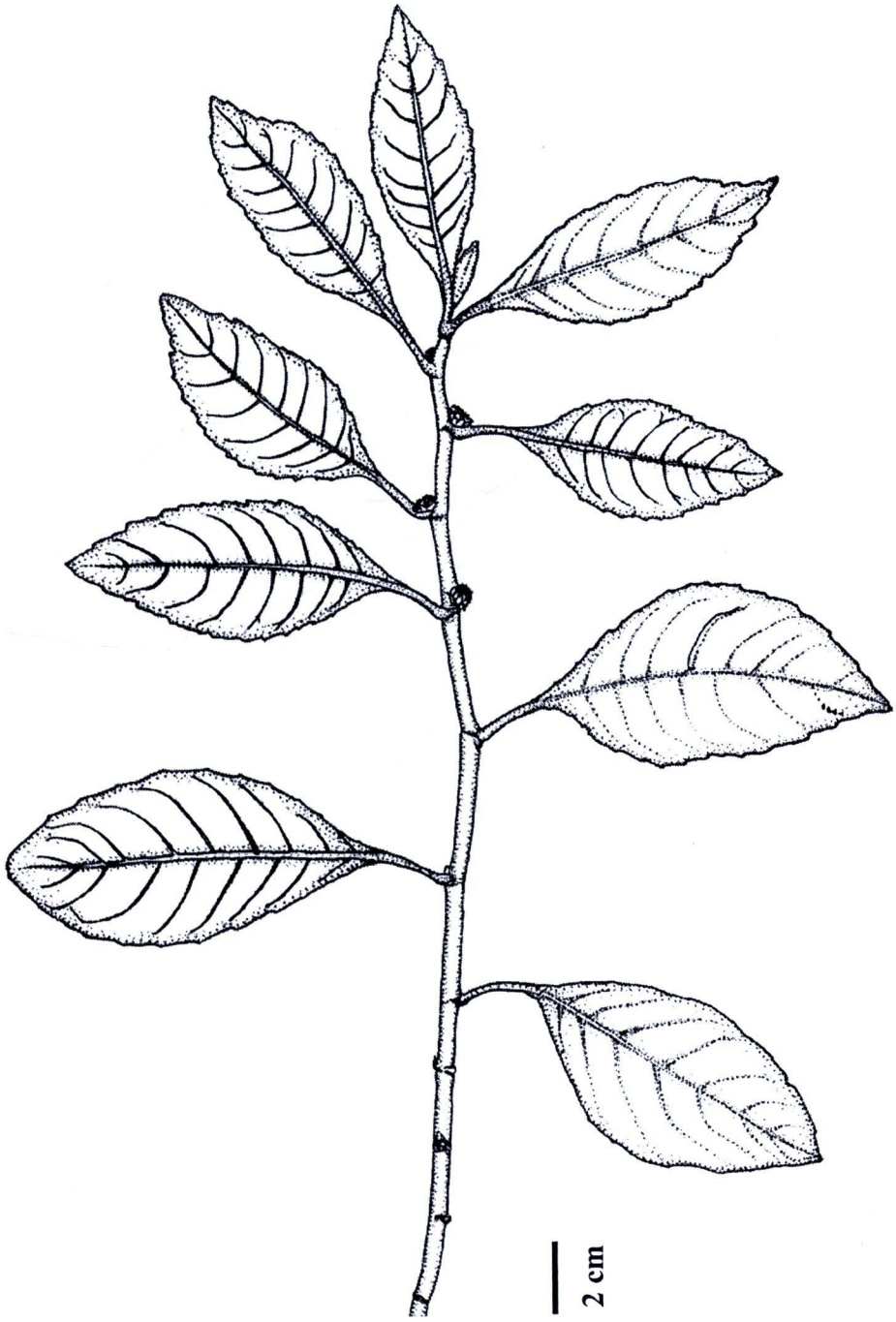


Figure 2.49 *Sparganophoros sparganophora*

Figure 2.50 *Strobocalyx arborea*

Figure 2.51 *Strobocalyx solanifolia*

Figure 2.52 *Tarlmounia elliptica*

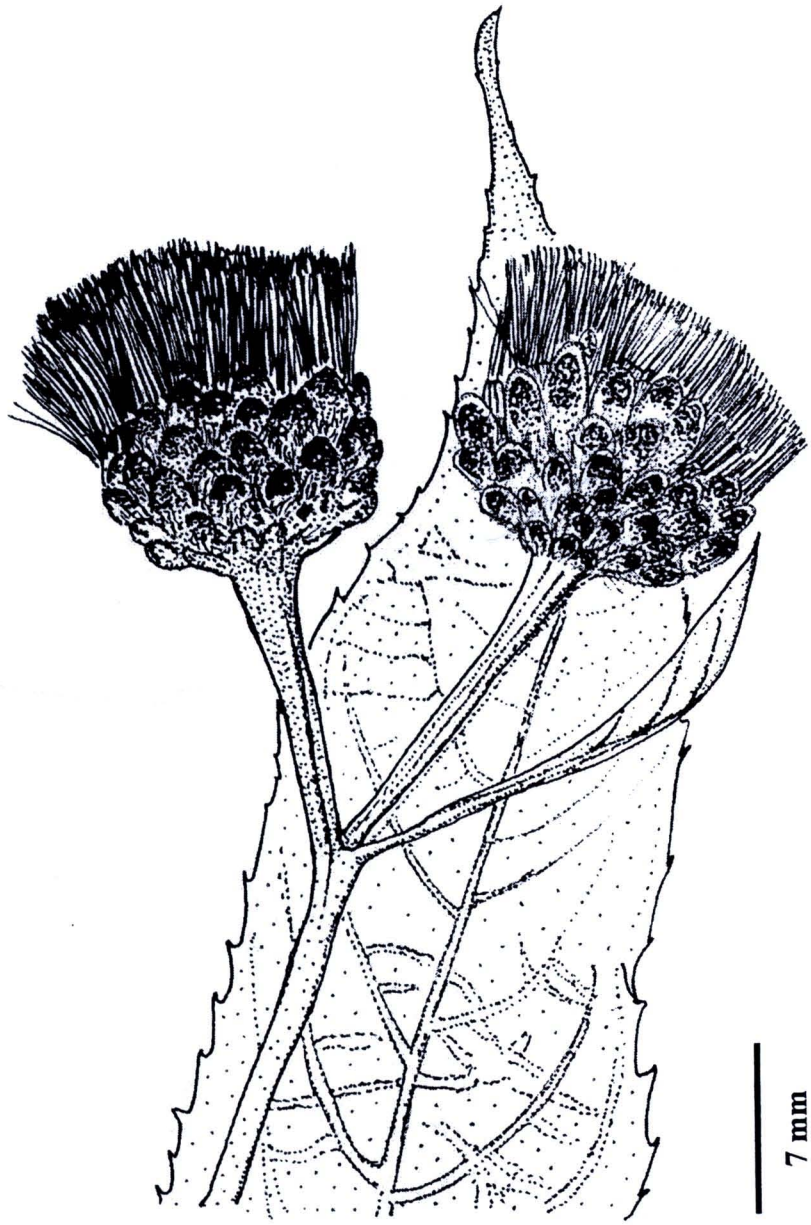


Figure 2.53 *Vernonia birmanica*

Figure 2.54 *Vernonia cinerea* var. *montana*; **A.** habit **B.** capitulum

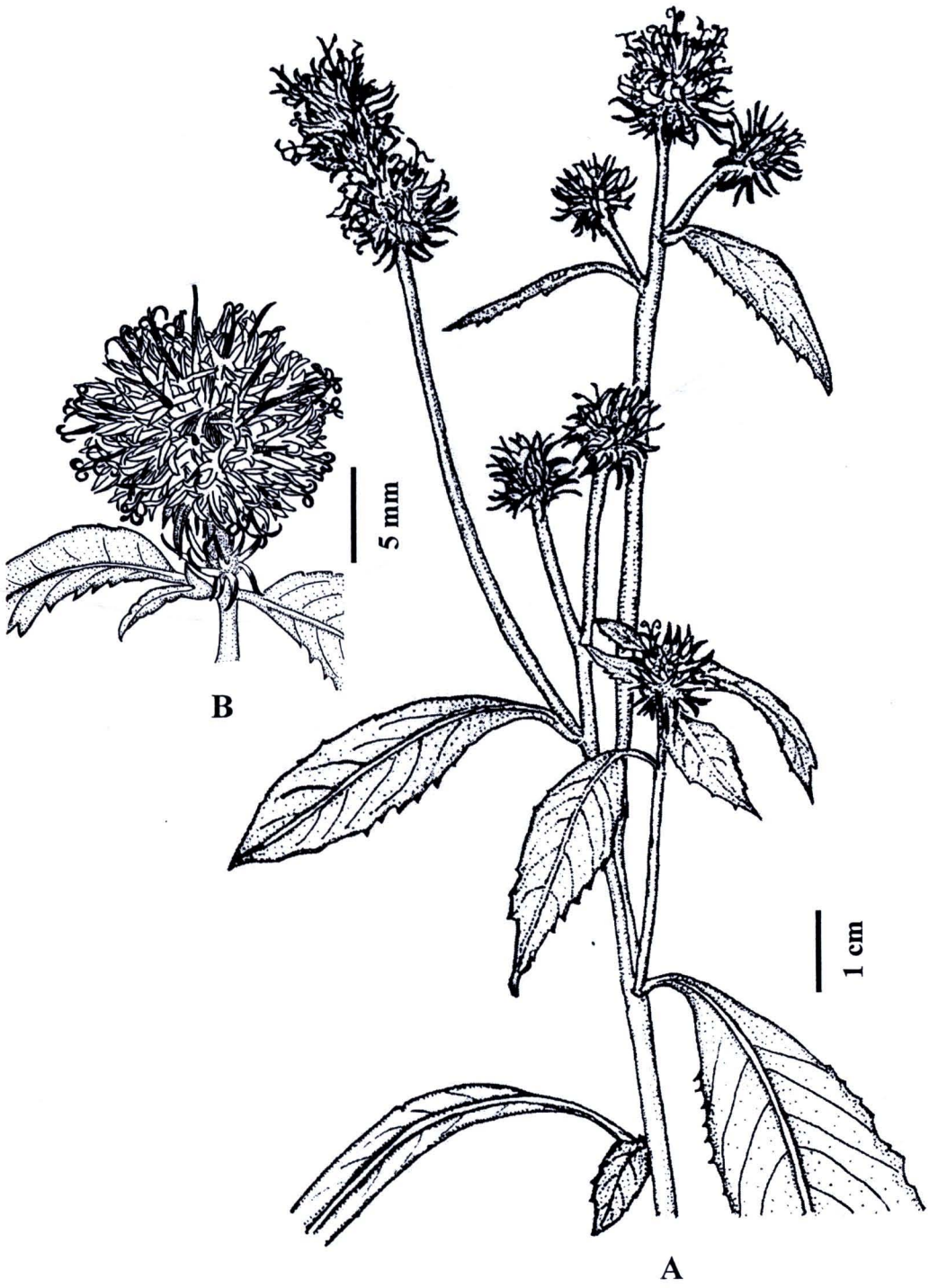


Figure 2.55 *Vernonia curtisii*; **A.** habit **B.** capitulum

Figure 2.56 *Vernonia pseudobirmanica*

Figure 2.57 *Vernonia pulicarioides*

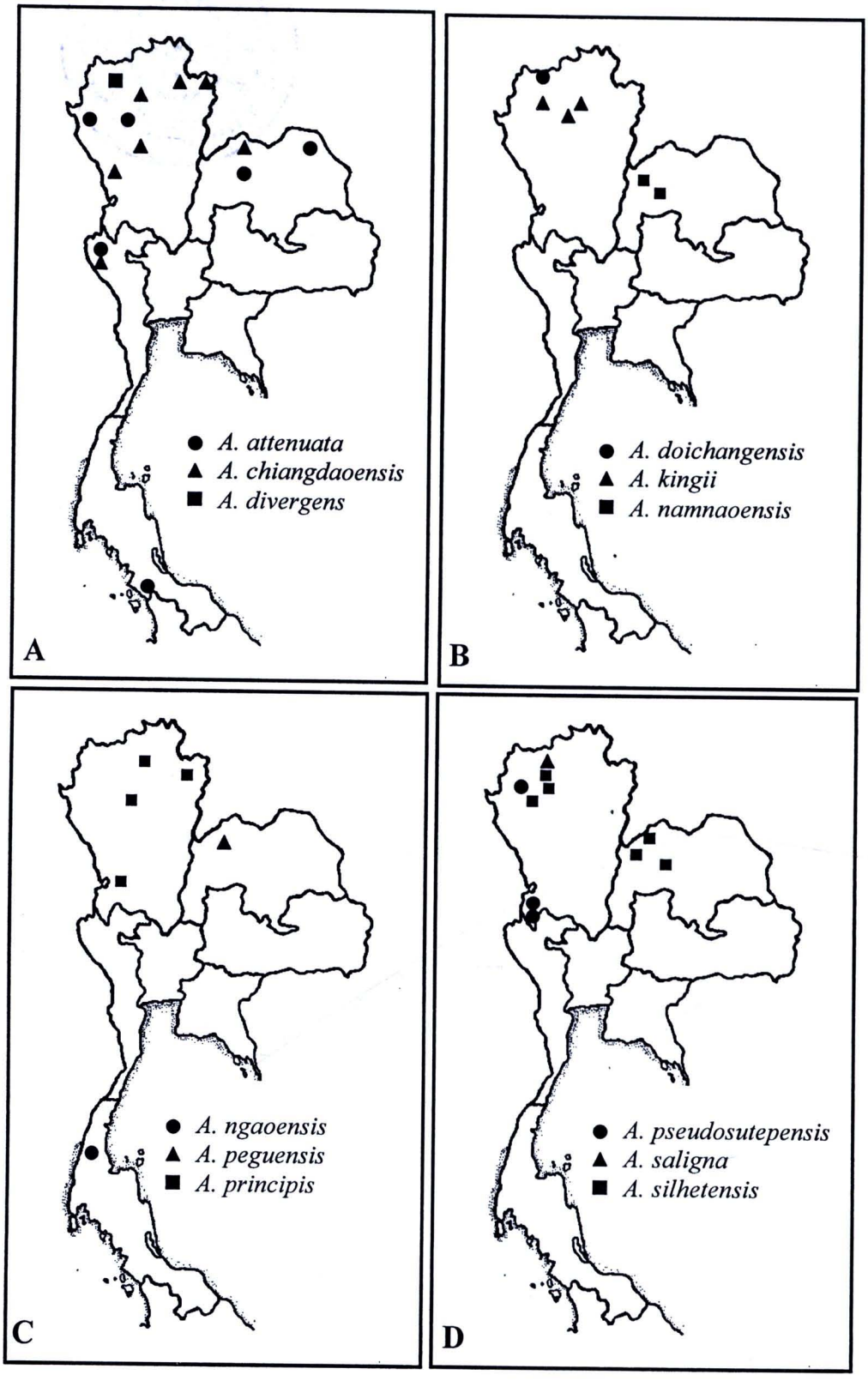


Figure 2.58 Distributional maps of *Acilepis*.

