

## ***Asteraceae* Diversity and A New Record For Java at Citalahab Village, Gunung Halimun-Salak National Park**

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**Abstract:** *Asteraceae* is the second largest plant family in the world. The family member has reached 227 species in Java. However, there is no current record of wild *Asteraceae* around local village within Gunung Halimun-Salak National Park. This study is to provide current *Asteraceae* species data and the threat for the conservation area. Explorative method has been conducted in 6 sites. The result shows that there are 20 species found with the tribes composition are 8 *Heliantheae*, 6 *Eupatorieae*, 3 *Senecioneae*, 1 *Astereae*, 1 *Cichorieae*, and 1 new record *Vernonieae* in Java. Key identification for species are provided and the new record has been described. Most species categorized as introduced with several other categorized as invasive alien species. In conclusion, numbers of *Asteraceae* family has been recorded with some potential invasive threat in Gunung Halimun-Salak National Park. Regular population control and treatment are recommended in order to protect native species in the conservation area.

**Keywords:** *Asteraceae*, *Elephantopus mollis*, Halimun-Salak, tea plantation

### **Introduction**

*Asteraceae* Bercht. & J. Presl are the second largest genera in the world with about 1623 genera and 24.700 species (Funk, *et al.*, 2009; Shi, *et al.*, 2011; Christenhusz & Byng, 2016). The family could be found abundantly with high number of diversity, start from tropical, subtropical, semi-arid, to mediteranian area. Besides, *Asteraceae* could also grow from sea level to alpin zone (Cox, *et al.*, 2016). Majority of *Asteraceae* member are easily wide spreading far by wind in seeds and adaptable across area or even continent (Pons, *et al.* 1987; Keeley, *et al.* 2007; Jeffrey, 2009).

Based on *Flora of Java* and updated data after, it has been recorded that there are about 227 species *Asteraceae* occur in Java (Backer & Bakhuizen van den Brink, 1965; Irsyam & Hariri, 2016; Padmanaba, *et al.* 2017). Many of the

species are known as introduced or even invasive alien species (Backer & Bakhuizen van den Brink, 1965; Yoshihumi, *et al.* 2014). That absolutely could become latent danger for native species, especially in conservation area.

Gunung Halimun-Salak National Park is a unique location. The national park are surrounded by Mount Halimun Utara (1.929 m asl), Mount Ciawitali (1.530 m asl), Mount Kencana (1.831 m asl), Mount Botol (1.850 m asl), Mount Sanggabuana (1.920 m asl), Mount Kendeng Selatan (1.680 m asl), Mount Halimun Selatan (1.758 m asl), Mount Endut (1.471 m asl), Mount Sumbul (1.926 m asl), and Mount Salak (2211 m asl) (Hartono *et al.* 2007). However, there are villages and tea plantation inside layers of mountain which not include in conservation site area (Wisnubudi, 2009). Uji (2002) has found seven species *Asteraceae* in southern part of the National Park, Priyadi, *et al.* (2010) has made checklist for five hundred

species of Halimun-Salak, and Sunaryo, *et al.* (2012) has recorded there are two introduced species *Asteraceae* grow with one of that occur as invasive species. However, there are no whole new checklist data about *Asteraceae*, especially inside tea plantation. Aim of this research is to report current data about *Asteraceae* species at the tea plantation. The result hopefully helpful to protect conservation area around from introduced and invasive alien species taxa.

## Material and Methods

### Sites

Field observation were done at Nirmala tea plantation and surround area, Citalahab Village, Inside non-conservation site of Gunung Halimun-Salak National Park (1002—1149 m asl) on January 2019. There are 6 locations for field samplings.

1. Rice fields (RF: S 06° 44.364' E 106° 31.842').
2. Upper village/Citalahab Bedeng (VI: S 06° 44.110' E 106° 31.780')
3. Tea plantation 1 (TP1: S 06° 44.346' E 106° 31.967').
4. Tea plantation 2 (TP2: S 06° 44.238' E 106° 31.950')
5. Tea plantation 3 (TP3: S 06° 44.575' E 106° 32.403')..
6. Near Curug Macan (Macan Waterfall) (CM: S 06° 44.768' E 106° 32.400').

