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FIRST RECORD OF NATURALIZED *ACMELLA BRACHYGLOSSA* AND *ACMELLA RADICANS* (ASTERACEAE: HELIANTHEAE) IN JAVA, INDONESIA

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ABSTRAK

Zakaria Al Anshori, Arifin S.D. Irsyam, Asih P. Dewi, Muhammad R. Hariri, Peniwidiyanti, Rina R. Irwanto. 2022. Rekaman Pertama *Acmella brachyglossa* dan *Acmella radicans* (Asteraceae: Heliantheae) Ternaturalisasi di Jawa, Indonesia. *Floribunda* 7(1): 18–25 — *Acmella brachyglossa* dan *A. radicans* merupakan dua jenis tumbuhan introduksi yang berasal dari Amerika Tengah dan Amerika Selatan. Pada tulisan ini, kedua jenis tersebut dilaporkan secara resmi ternaturalisasi di Pulau Jawa. *Acmella brachyglossa* dicirikan dengan perbungaan yang berwarna kuning pucat dan memiliki bunga pita sebanyak 5–8 helai. Sementara itu, *A. radicans* memiliki perbungaan yang hanya terdiri dari bunga tabung, bunga bermerositas 4, dan berwarna putih. *Acmella brachyglossa* telah dikoleksi dari Jawa Barat (Kabupaten Sumedang dan Kabupaten Bogor). Sementara itu, *A. radicans* ditemukan di Jawa Barat (Kabupaten Bandung, Kota Bandung, Kabupaten Sumedang) dan Jawa Tengah (Kabupaten Temanggung). Deskripsi, ilustrasi, kunci marga *Acmella* di Jawa, dan diskusi singkat disajikan dalam tulisan ini.

Kata kunci: *Acmella*, jotang, rekaman baru, taksonomi, ternaturalisasi

Zakaria Al Anshori, Arifin S.D. Irsyam, Asih P. Dewi, Muhammad R. Hariri, Peniwidiyanti, Rina R. Irwanto. 2022. First Record of Naturalized *Acmella brachyglossa* and *Acmella radicans* (Asteraceae: Heliantheae) in Java, Indonesia. *Floribunda* 7(1): 18–25 — *Acmella brachyglossa* and *A. radicans* are introduced species native to Central and South America. Here, both species are formally reported for the first time in Java. *Acmella brachyglossa* is characterized by its pale yellow-colored heads and has 5–8 ray flowers. Meanwhile, *A. radicans* has discoid heads, 4-merous flowers, and white-coloured. *Acmella brachyglossa* was collected from West Java (Sumedang Regency and Bogor Regency). While *A. radicans* was found in West Java (Bandung Regency, Bandung City, Sumedang Regency) and Central Java (Temanggung Regency). Descriptions, illustrations, a key to *Acmella* of Java, and a brief discussion are presented in this paper.

Keywords: *Acmella*, jotang, new record, taxonomy, naturalized

Human activities can move a plant species across the border of its native distribution, such as a plant called an introduced or alien plant species. According to Pyšek *et al*. (2004), naturalization is the process by which introduced plants sustain self-replacing populations for at least ten years without any human interventions. They can grow independently in their new distributional areas by seeds or ramets (tillers, tubers, bulbs, fragments) (Pyšek *et al*. 2004). Previous studies revealed that 13,168 plant species have become naturalized worldwide (van Kleunen *et al*. 2015; Pyšek *et al*. 2017). As

many as 878 introduced plants are found in Malesia, and 467 species have naturalized in the region (Holmes *et al*. 2022). The three largest naturalized groups in Malesia are Fabaceae (171 species), Poaceae (160 species), and Asteraceae (103 Species) (Holmes *et al*. 2022).