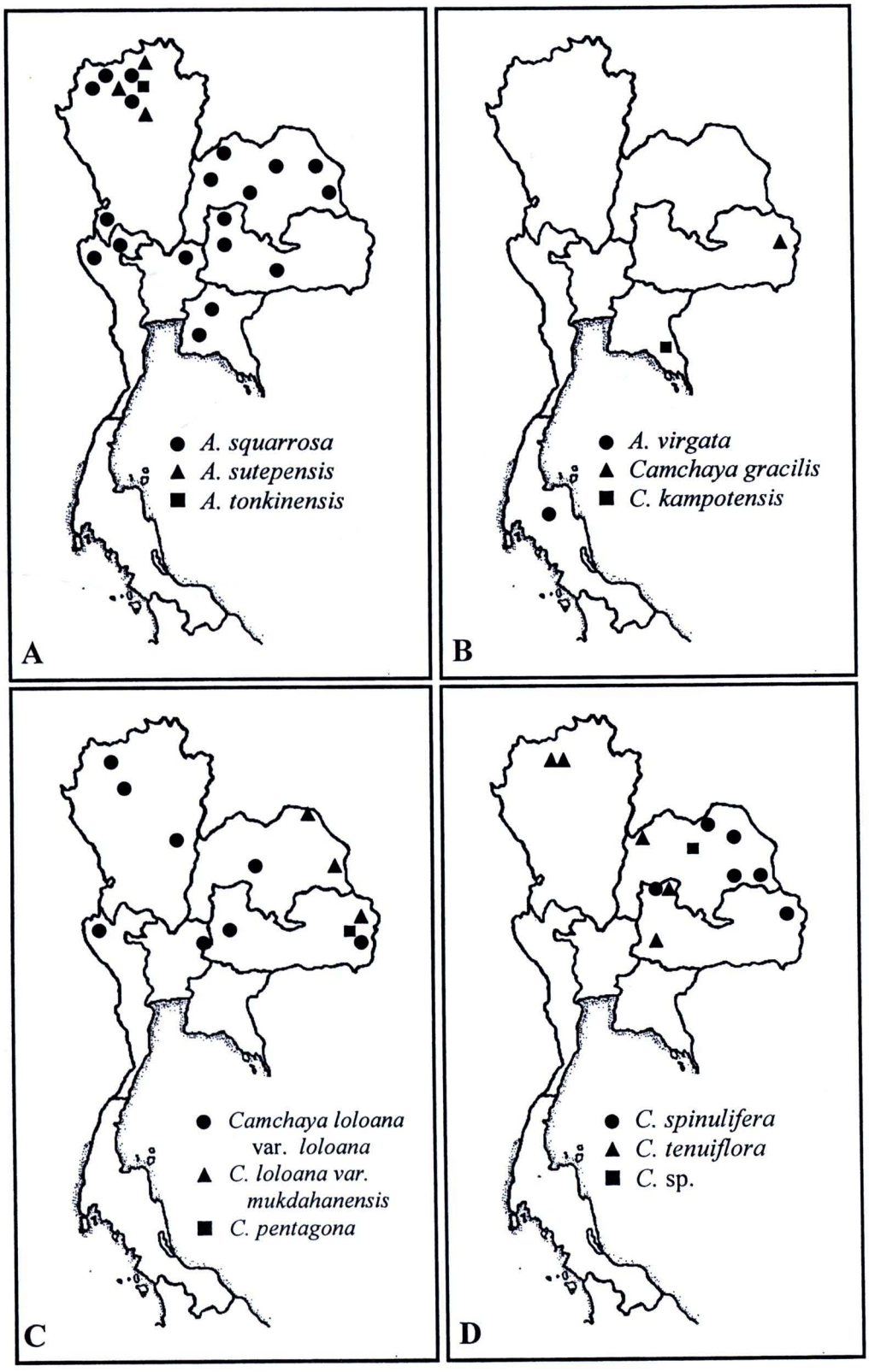


Figure 2.59 Distributional maps of *Acilepis* and *Camchaya*.

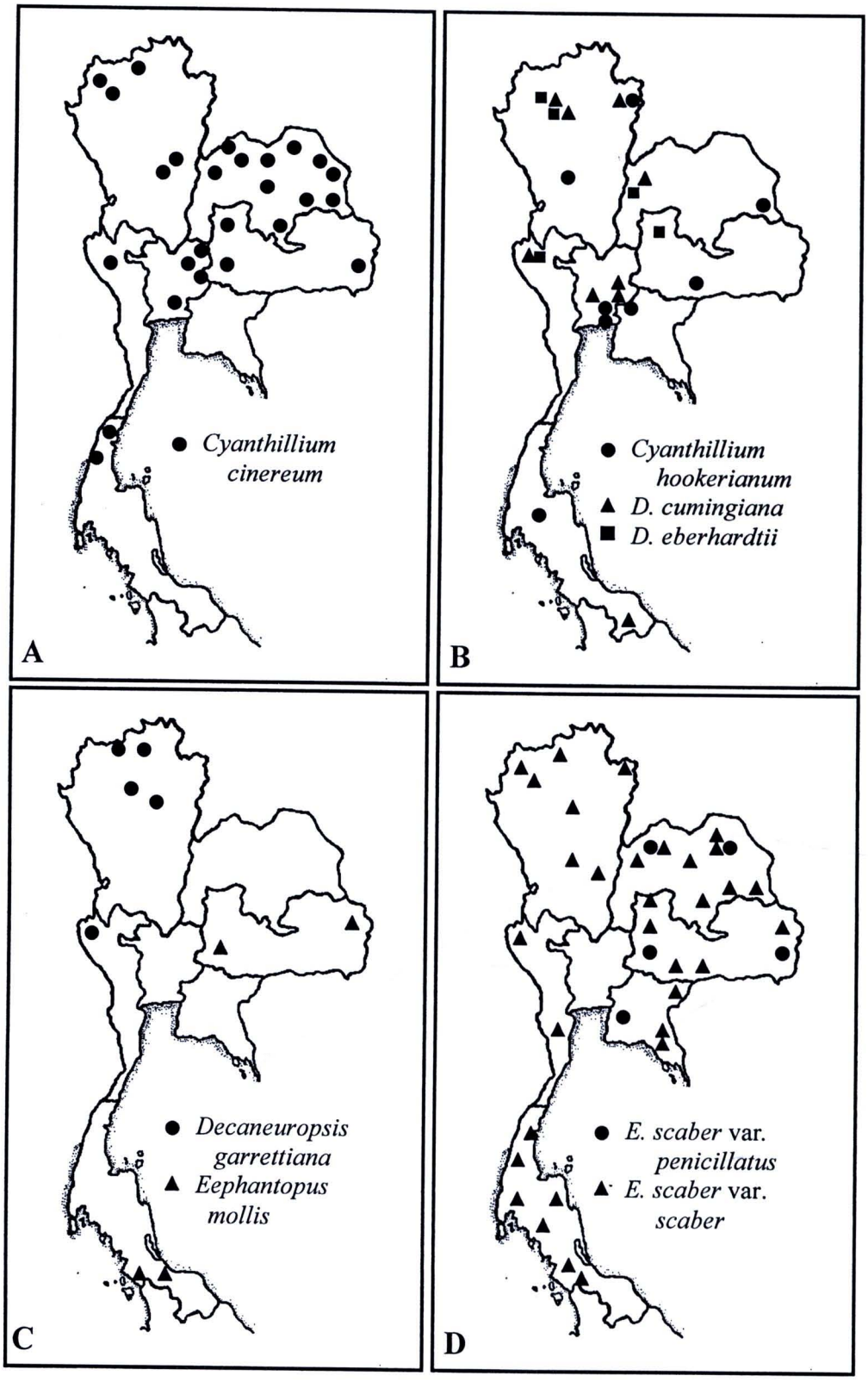


Figure 2.60 Distributional maps of *Cyanthillium*, *Decaneuropsis* and *Elephantopus*.

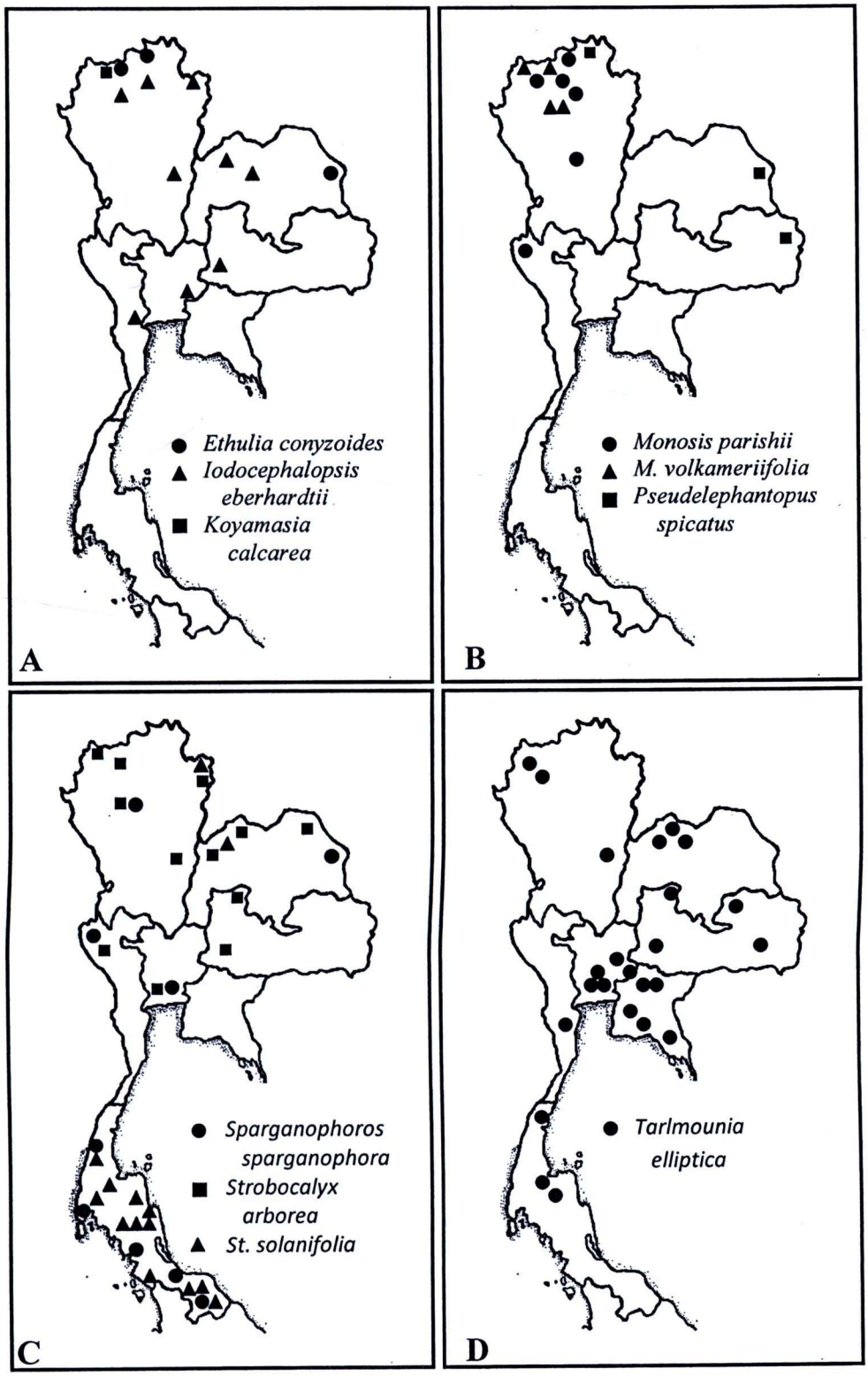


Figure 2.61 Distributional maps of *Ethulia, Iodocephalopsis, Koyamasia, Monosis, Pseudelephantopus, Sparganophoros, Strobocalyx* and *Tarlmounia*.

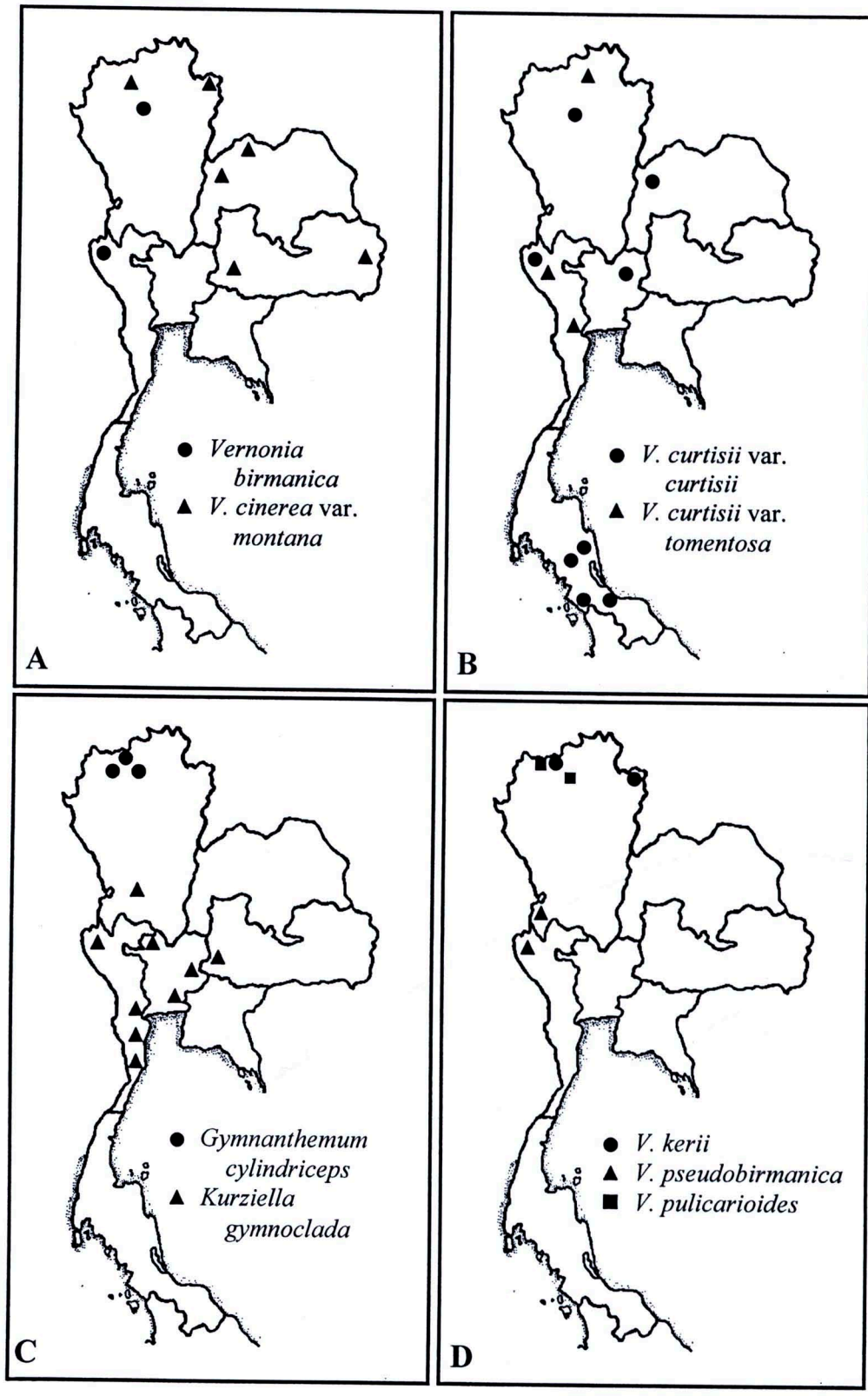


Figure 2.62 Distributional maps of *Gymnanthemum, Kurziella* and *Vernonia*.