### Material

Material used are scissor, graduated ruler, pencils, notebook, black backdrop, alcohol 70%, newspapers sheet, Global Positioning System (GPS) Garmin 64S and camera NIKON Coolpix P520.

### Plants Sampling

Explorative method is used with 20 x 20 meters roaming area. Dried herbarium specimens had been made using 70% alcohol. Following characters had been identified and described by measuring size and shape of the stems, leaves, florets, and cypsela. Data analysis and key identification had been made descriptively. Herbarium stored at Department Biology, Faculty Mathematics and Natural Sciences, Universitas Indonesia.

## Result and Discussion

### Asteraceae Diversity

There were found 20 wild *Asteraceae* species during field observation in Nirmala tea plantation at Gunung Halimun-Salak National Park, West Java, in January 2019 (fig. 1). Most of species had been found common at RF, VI, TP1, TP2, and TP3, but absent at CM, *Ayapana triplinervis* had only found at RF, *Lactuca indica* had only found at VI, and *Adenostemma lavenia* had only found around CM (table 1). *Adensotemma. lavenia* had seen with uncommon habit for *Asteraceae* because the species could grow under the shade of trees. Moreover, the species had been seen spread extend to the forest within conservation site.

One of the species are related to *Elephantopus* genera. It was certainly not the one that reported from *Flora of Java* (Backer & Bakhuizen van den Brink, 1965). The species similar to *E. scaber* by sessile heads with three foliage bract, but differ by white flowers color and florets position that emerge in axillar and terminal. Therefore, an examination for the species has been done.

### Key for species:

- 1a Flower homogamous .....2
- 1b Flower heterogamous .....11
- 2a Flower obviously ligulate. Corolla yellow, with 5 lobes at apex. Leaves subcoriaceous. Sap often milky..... *Lactuca indica*
- 2b Flower rather tubular.....3
- 3a Style-arms longer than corolla, glomerulate or glomeruliform ..... 4
- 3b Style-arms short ..... 9
- 4a Plant twining .....*Mikania micrantha*
- 4b Plant terrestrial erect ..... 5
- 5a Heads rather scattered on terminal paniculiform. Cypsela tuberculate and sticky..... *Adenostemma lavenia*
- 5b Heads in paniculiform corymbs and dense..... 6
- 6a Herb to small shrub about 1 m or less..... 7
- 6b Large shrub 2 m or more..... 8

7a Flower about 20, corolla about 6 mm long, white. Leaves oblong to lanceolate, with glabrous or subglabrous surface .....*Ayapana triplinervis*  
 7b Flower 60—75, corolla 1—1,5 mm long, white or purple. Leaves broadly ovate, triangular-ovate, or rhomboid-ovate, both surface covered with long hair ..... *Ageratum conyzoides*

8a Heads 1—2 cm long, flower white to bright purple. Stem often has swollen globose part..... *Chromolaena odorata*  
 8b Heads small, 5—6 mm long.....  
 .....*Austroeupatorium inulaefolium*

9a Head discoid. Receptacle paleate. Bear only up to 4 flowers. Flower white, zygomorph with 5 lobes..... *Elephantopus mollis* (Fig. 2)  
 9b Head cylindric, more or less elongate. Receptacle epaleate. Involucre mostly calyculate  
 .....10

10a Involucre calyculate. Heads nodding during anthesis, erect after.....  
 ..... *Crassocephalum crepidioides*  
 10b Involucre without calyculate on outer layer .....*Emilia sonchifolia*

11a Ray flower inconspicuous or filiform. Heads cylindric or disciform..... 12  
 11b Ray flower conspicuous and ligulate. Heads radiate or discoid..... 14

12a Cypsela without hairy pappus, exocarp fleshy and endocarp stony, with black persistent involucre. Flowers white.....  
 .....*Clibadium surinamense*  
 12b Cypsela with hairy pappus .....13