Asteraceae is one of the significant contributors to the naturalized flora in the world (Wu & Wang 2005). It comprises 600–1700 genera and 24,000–30,000 species distributed globally, except in the Antarctic (Funk *et al*. 2009; Hind 2015). Tropical America was recorded as the critical origin of naturalized species of Asteraceae, followed by Europe and temperate America. Several newly naturalized Asteraceae have been reported from Malesia in the last five years, for example, *Praxelis clematidea* R.M.King & H.Rob., *Tilesia baccata* (L.) Pruski and *Wollastonia asperrima* Decne (Chen *et al*. 2018; Tjitrosoedirdjo & Wahyuni 2018; Middleton *et al*. 2022). In this study, we formally report two newly naturalized species in Java, Indonesia, *Acmella brachyglossa* Cass. and *A. radicans* (Jacq.) R.K.Jansen. The occurrence of both species has not mentioned by Koster & Philipson (1950), Backer & Bakhuizen van den Brink (1965), and Jansen (1985).

According to the previous studies, five species of *Acmella* occurred in Java, namely *A. calva* (DC.) R.K.Jansen, *A. grandiflora* (Turcz.) R.K.Jansen., *A. oleracea* (L.) R.K.Jansen, *A. paniculata* (Wall. ex DC.) R.K.Jansen, and *A. uliginosa* (Sw.) Cass (Koster & Philipson 1950; Backer & Bakhuizen van den Brink 1965; Jansen 1985). Most of them are naturalized species from America, while *A. grandiflora* is native to Vietnam, Java, the Philippines, and Papua New Guinea (Jansen 1985). Our finding increases the number of *Acmella* in Java into seven species. A key to the species in Java, the colour photographs of *A. brachyglossa* and *A. radicans*, and a brief discussion are provided.

MATERIALS AND METHODS

Botanical exploration was conducted in West Java (Bogor City, Bogor Regency, Bandung City, Bandung Regency, Sumedang Regency), Central Java (Rembang Regency, Kebumen Regency, Temanggung Regency), and East Java (Banyuwangi Regency, Malang City, Situbondo Regency) from March to May 2022. The flowering materials were collected following van Balgooy (1987). The plant materials were preserved using the standard method of Bridson & Forman (1998) and observed at Herbarium Bandungense (FIPIA), School of Life Sciences and Technology (SITH), ITB. Identification was made according to Jansen (1981), Jansen (1985), Chung *et al.* (2008), Rahman *et al.* (2016), Maity *et al.* (2017), and Panyadee & Inta (2022). Specimen observations were carried out in the Herbarium Bandungense (FIPIA).

RESULT AND DISCUSSION

Taxonomic treatment

1. ***Acmella brachyglossa*** Cass., Dict. Sci. Nat. (ed. 2) 50: 258. 1827; Jansen, Syst. Bot. Monogr. 8: 73. 1985; Chung et al., Bot. Stu. 49: 74-76. 2008; Panyadee & Inta, Biodiv. 23(4): 2178. 2022. — TYPE: French Guiana, 1819-1821, *Poiteau s.n.* (holotype: P; isotype: G [G00222077, image seen]). Figure 1.

Herb, erect to ascending, up to 25 cm high, rooting at nodes. Stem angular, many-branched, purplish brown; branchlets angular, green or purple, strigose. Leaves opposite; petioles 5–15 mm long, green, strigose; lamina ovate, 2–3.5 × 1.5–3 cm, base attenuate, margin denticulate to coarsely dentate, apex acute, triplinerved, adaxial surface green, abaxial surface pale green. Heads conical to ovoid, 5–11 × 3–6 mm, solitary, axillary or terminal, radiate; peduncles 0.8–4 cm long, slender, green, glabrous; receptacles narrowly conical, 5 × 1 mm, apex acuminate; phyllaries 7–9, 2-seriate, ovate, 4–4.9 × 1–2 mm, margin transparent, ciliate, green. Paleae boat-shaped, 4 × 1 mm, apex acuminate, membranous, green. Ray flowers 5–8, corolla ca. 3 mm long, pale yellow; tube ca. 1 mm long; limb ca. 2 mm long, 3-lobed; styles ca. 2 mm long, style arms 2, yellow; achene ca. 1.5 mm long, brown, ciliate; pappus 2, white. Disc flowers ca. 100, corolla ca. 1.4–2 mm long, pale yellow, 4–5-merous; tube ca. 0.5 mm long; throat ca. 1 mm long; lobes triangular, ca. 0.5 mm long; stamens 4–5, ca. 1 mm long; filaments free, filiform, white; anthers linear, connate, blackish brown; apical appendices triangular, transparent; styles ca. 1 mm long, style arms 2, papillose, pale yellow; achenes cylindric, ca. 2 mm long, blackish brown, margin ciliate, surface strigose; pappus 2, white.