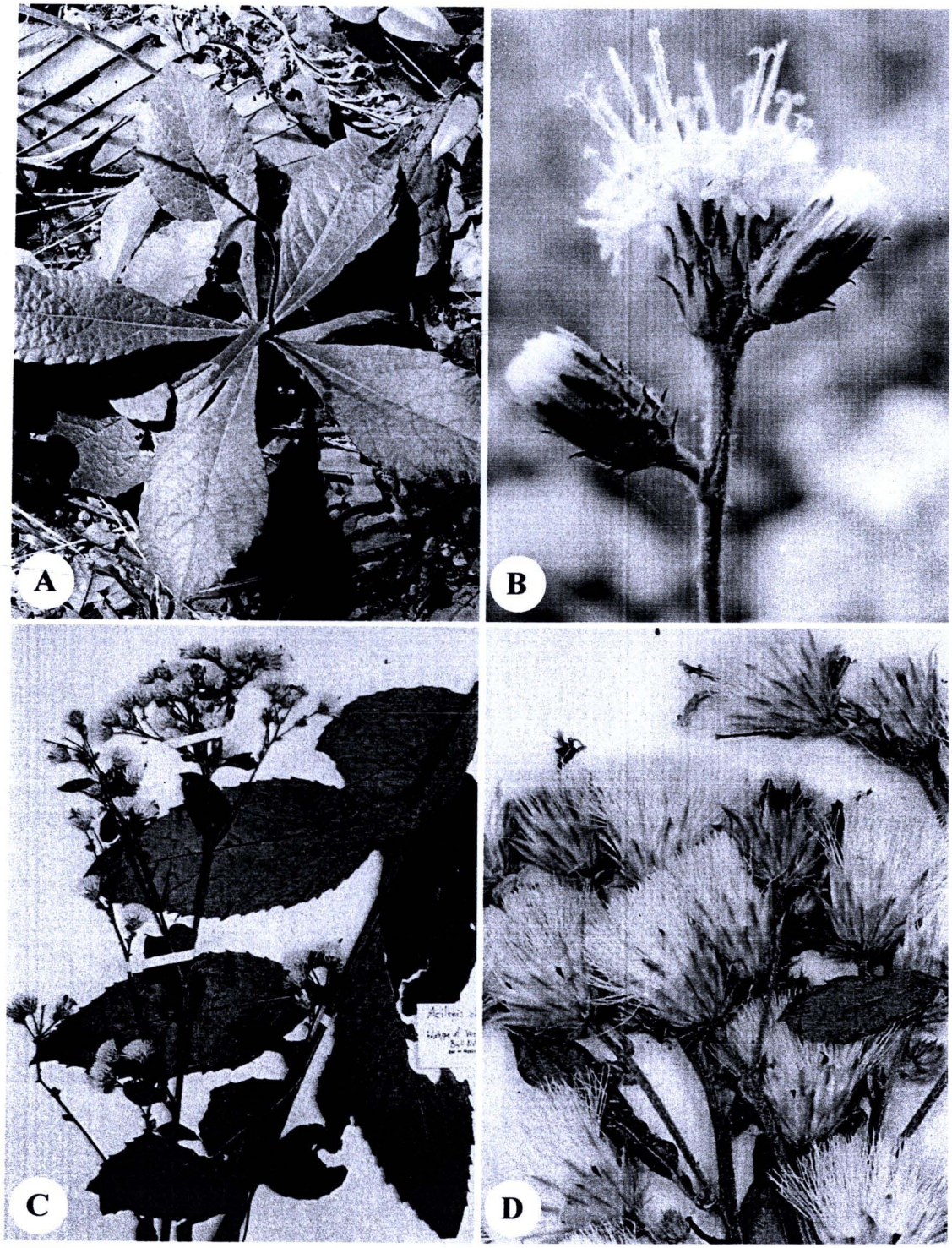


Figure 2.63 **A. & B.** *Acilepis attenuata*

C. & D. *Acilepis chiangdaoensis*

Figure 2.64 **A. & B.** *Acilepis divergens*

C. & D. *Acilepis doichangensis*

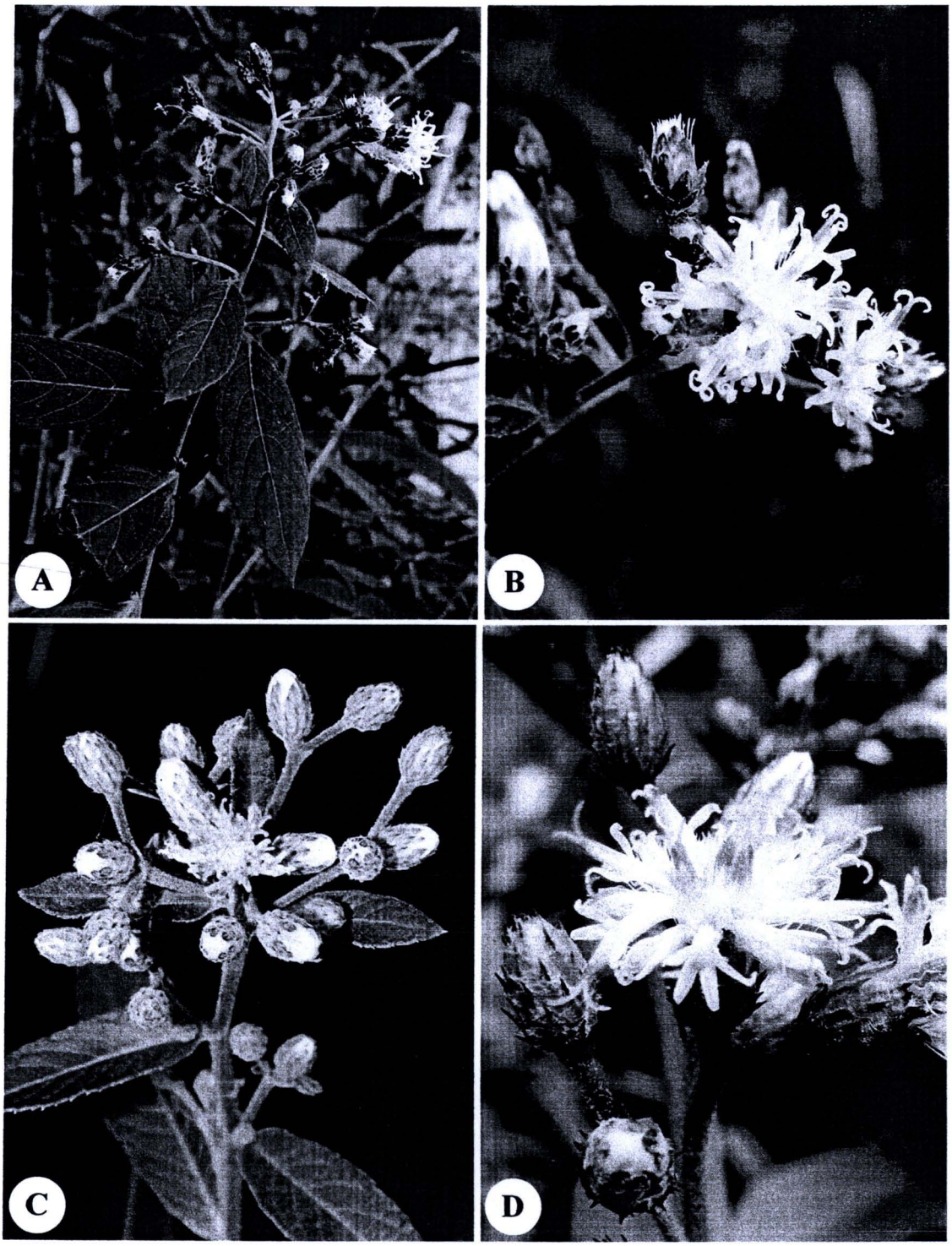


Figure 2.65 **A. & B.** *Acilepis kingii*

C. & D. *Acilepis namnaoensis*

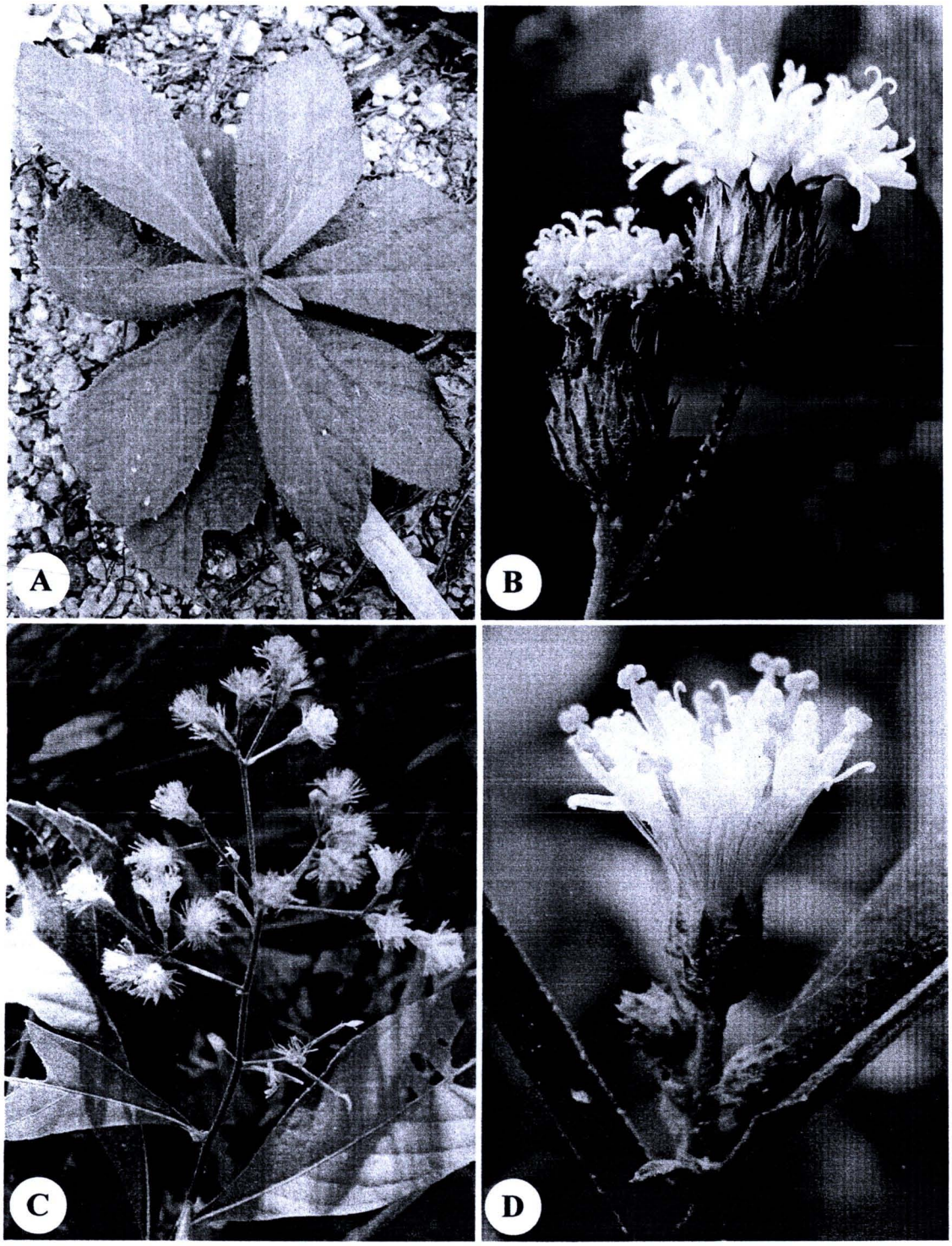


Figure 2.66 **A. & B.** *Acilepis ngaoensis*

C. & D. *Acilepis peguensis*

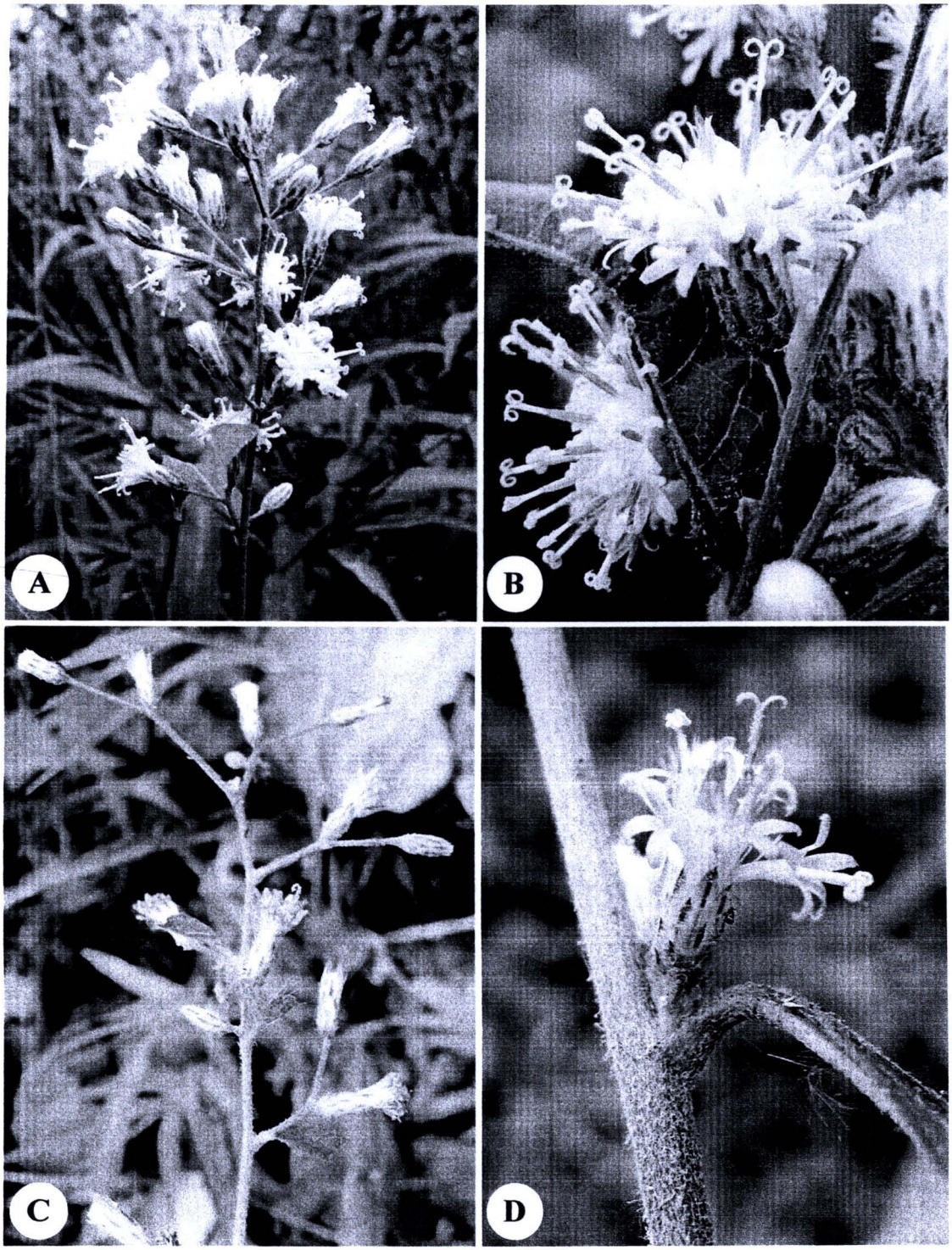


Figure 2.67 **A. & B.** *Acilepis principis*