13a Head disciform. Pappus yellow or brownish  
 ..... *Erigeron sumatrensis*  
 13b Head cylindric. Pappus white with red or purple at the upper part. Involucre calyculate  
 .....*Erechtites valerianifolia*

14a Ray flower yellow .....15  
 14b Ray flower white .....18

15a Pappus present, 2—3. Cypsela 1—3 mm. Heads conical..... *Acmella paniculata*

15b Pappus reduced to awned or wanting.....  
 ..... 16

16a Pappus awned..... *Calyptocarpus vialis*  
 16b Pappus wanting ..... 17

17a Ray flower about 15 mm long. Basal leaves often with 3 lobes, margin serrate  
 ..... *Sphagneticola trilobata*  
 17b Ray flower 5—7 mm long. Leave simple, margin crenate-serrate .....*Synederella nodiflora*

18a Leaves imparipinnate..... *Bidens pilosa*  
 18b Leaves simple.....19

19a Ray flower 4—5. Pappus present  
 ..... *Galinsoga parviflora*  
 19b Ray flower numerous. Pappus wanting  
 ..... *Eclipta prostrata*

## Discussion

### Note on Asteraceae Species in Citalahab

Several *Asteraceae* species at tea plantation, Citalahab village, are categorized well as introduce, weed, or even invasive alien species in Java (Kostermans, *et al.*, 1987; Zachariades, *et al.*, 2009; Sunaryo, *et al.* 2012; Yoshihumi, *et al.* 2014; Padmanaba, *et al.* 2017). Most of species originally come from South, Central, and North America long time ago, except *C. crepidioides* that native to tropical Africa. Only *A. lavenia*, *E. sonchifolia*, and *L. indica* that has wide distribution in Old World including Asia tropical to Pacific, make that likely native in Malesia (Backer & Bakhuizen van den Brink 1965; Shi, *et al.*, 2011; Monge, *et al.*, 2016; Nisyawati & Mustaqim, 2017).

*Adenostemma lavenia* has number varieties across region. Panigrahi (1975) studied that there are eight varieties within species in India region. Though this taxa has complex issues, but all the varieties has similar ecological condition to grow-well in shades and near water resource. Species *A. lavenia* already reported tend to grow under the shade and humid localities in Java (Backer & Bakhuizen van den Brink, 1965). That report has same condition with the ecology of two *A. lavenia* varieties in Australia which were found on the edge of creeks and swamps (Orchard, 2011). Besides, *A. lavenia* that

found at Leuser, Aceh, has similar location on high mountains (Tjitrosoedirdjo, 2002). That created a note that edge effect of the areas has potential concern to overpopulated this species.

*Ayapana triplinervis*, write as *Eupatorium triplinerve* in Flora of Java, comes from Brazil (Backer & Bakhuizen van den Brink, 1965). This species spread to Java long time ago, but noted that rarely found in flowering phase. The expand and reproducing of the species often using rooting stem, wick seems not very effective for population growth. However, presence of *A. triplinerve* were not harmless. In Gunung Halimun-Salak National Park, the species already occur and become threat at three others southern areas (Uji, 2002).

Several ways to control the introduced species have been done by local people intentionally or not. Tea plantation has regular rejuvenation pruning. Weeds around the tea plant included in that field clearance, so that several *Asteraceae* species would lost periodically. That is more or less useful, though that still too hard to control the weeds to spread across large open areas around the national park. It must be consider that alien plant species are usually introduced and grew by several ways on purpose or not (Pons, *et al.* 1987; Westaway, *et al.* 2018).

The other way to control the population may comes from medicine, food, and livestock collecting. Generally, almost *Asteraceae* species in Indonesia, especially Halimun, are usable. Several sundanese ethnics often use *A. conyzoides*, *C. odorata*, *E. valerianifolia*, and *A. inulaefolium* with another species within the family for medicinal and food resource purposes (Sihotang, 2011; Putri, *et al.*, 2016; Malini, *et al.*, 2017). Most species even often used for livestock fodder and insects invitee, include for honey bee *Apis cerana* (Kostermans, *et al.*, 1987; Jasmi, 2017). Therefore, local people has important role to control the population of introduced species.

