**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 *Euaptoroeae*, 3 *Senecioneae*, 1 *Asteraeae*, 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

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**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 Ciwitali (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). Adenostemma lavenia had seen with uncommon habit for Asteraceae because the species could grow under the shade of trees. Moreover, the species had been been 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
1b Flower heterogamous
2a Flower obviously ligulate. Corolla yellow, with 5 lobes at apex. Leaves subcoriaceous. Sap often milky. Lactuca indica
2b Flower rather tubular.
3a Style-arms longer than corolla, glomerulate or glomeruliform
3b Style-arms short
4a Plant twining
4b Plant terrestrial erect
5a Heads rather scattered on terminal paniculiform. Cypsela tuberculate and sticky. Adenostemma lavenia
5b Heads in paniculiform corymbs and dense
6a Herb to small shrub about 1 m or less
6b Large shrub 2 m or more
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 disciform. 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 epaulet. Involucre mostly calyculate

10a Involucre calyculate. Heads nodding during anthesis, ............... erect after. ........................................ Crassocephalum crepidioides

11a Ray flower inconspicuous or filiform. Heads cylindric or disciform. ............... 12
11b Ray flower conspicuous and ligulate. Heads radiate or disciform. ............... 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
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
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, wich seems not very effective for population growth. However, presence of *A. triplinerve* were not harmful. 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 ethnis often use *A. conyzoides*, *C. odorata*, *E. valeranifolila*, 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* occurance 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-spathulate, 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; foliages bracts 3, deltoid; capitula tubular, 7–8 mm long; receptacle flat, about 1 mm in diam., glabrous; involucres 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. Cypselas 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       | *Erigeron sumatrensis* Retz.                 | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 2   | Cichorieae     | *Lactuca indica* L.                          | -  | ✓  | -   | -   | -   | -  |
| 3   | Eupatorieae    | *Adenostemma lavenia* (L.) Kuntze            | -  | -  | -   | -   | -   | ✓  |
| 4   | Eupatorieae    | *Ageratum conyzoides* (L.) L.                | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 5   | Eupatorieae    | *Austrouepatorium inulaefolium* (Kunth) R.M.King & H.Rob. | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 6   | Eupatorieae    | *Ayapana triplinervis* (Vahl) R.M.King & H.Rob. | ✓  | -  | -   | -   | -   | -  |
| 7   | Eupatorieae    | *Chromolaena odorata* (L.) R.M.King & H.Rob. | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 8   | Eupatorieae    | *Mikania micrantha* Kunth                    | ✓  | ✓  | ✓   | -   | ✓   | -  |
| 9   | Heliantheae    | *Acmella paniculata* (Wall. ex DC.) R.K.Jansen | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 10  | Heliantheae    | *Bidens pilosa* L.                           | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 11  | Heliantheae    | *Calyptocarpus vialis* Less.                 | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 12  | Heliantheae    | *Clibadium surinamense* L.                   | ✓  | ✓  | ✓   | -   | ✓   | -  |
| 13  | Heliantheae    | *Eclipta prostrata* (L.) L.                  | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 14  | Heliantheae    | *Galinsoga parviflora* Cav.                  | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 15  | Heliantheae    | *Sphagnetica trilobata* (L.) Pruski          | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 16  | Heliantheae    | *Synedrella nodiflora* (L.) Gaertn.          | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 17  | Senecionae     | *Crasocephalum crepidioides* (Benth.) S.Moore | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 18  | Senecionae     | *Emilia sonchifolia* (L.) DC. ex DC.         | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
| 19  | Senecionae     | *Erechites valerianifolia* (Link ex Wolf) Less. ex DC. | ✓  | ✓  | ✓   | -   | ✓   | -  |
| 20  | Vernonieae     | *Elephantopus mollis* Kunth                  | ✓  | ✓  | ✓   | ✓   | ✓   | -  |
Figure 1. Asteraceae at Citalahab. A. Astereae: Erigeron sumatrensis. B. Cichorieae: Lactuca indica. C—H. Eupatorieae: Adenostemma lavenia; Ageratum conyzaoides; Austroeupatorium inulaefolium; Ayapana triplinervis; Chromolaena odorata; Mikania micrantha. I—P. Heliantheae: Acmella paniculata; Bidens pilosa; Calyptocarpus vialis; Clibadium surinamense; Eclipta prostrata; Galinsoga parviflora; Sphagneticola trilobata; Synedrella nodiflora. Q—S. Senecioneae: Crassocephalum crepidooides; Emilia sonchifolia; Erechtites valerianifolia. T. Vernonieae: 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.