C. & D. *Acilepis pseudosutepensis*

Figure 2.68 **A. & B.** *Acilepis saligna*

C. & D. *Acilepis silhetensis*

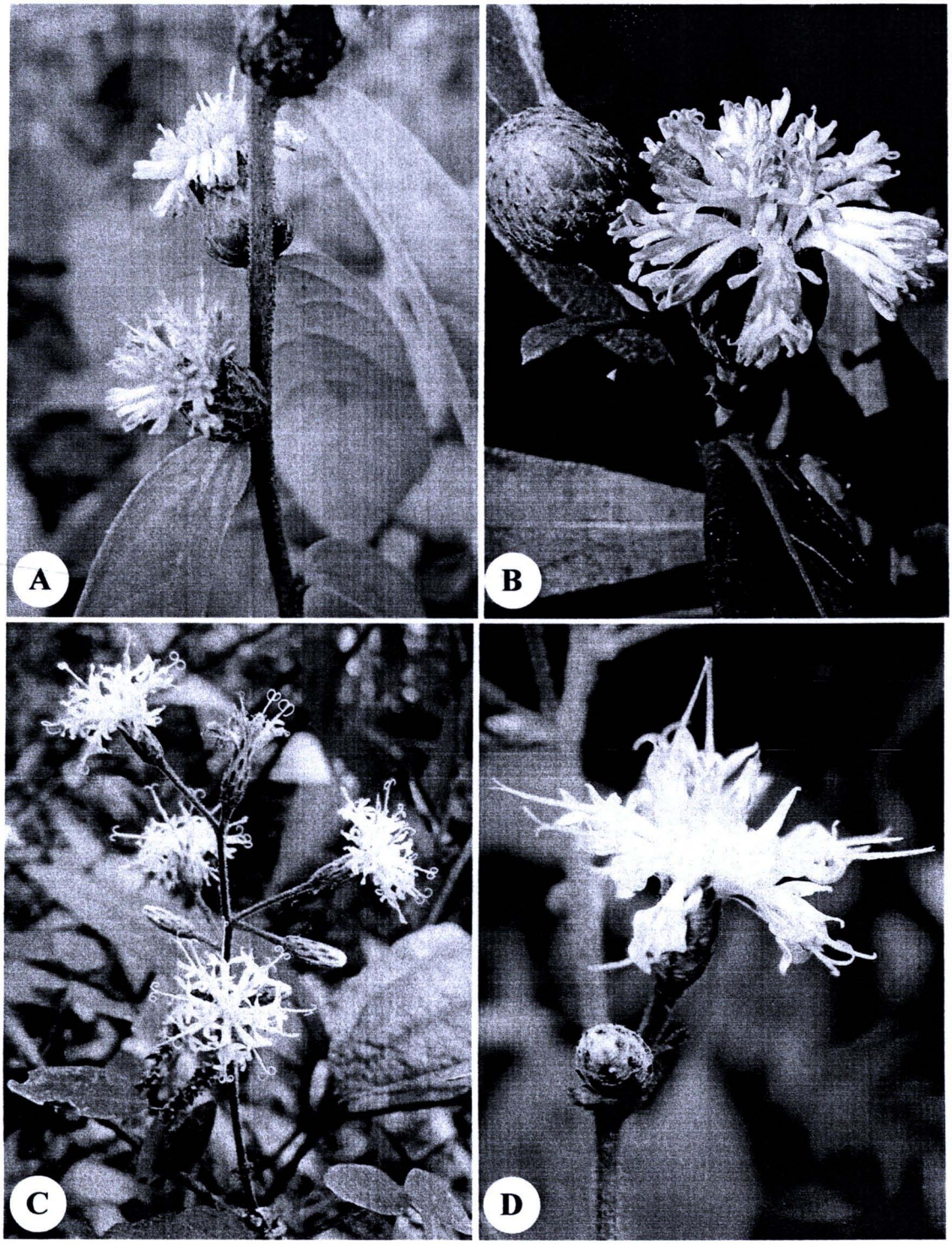


Figure 2.69 **A. & B.** *Acilepis squarrosa*

C. & D. *Acilepis sutepensis*

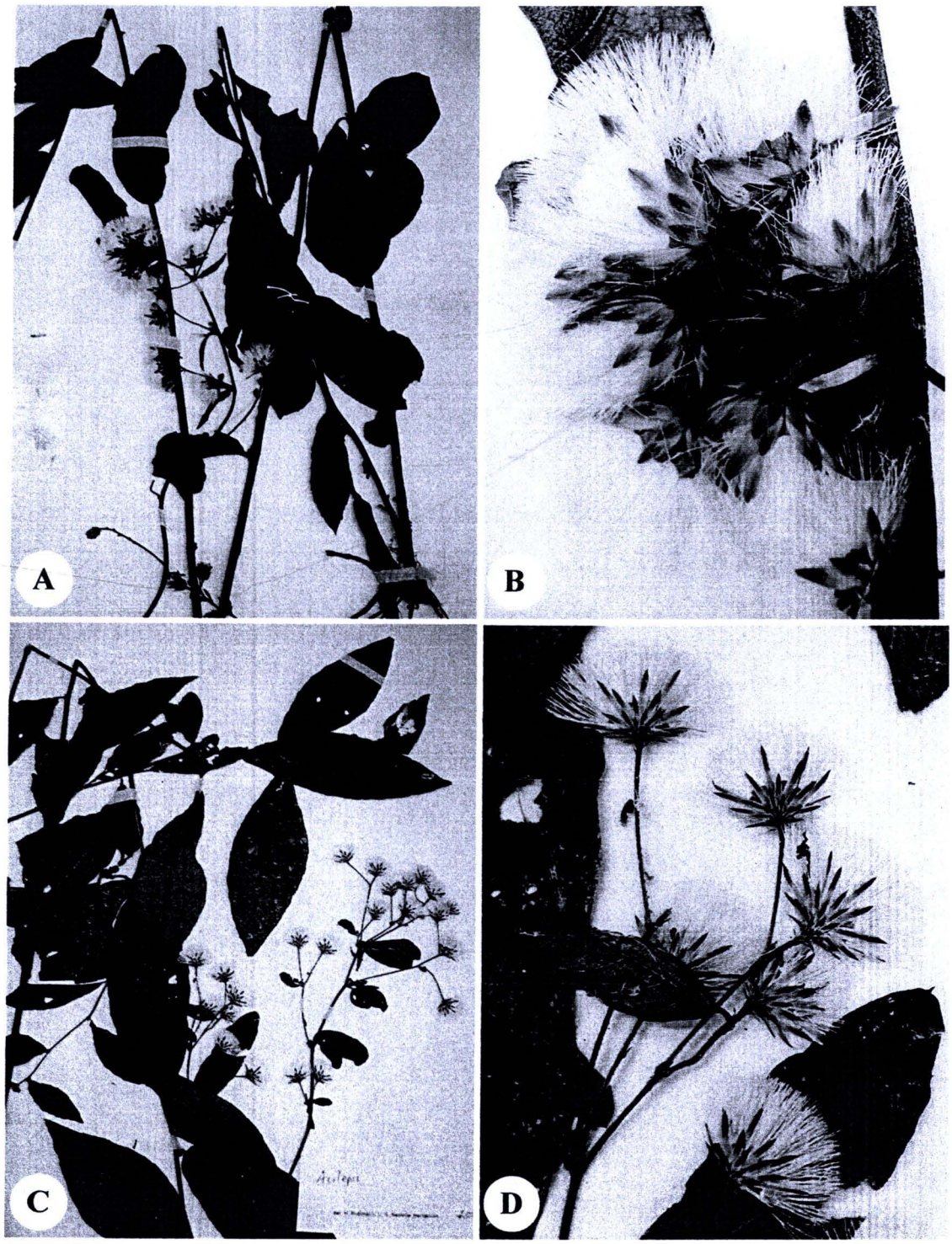


Figure 2.70 **A. & B.** *Acilepis tonkinensis*

C. & D. *Acilepis virgata*

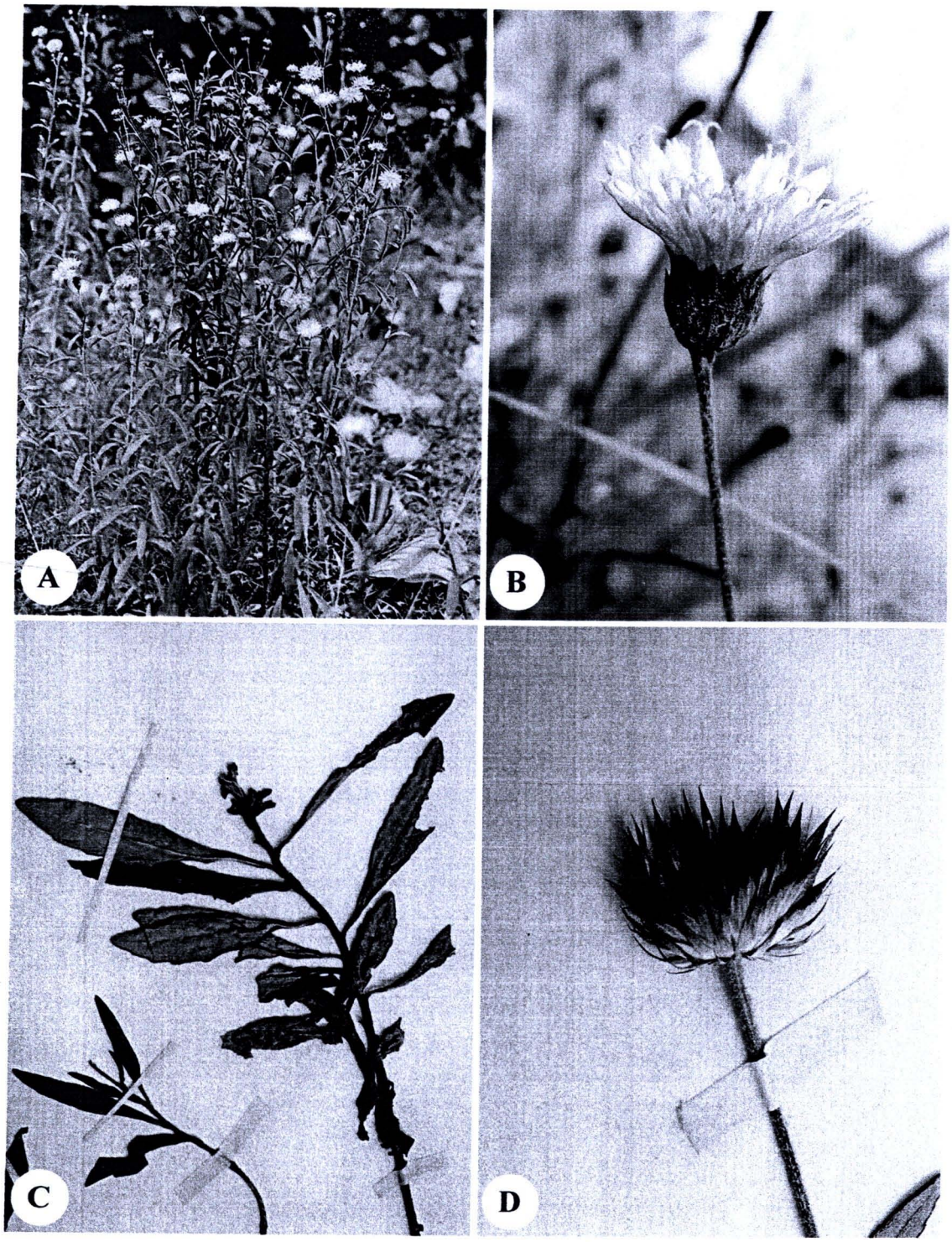


Figure 2.71 **A. & B.** *Camchaya gracilis*

C. & D. *Camchaya kampotensis*

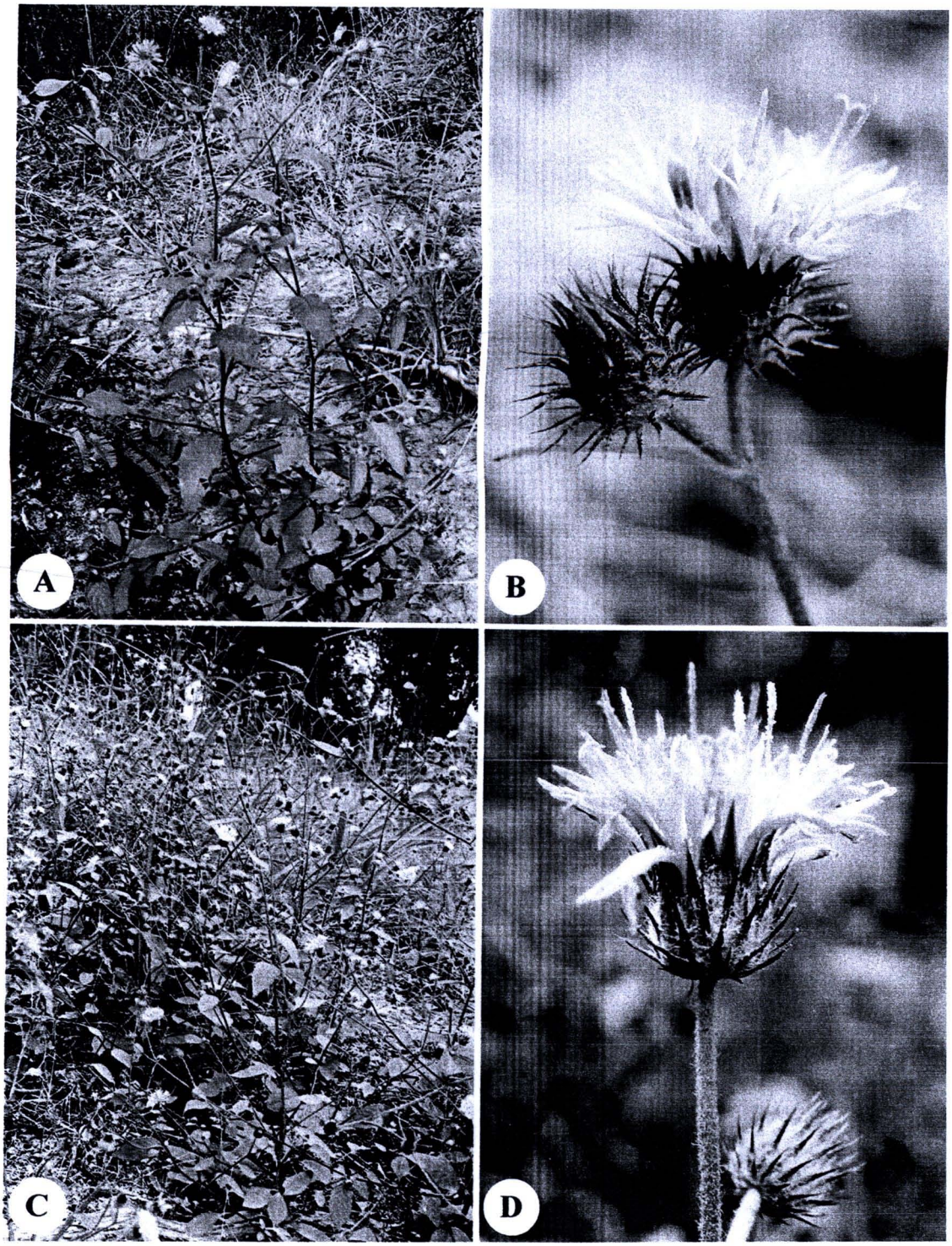