### A New Record of Alien Plant Species

Genera *Elephantopus* L., (*Asteraceae*, *Vernonieae*) are widely spread from old world to new world with about 28 species (Keeley & Robinson, 2009). The genera apparently arose from New World Andean-based according to lineage (Keeley, *et al.* 2007). Within the Malesia subcontinental region of botany, genera *Elephantopus* are already recorded for Java (Backer & Bakhuizen van den Brink, 1965), Sumatra (Tjitrosoedirdjo, 2002), Peninsular Malaysia (Hashim, *et al.* 2010), Borneo (Indra,

*et al.* 2014), Sulawesi (Syah, *et al.* 2014; Rugayah, *et al.* 2015), to Lesser Sunda Islands (Westaway, *et al.* 2018).

*Elephantopus* had been found in the field observation has no match from any record in Java. After following examination, the species identified match as *E. Mollis*. This species was already reported by Moody (1989) to occurs as a weed in South East Asia, but it was recorded from The Phillipines and without mentioning the Indonesia as the sources of the record. Later, record from several main islands are available, such as Sumatra (Tjitrosoedirdjo, 2002), Borneo (Indra, *et al.* 2014), Sulawesi (Syah, *et al.* 2014; Rugayah, *et al.* 2015), and Lesser Sunda Islands (Westaway, *et al.* 2018). Besides, *E. Mollis* has long distance dispersal in the tribal history to move across the ocean (Keeley, *et al.* 2007), so that *E. mollis* occurrence in Java has strong reasons.

### Taxonomic treatments

*Elephantopus mollis* Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. 4(14): 26. 1820. – Type: Venezuela, Caracas, *Humboldt & Bonpland* no. 627 (holotype: P!),

**Description:** Herbs, 1 m tall. Stems erect or procumbent, terete or inconspicuously angled, hair pilose, whitish colored. Leaves rosulate at lower part, alternate upper part; sometimes with up to 2 foliage stipules, ovate to elliptic; petiole up to 10 mm or almost absent; lamina elliptic, oblong, to oblong-sphatulate, 10–16 cm long, 2–5,5 cm wide, base attenuate, margin crenate, slightly undulate near the base, apex acute; slightly coriaceous; both surfaces pilose; cauline leaves oblong-elliptic, oblong, to oblong-lanceolate, 2,5–8 cm, 0,5–3,5 cm wide. Heads terminal and axillary, branched; foliage bracts 3, deltoid; capitula tubular, 7–8 mm long; receptacle flat, about 1 mm in diam., glabrous; involucre tubular, 6.5–8 mm long, 3–4 mm in diam. Phyllaries 8, in 2 series, decussate, light green, margin entire, outer surface puberulous, without glands; the outer ovate, apex acute; the inner ones lanceolate, apex acuminate. Florets 4; corolla white, zygomorphic, glabrous; corolla tubes slender, 3–5 mm long, with 5 lobes, 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. Cypsel clavate, 2.5–3 mm long, pubescent, densely covered with twin hairs but lacking glands, inconspicuously ribbed; pappus consist of 5

bristles in one series, sigmoid at base, 3–5 mm long.

**Distribution:** Native to tropical America. Naturalized In Java at tea plantation Halimun-Salak (1049—1149 m asl) down to sub-district Nanggung, Bogor, and seen also in Cikole, sub-district Lembang, Bandung Regency, below the shade of *Pinus* trees.

**Specimens examined:** West Java, Citalahab, tea plantation, Dee Dee Al Farishy, DEE036A (Herbarium UI); West Java, Citalahab, tea plantation, Dee Dee Al Farishy, DEE036B (Herbarium UI); West Java, Citalahab, tea plantation, Dee Dee Al Farishy, DEE039 (Herbarium UI); West Java, Citalahab, tea plantation, Dee Dee Al Farishy, DEE050 (Herbarium UI).