Figure 2.72 **A. & B.** *Camchaya loloana* var. *loloana*

C. & D. *Camchaya loloana* var. *mukdahanensis*

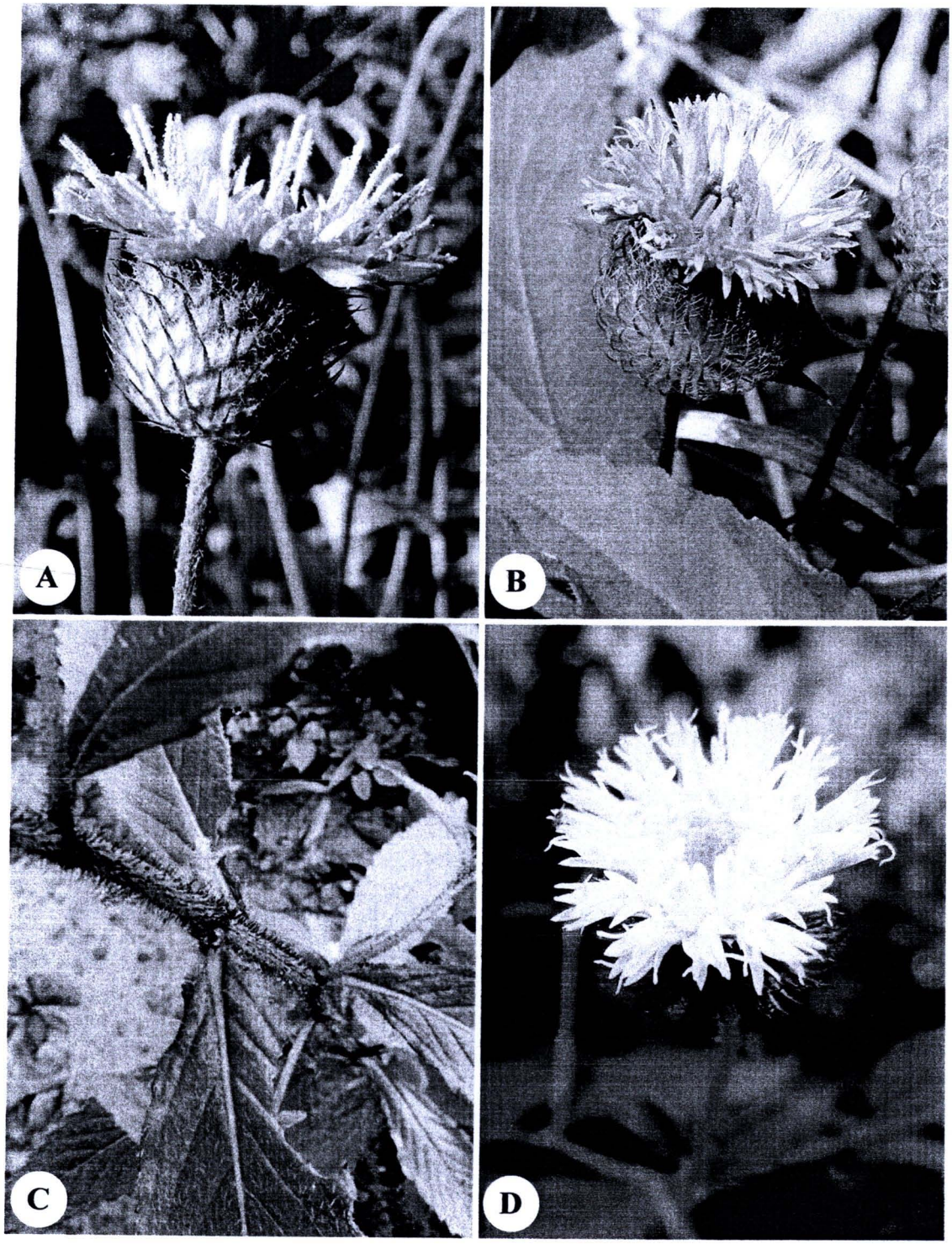


Figure 2.73 **A.** *Camchaya pentagona*

B. - D. *Camchaya spinulifera*

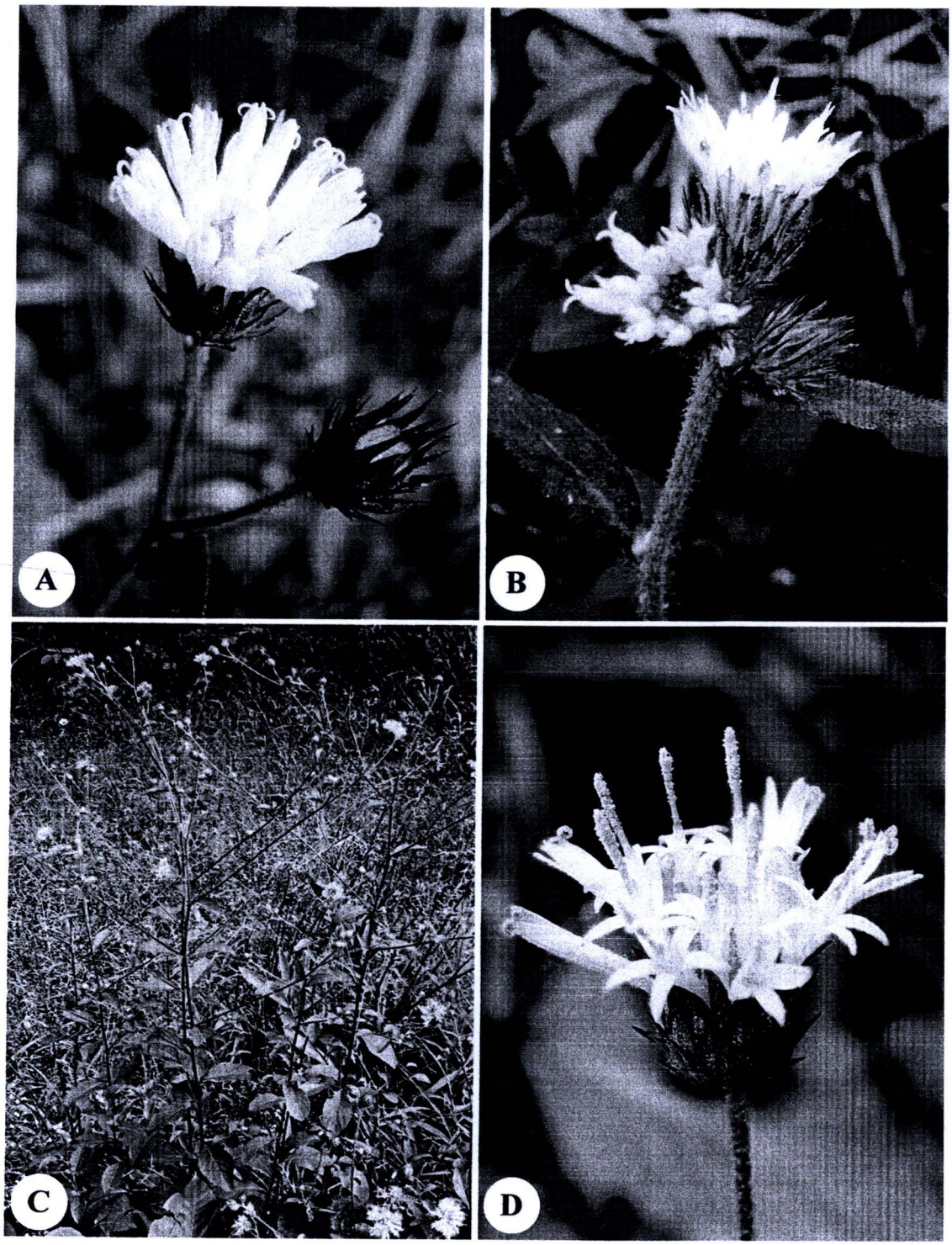


Figure 2.74 **A. & B.** *Camchaya tenuiflora*

C. & D. *Camchaya* sp.

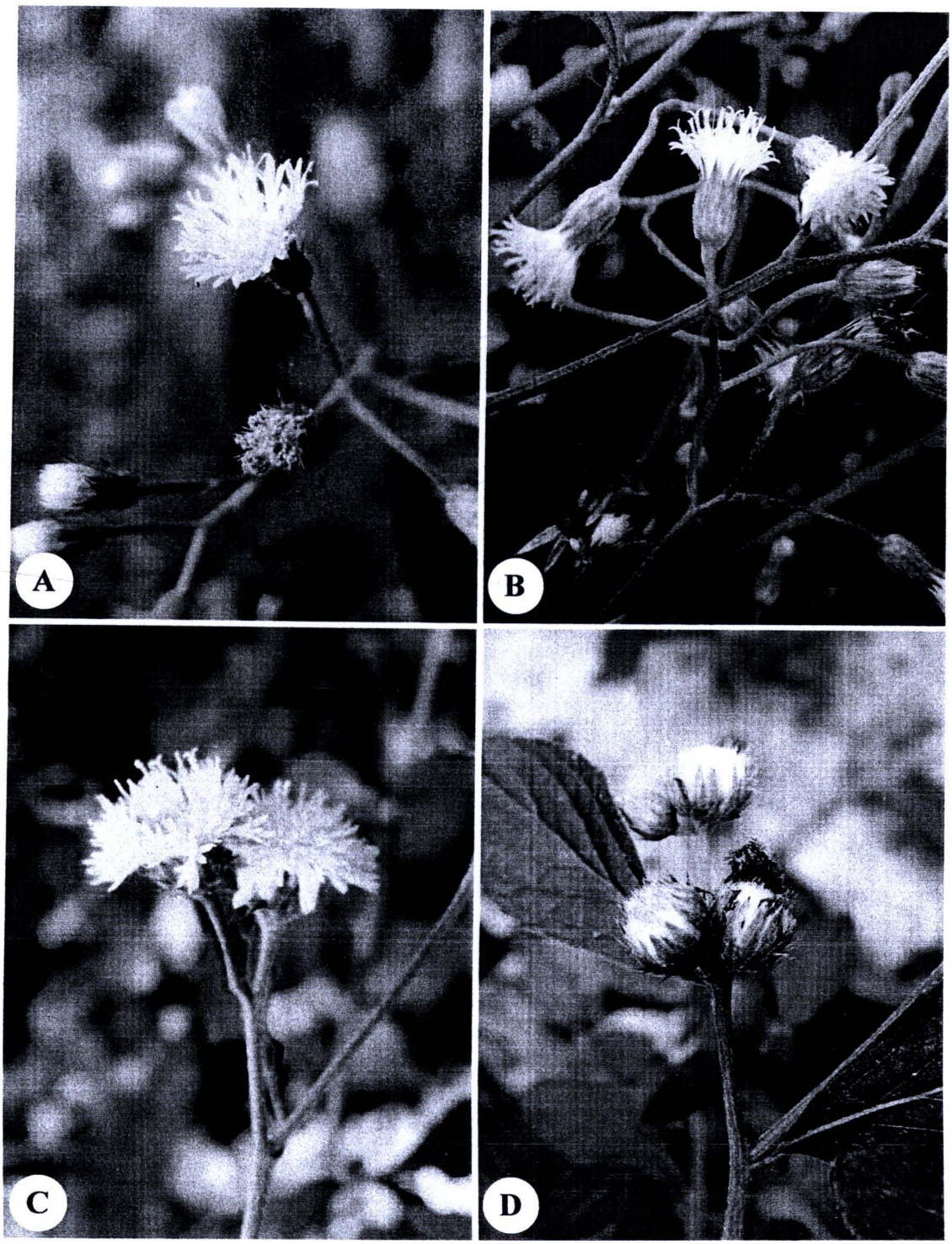


Figure 2.75 **A. & B.** *Cyanthillium cinereum*

C. & D. *Cyanthillium hookerianum*

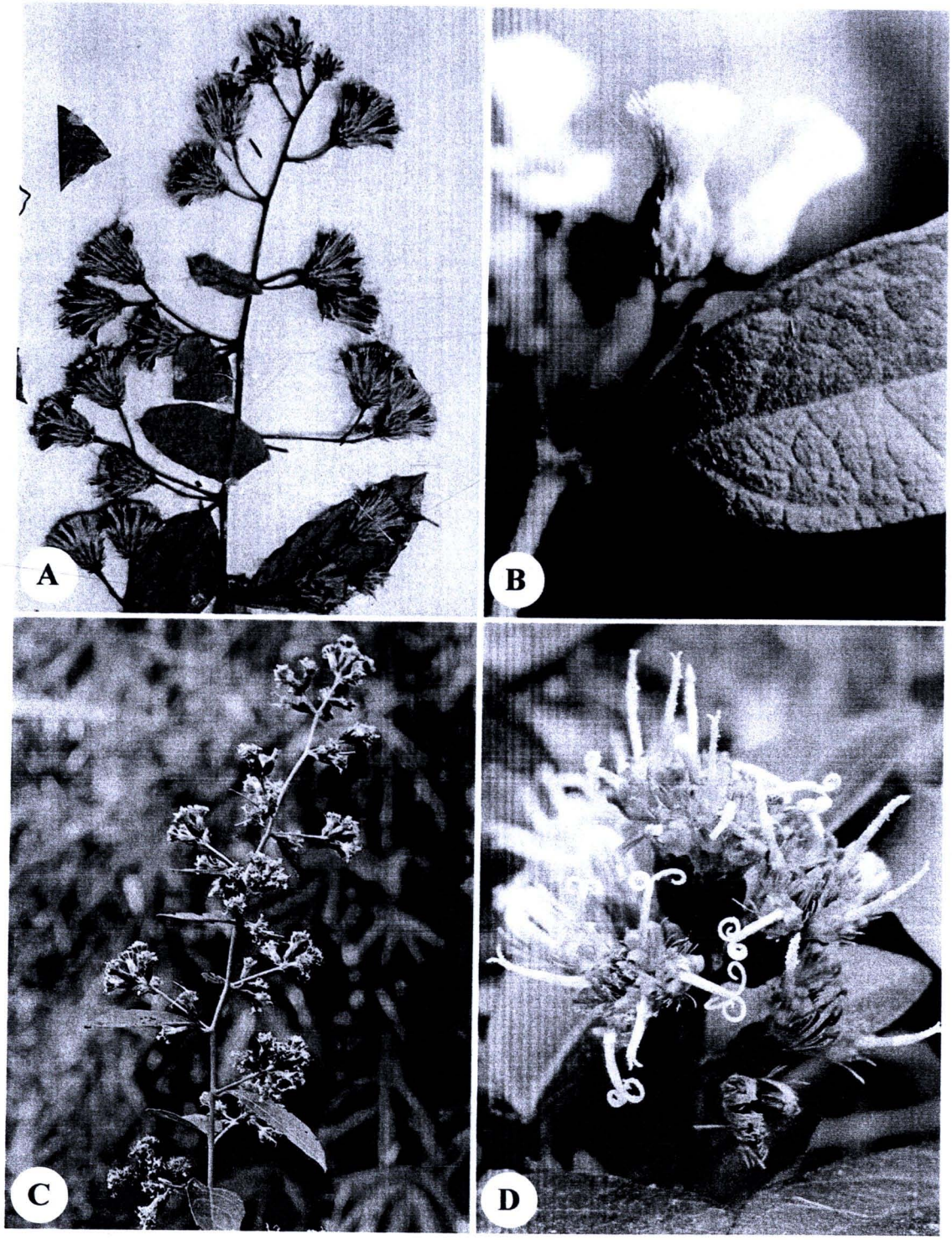


Figure 2.76 **A. & B.** *Decaneuropsis cumingiana*