**Ecology:** from open areas such as tea plantation to shady condition below *Pinus* forest, up to 1100 m asl.

**Phenology:** The species has been seen flowering in July 2018 at Cikole, Bandung Regency, West Java, then found flowering again in January 2019 at Citalahab, West Java. This phenology is different than related taxa *E. Scaber* that flowering only during the peak of drought season, from July to Oktober.

**Note:** distinguished by having larger leaves on the erect stem (vs few and small *E. scaber*) and predominantly white colored on whole corolla part (vs purple or violet on limb *E. scaber*).

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Table 1. Checklist of *Asteraceae* on tea plantation, Citalahab village, Gunung Halimun-Salak National Park

No.	Tribe	Species	RF	VI	TP1	TP2	TP3	CM
1	Astereae	<i>Erigeron sumatrensis</i> Retz.	✓	✓	✓	✓	✓	-
2	Cichorieae	<i>Lactuca indica</i> L.	-	✓	-	-	-	-
3	Eupatorieae	<i>Adenostemma lavenia</i> (L.) Kuntze	-	-	-	-	-	✓
4	Eupatorieae	<i>Ageratum conyzoides</i> (L.) L.	✓	✓	✓	✓	✓	-
5	Eupatorieae	<i>Astrouepatorium inulaefolium</i> (Kunth) R.M.King & H.Rob.	✓	✓	✓	✓	✓	-
6	Eupatorieae	<i>Ayapana triplinervis</i> (Vahl) R.M.King & H.Rob.	✓	-	-	-	-	-
7	Eupatorieae	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	✓	✓	✓	-	✓	-
8	Eupatorieae	<i>Mikania micrantha</i> Kunth	✓	✓	✓	-	✓	-
9	Heliantheae	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen	✓	✓	✓	✓	✓	-
10	Heliantheae	<i>Bidens pilosa</i> L.	✓	✓	✓	✓	✓	-
11	Heliantheae	<i>Calyptocarpus vialis</i> Less.	✓	✓	✓	✓	✓	-
12	Heliantheae	<i>Clibadium surinamense</i> L.	✓	✓	✓	-	✓	-
13	Heliantheae	<i>Eclipta prostrata</i> (L.) L.	✓	✓	✓	✓	✓	-
14	Heliantheae	<i>Galinsoga parviflora</i> Cav.	✓	✓	✓	✓	✓	-
15	Heliantheae	<i>Sphagneticola trilobata</i> (L.) Pruski	✓	✓	✓	✓	✓	-
16	Heliantheae	<i>Synedrella nodiflora</i> (L.) Gaertn.	✓	✓	✓	✓	✓	-
17	Senecionae	<i>Crassocephalum crepidioides</i> (Benth.) S.Moore	✓	✓	✓	✓	✓	-
18	Senecionae	<i>Emilia sonchifolia</i> (L.) DC. ex DC.	✓	✓	✓	✓	✓	-
19	Senecionae	<i>Erechtites valerianifolia</i> (Link ex Wolf) Less. ex DC.	✓	✓	✓	-	✓	-
20	Vernonieae	<i>Elephantopus mollis</i> Kunth	✓	✓	✓	✓	✓	-