C. & D. *Decaneuropsis eberhardtii*

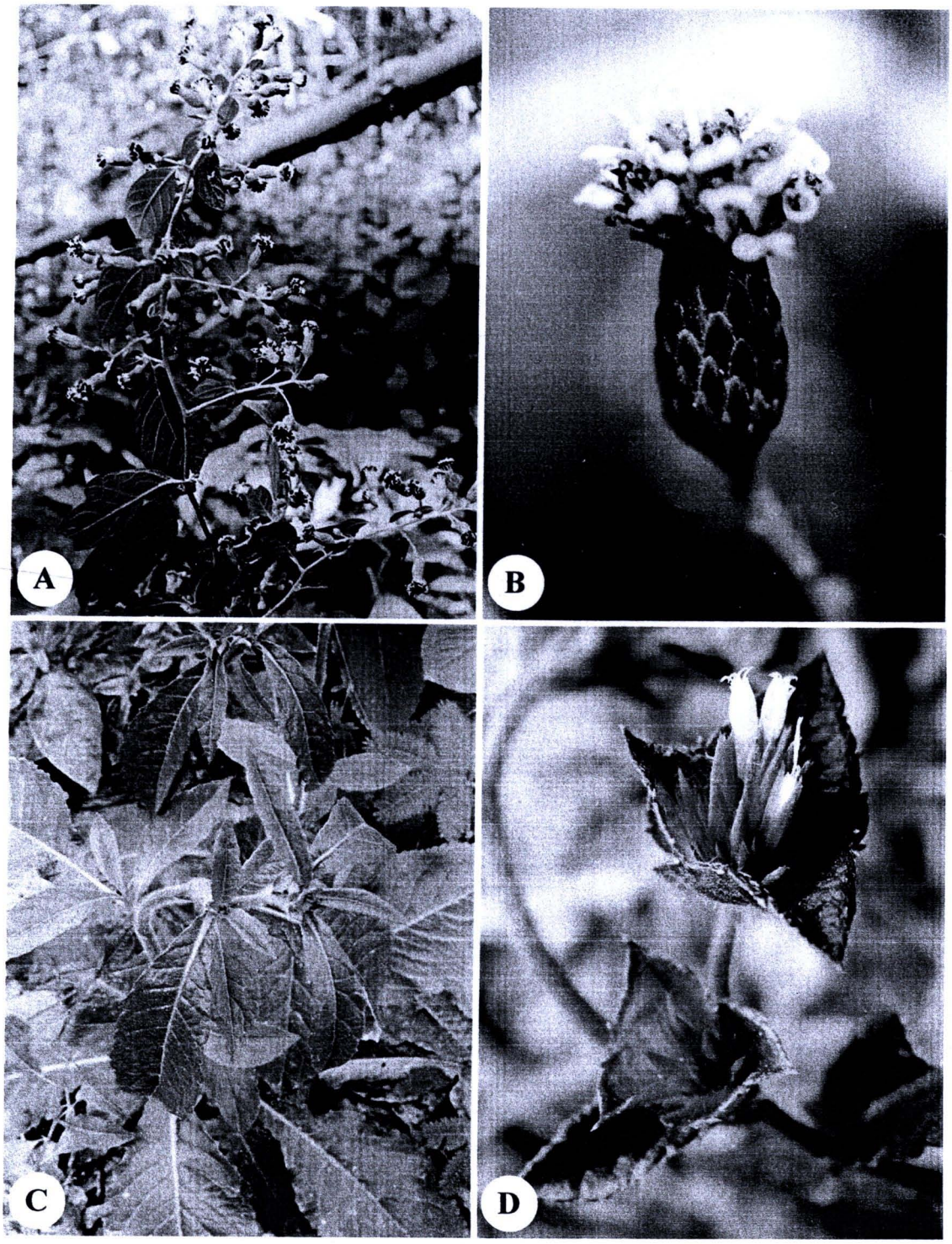


Figure 2.77 **A. & B.** *Decaneuropsis garrettiana*

C. & D. *Elephantopus mollis*

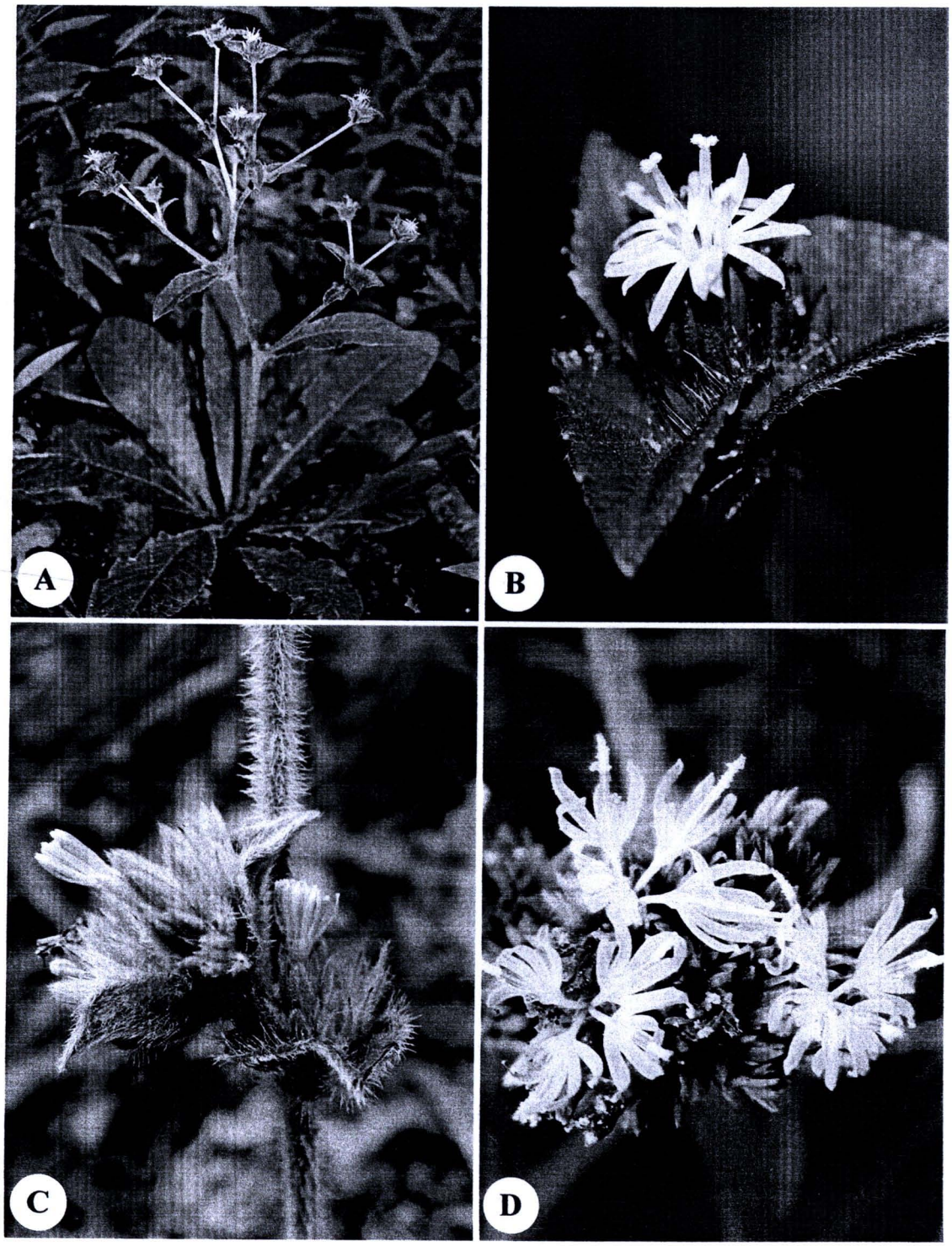


Figure 2.78 **A. & B.** *Elephantopus scaber* var. *scaber*

C. & D. *Elephantopus scaber* var. *penicillatus*

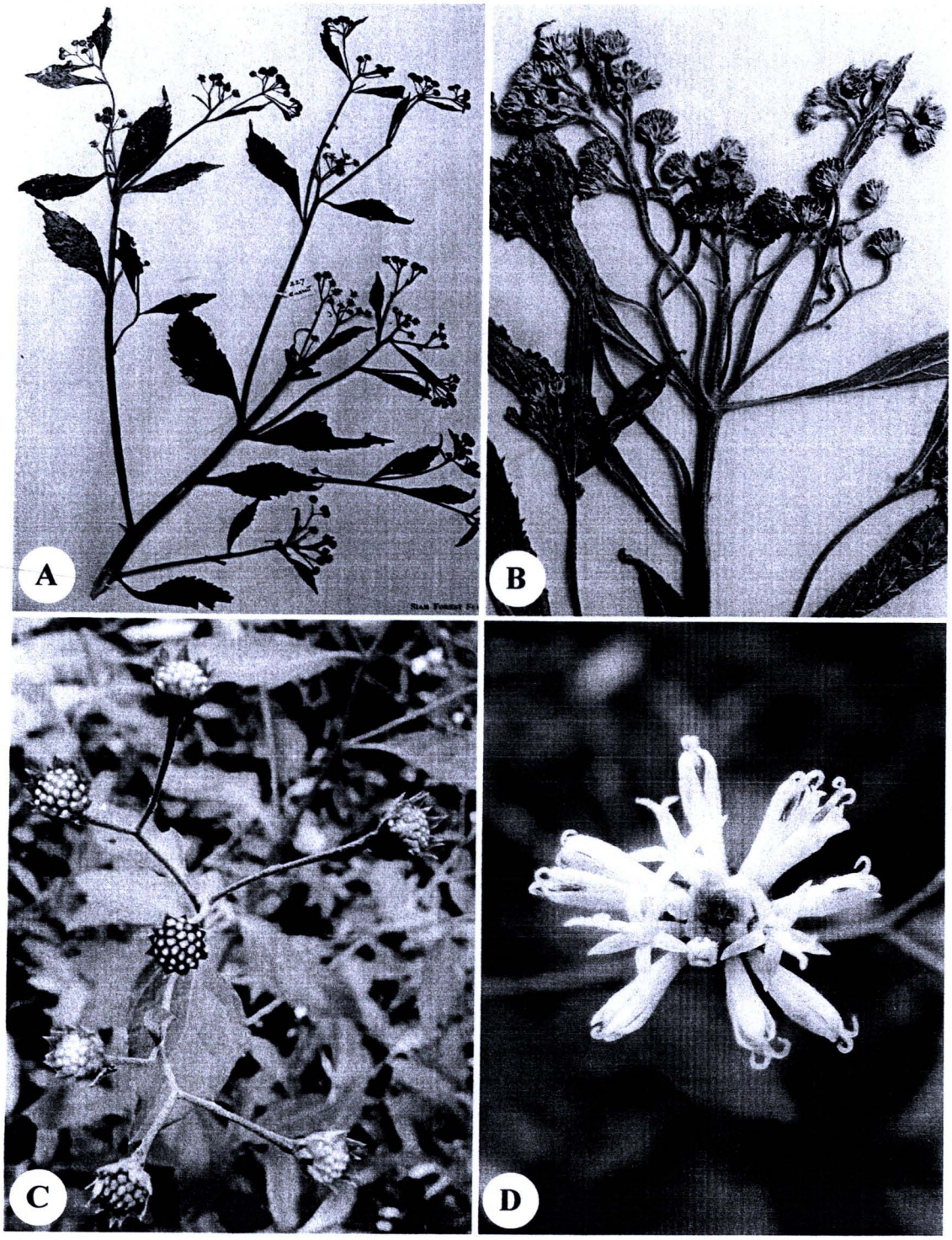


Figure 2.79 **A. & B.** *Ethulia cornizoides*

C. & D. *Iodocephalopsis eberhardtii*

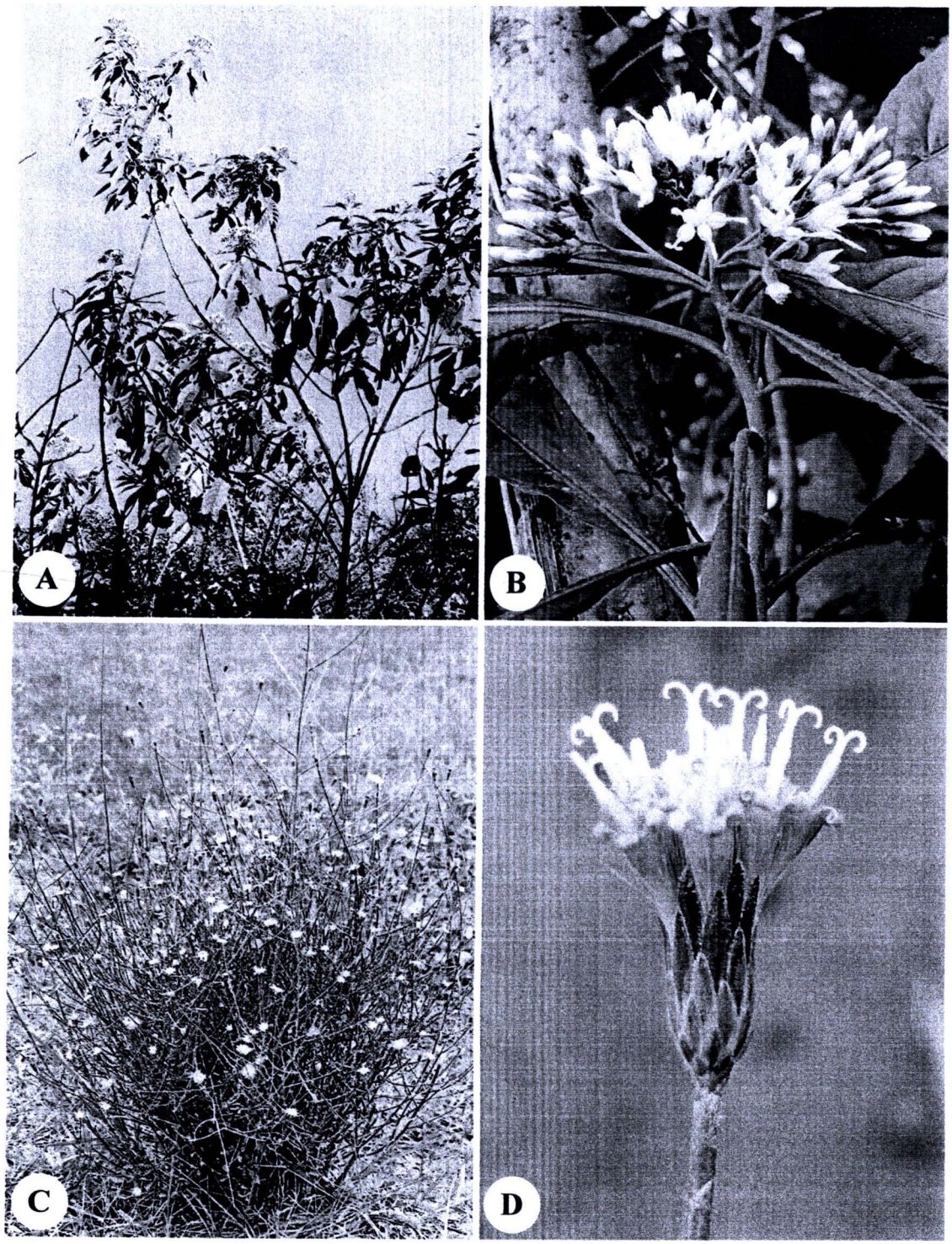