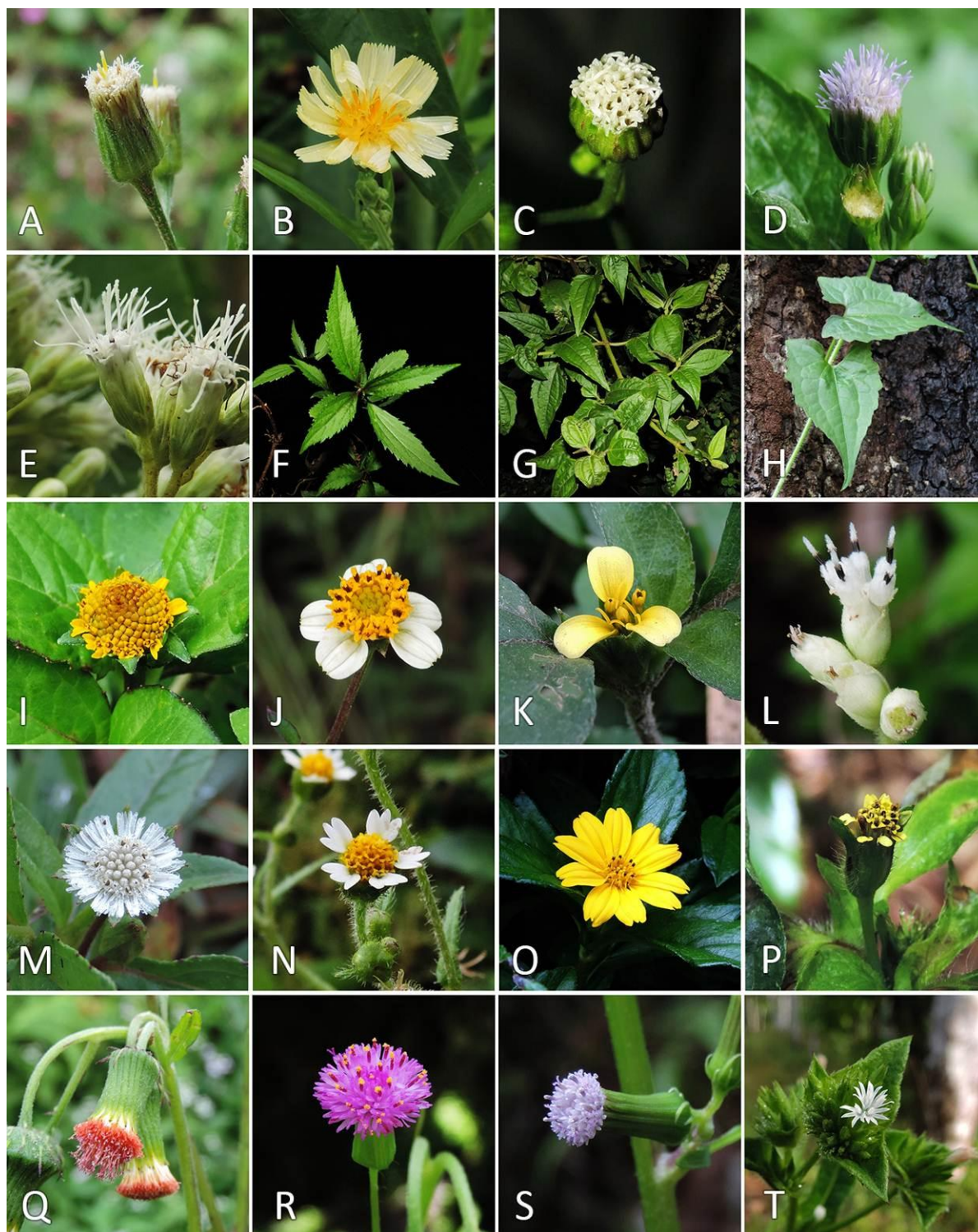


Figure 1. Asteraceae at Citalahab A. Astereae: *Erigeron sumatrensis*. B. Cichorieae: *Lactuca indica*. C—H. Eupatorieae: *Adenostemma lavenia*; *Ageratum conyzoides*; *Austroeupatorium inulaefolium*; *Ayapana triplinervis*; *Chromolaena odorata*; *Mikania micrantha*. I—P. Heliantheae: *Acemella paniculata*; *Bidens pilosa*; *Calyptocarpus vialis*; *Clibadium surinamense*; *Eclipta prostrata*; *Galinsoga parviflora*; *Sphagneticola trilobata*; *Synedrella nodiflora*. Q—S. Senecioneae: *Crassocephalum crepidioides*; *Emilia sonchifolia*; *Erechites valerianifolia*. T. Vernoniaceae: *Elephantopus mollis*