Figure 2.80 **A. & B.** *Gymnanthemum cylindriceps*

C. & D. *Kurziella gymnoclada*

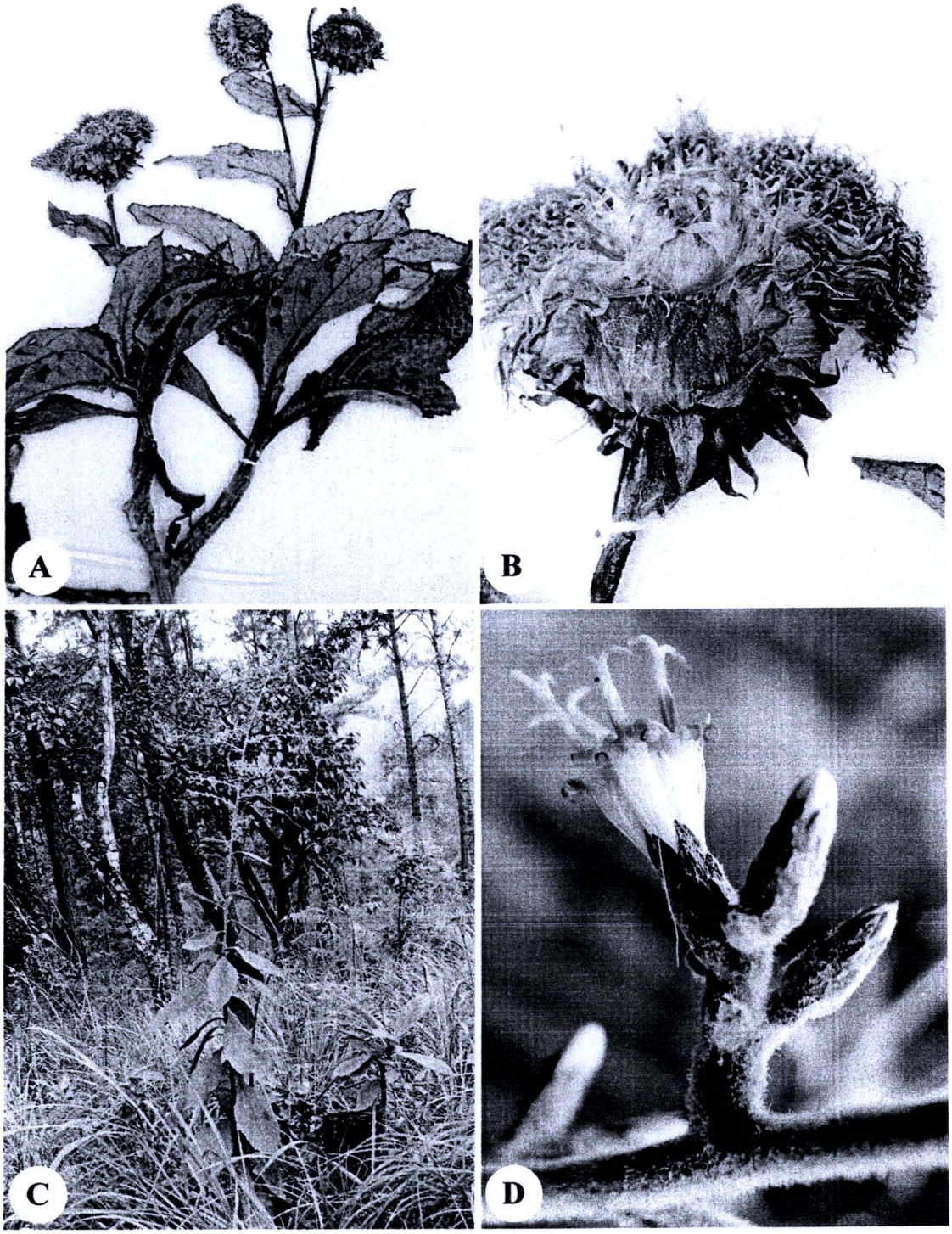


Figure 2.81 **A. & B.** *Koyamasia calcarea*

C. & D. *Monosis parishii*

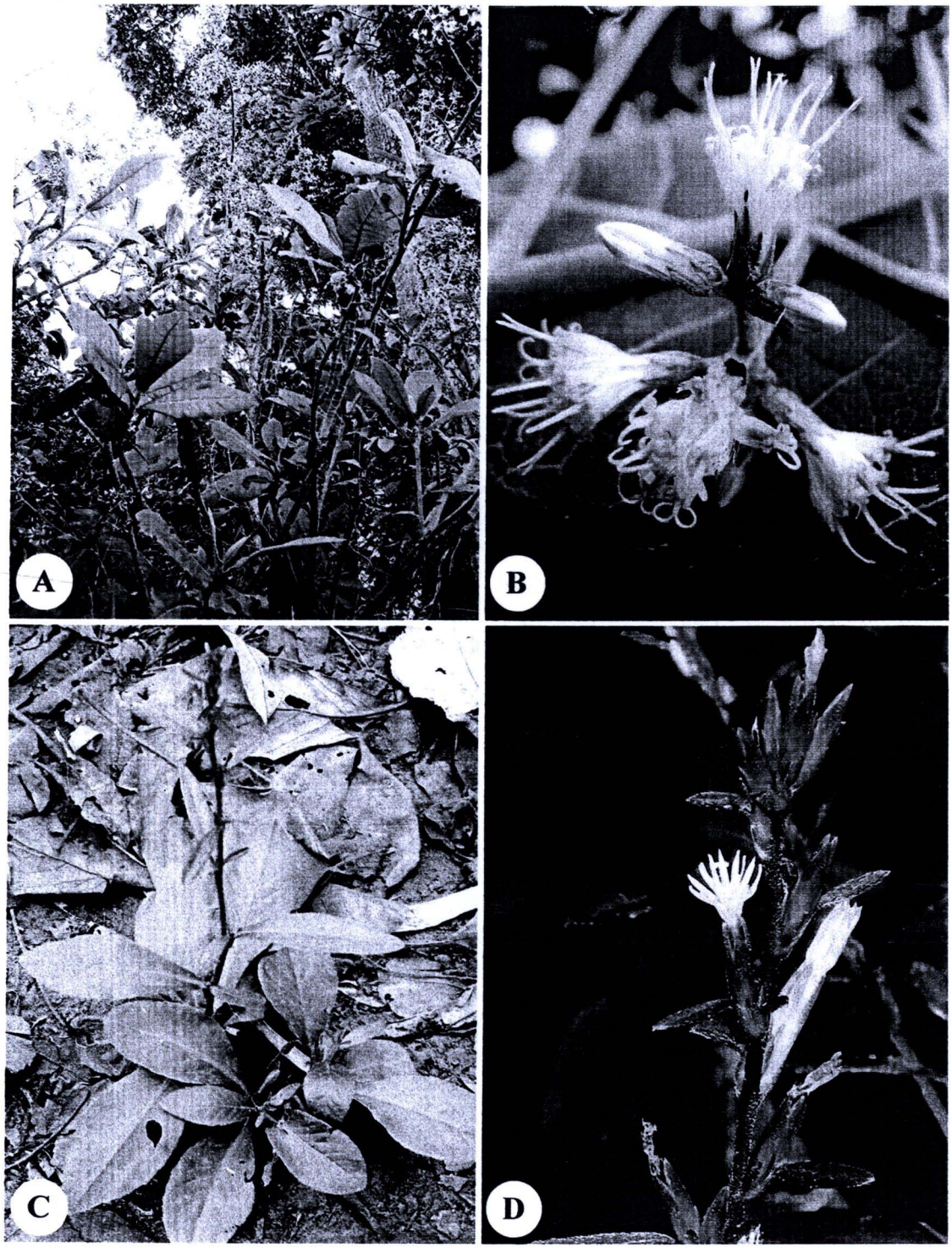


Figure 2.82 **A. & B.** *Monosis volkameriifolia*

C. & D. *Pseudelephantopus spicatus*

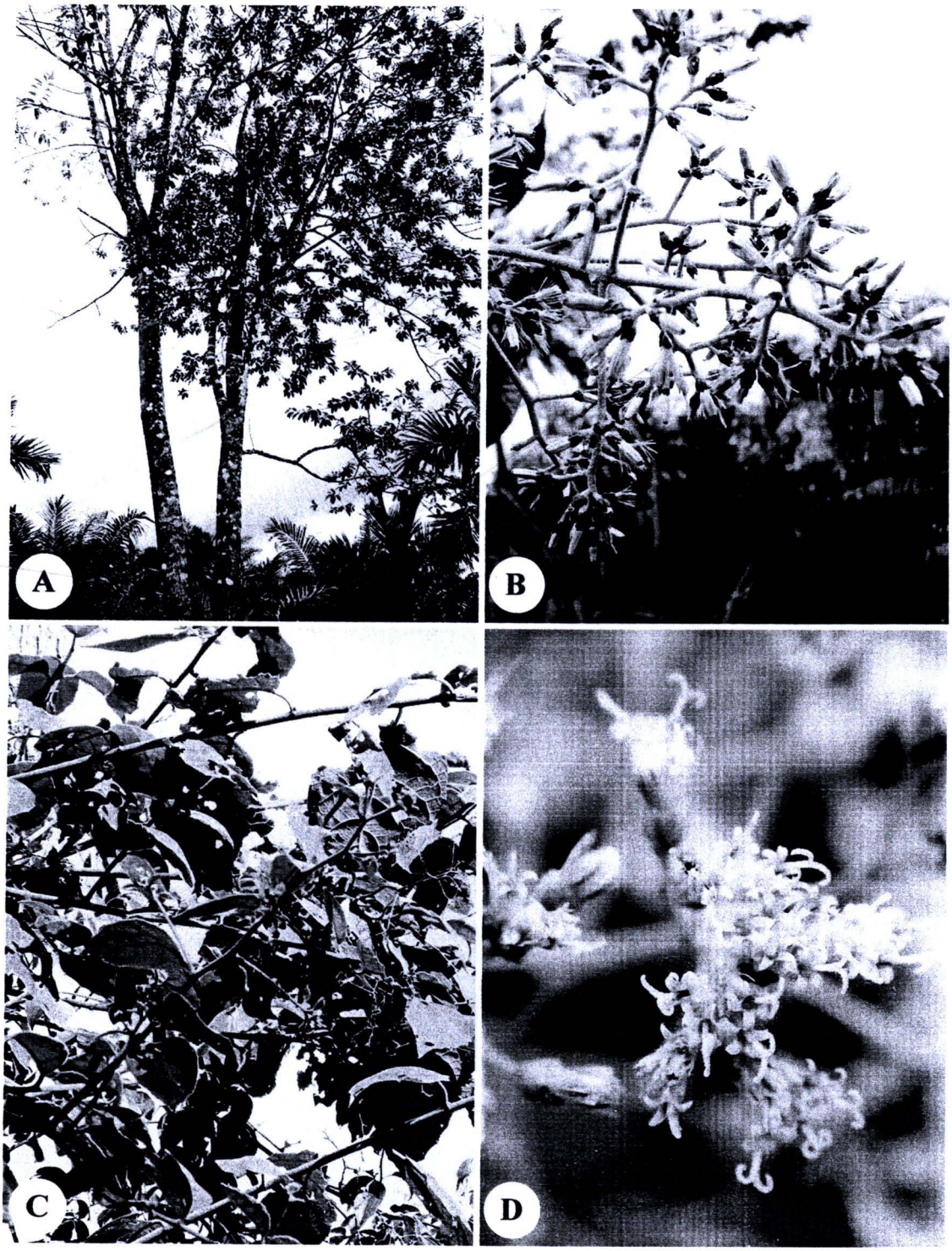


Figure 2.83 **A. & B.** *Strobocalyx arborea*

C. & D. *Strobocalyx solanifolia*

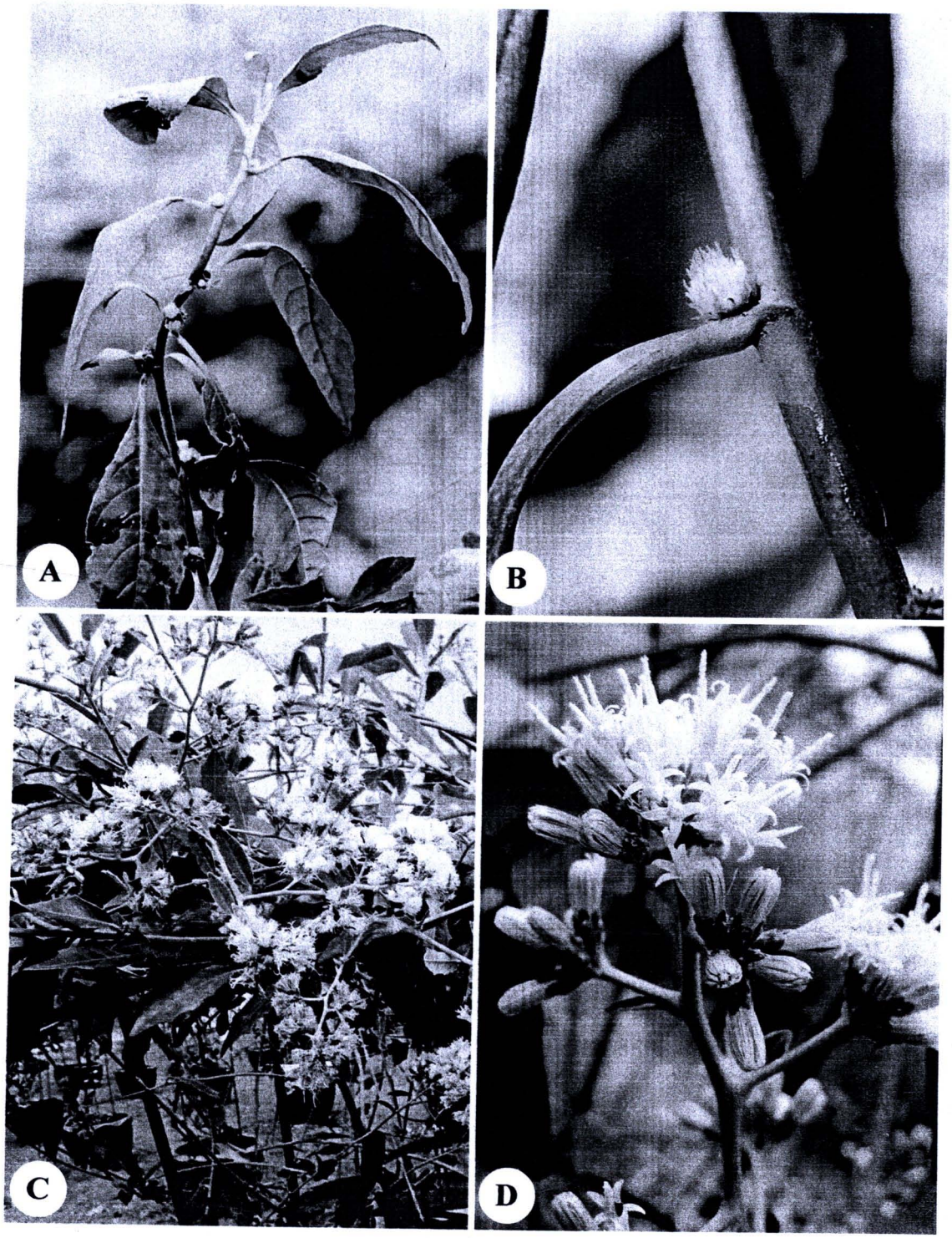


Figure 2.84 **A. & B.** *Sparganophoros sparganophora*

C. & D. *Tarlmounia elliptica*

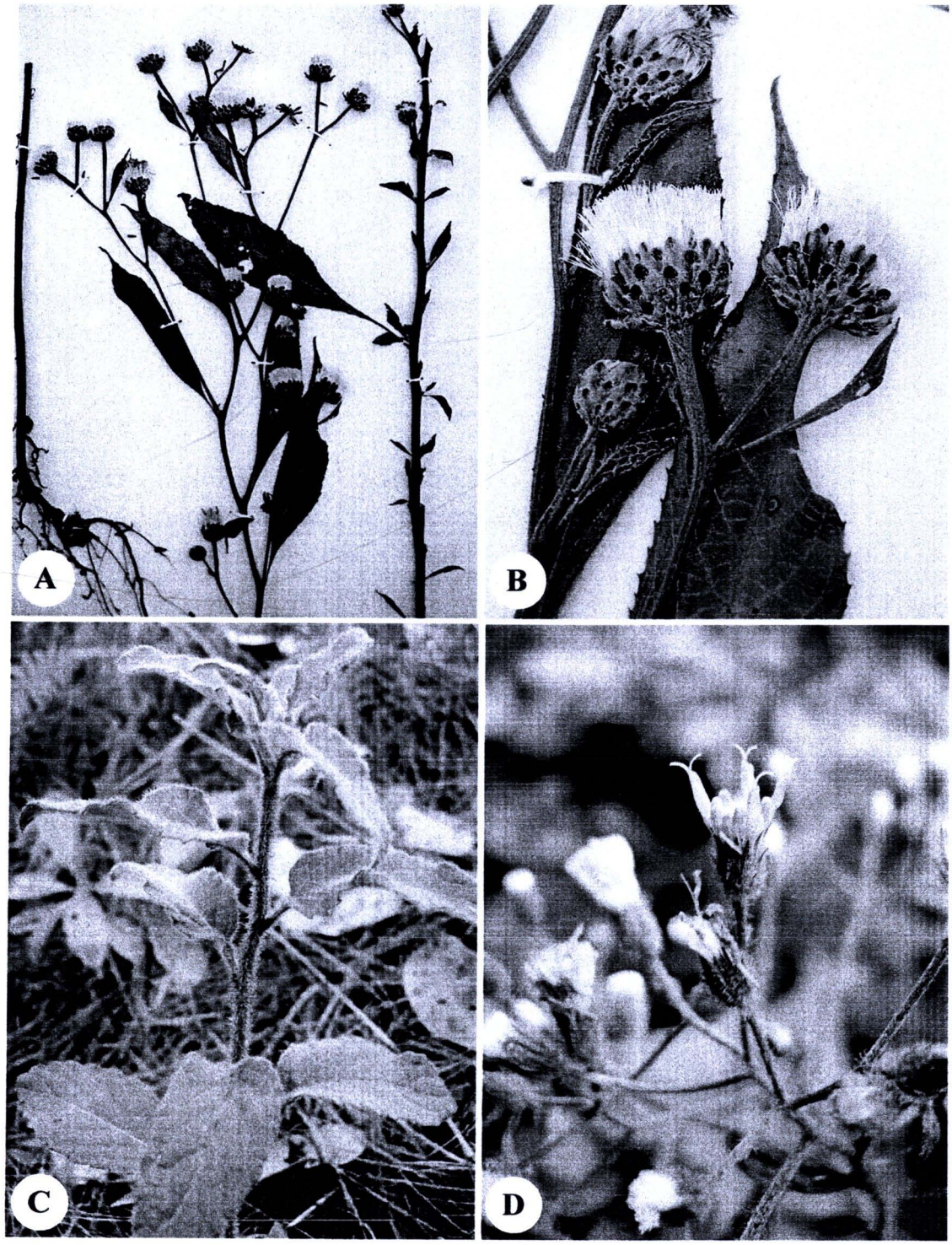


Figure 2.85 **A. & B.** *Vernonia birmanica*

C. & D. *Vernonia cinerea* var. *montana*

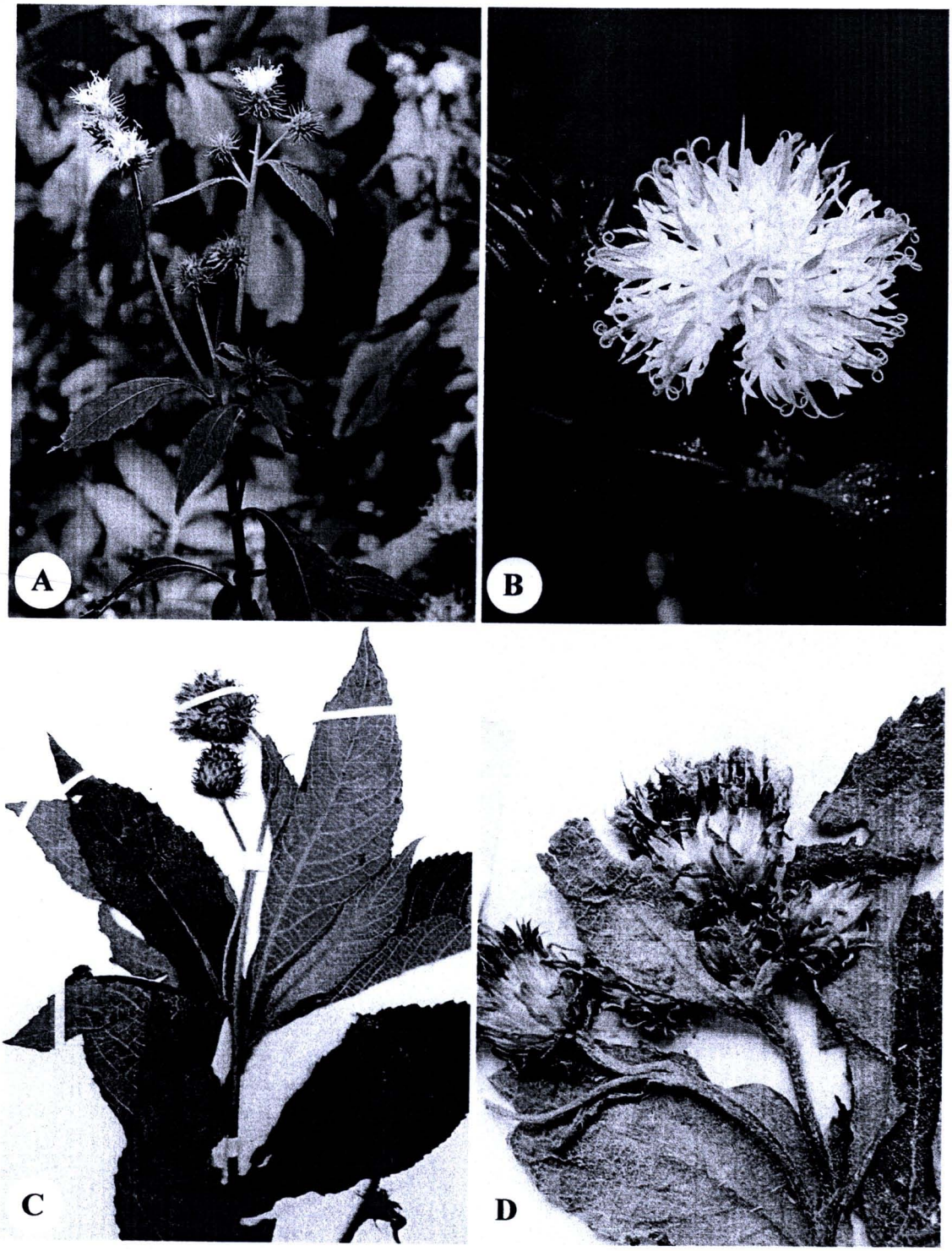


Figure 2.86 **A. & B.** *Vernonia curtisii* var. *curtisii*

C. & D. *Vernonia curtisii* var. *tomentosa*

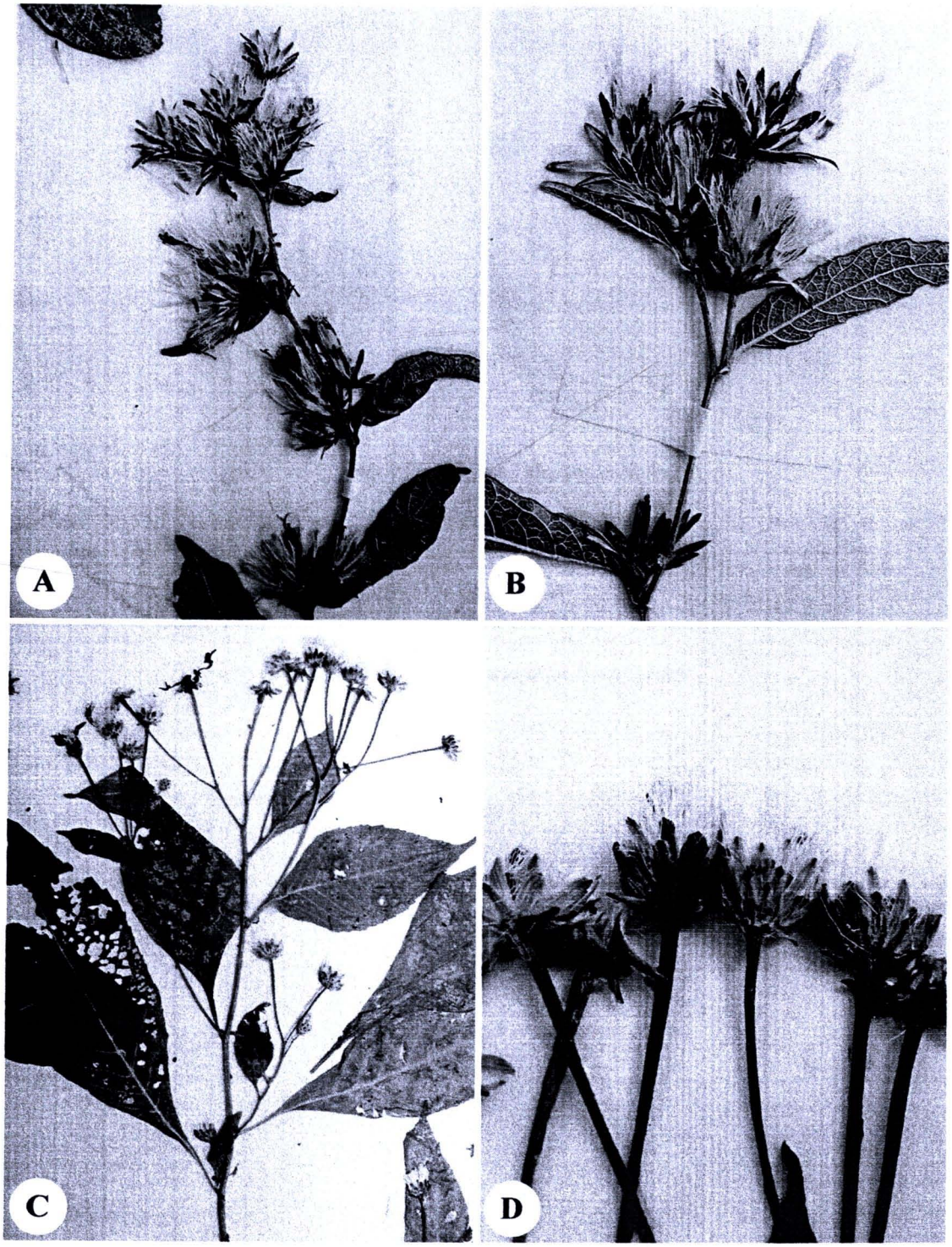


Figure 2.87 **A. & B.** *Vernonia kerrii*

C. & D. *Vernonia pseudobirmanica*

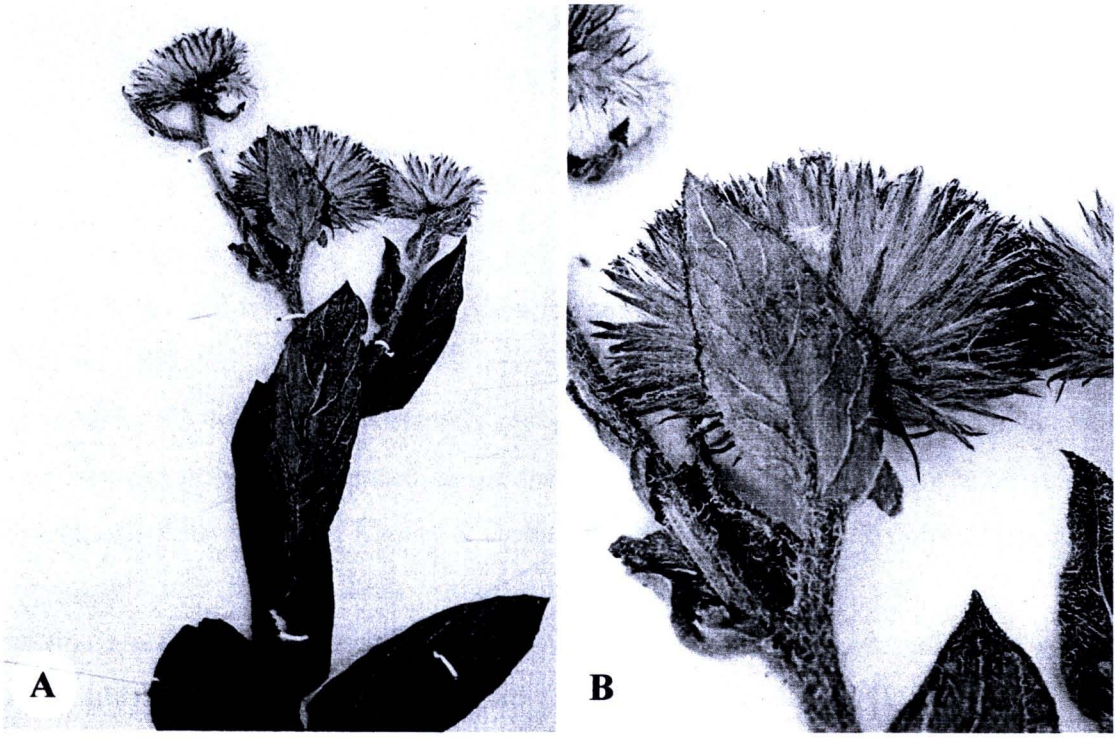


Figure 2.88 **A. & B.** *Vernonia pulicarioides*