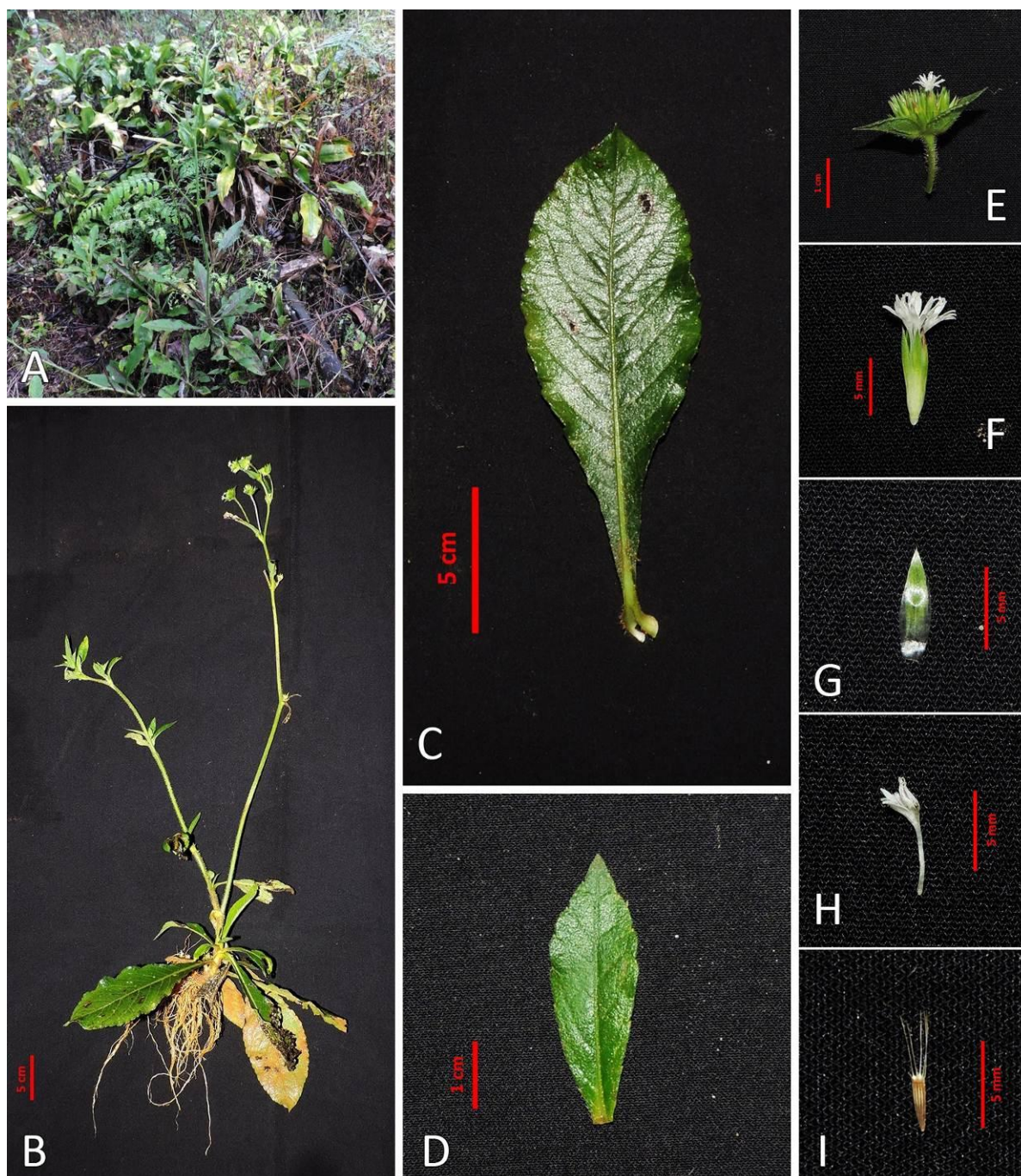


Figure 2. *Elephantopus mollis* A—B. Habitus. C. Rossete leaf. D. Cauline leaf. E. Head. F. Florets. G. Involucre. H. Flower. I. Cypsela.