Distribution. *Acmella brachyglossa* is native to Central America, northern South America, and the West Indies (Jansen 1985). It has been introduced to Taiwan (Chung *et al*. 2008) and Thailand (Panyadee & Inta 2022). In our study, *A. brachyglossa* was found in Sumedang Selatan Subdistrict, West Java.

Habitat. The species is primarily found in wasteland, roadside, and ditches (Jansen 1985; Panyadee & Inta 2022). We found this species grows along the side at 400 m elevation (Bogor Regency) and at 518 m elevation (Sumedang Regency).

Specimen examined. Indonesia: Java: **West Java**, Sumedang Regency, Sumedang Selatan Subdistrict, Pasanggrahan Baru, Jl. Nasional V, roadside, 6°52'02.1"S 107°53'13.4"E, 18.IV.2022, *ASD*

Irsyam 706 (FIPIA). West Bogor, Bogor Regency, Balumbang Jaya Subdistrict, Babakan Lio, Jl. Sawah Baru, roadside, 6°33'39.322"S 106° 44'12.280"E, 30.V.2022, *MR Hariri 387* (FIPIA).
Vernacular names. Jotang (Sundanese)

2. ***Acmella radicans*** (Jacq.) R.K.Jansen, Syst. Bot. Monogr. 8: 69. 1985; Panyadee & Inta, Biodiv. 23 (4): 2179-2180. 2022. *Spilanthus radicans* Jacq., Collectanea 3: 229. 1791. — TYPE: Venezuela. *Collector unknown* (holotype: not located; the illustration, *t. 584*, *Icones plantarum rariorum*, vol. 3, 1792, image seen). Figure 2.

Herb, erect to ascending, 19–130 cm high, rooting at nodes. Stem many-branched, green or purple, lenticelled; branchlets green or purple, glabrous to pilose or strigose. Leaves opposite; petioles 2–35 mm long, green or purple, glabrous to pilose or strigose; lamina narrowly ovate to broadly ovate, 1–9 × 0.5–6 cm, base attenuate, margin denticulate to coarsely dentate, apex acute to acuminate, triplinerved, adaxial surface green, abaxial surface pale green or purplish. Heads conical, 5–15 × 3–8 mm, in groups of 2–3 axillary or terminal clusters, discoid; peduncles 1.5–4 cm long, slender, green, pilose to strigose; receptacles narrowly conical, 5–10 × 1–2 mm, apex acuminate; phyllaries 6–9, 2-seriate, lanceolate to ovate, 4.5–5 × 1.5–3 mm, margin transparent, ciliate, glandular, green. Paleae boat-shaped, 4 × 2 mm, apex acuminate, membranous, glandular, green at the apex. Disc flowers 95 –120, ca. 2 mm long, white or greenish white, 4-merous; tube ca. 0.5 mm long; throat ca. 1 mm long; lobes triangular, ca. 0.4–0.5 mm long; stamens 4, ca. 1 mm long; filaments free, filiform, white; anthers linear, connate, black-brown; apical appendices triangular, transparent; styles ca. 1.5 mm long, style arms 2, papillose, yellowish brown; achenes cylindric, ca. 2–3 mm long, blackish brown, margin ciliate; pappus 2–3, white.
Distribution. *Acmella radicans* is distributed naturally from Mexico to NW. Venezuela, Bolivia, and the Caribbean (Jansen 1985). Recently, the species has been naturalized in Bangladesh (Rahman *et al*. 2016), India (Bhowmik *et al*. 2013; Jagpat & Bachulkar 2015; Maity *et al*. 2017; Bagga & Desmukh 2018), and Thailand (Panyadee & Inta 2022). This study, *A. radicans* were collected from Bandung City, Bandung Regency, Sumedang Regency (West Java) and Temanggung Regency (Central Java).
Habitat. The species is mainly found in weedy habitats, such as stream banks, roadsides, ditches, and cultivated fields at 60–1800 m elevation (Jansen 1985; Rahman *et al.* 2016). In Java, *A. radicans* has been naturalized in agricultural fields, gardens, sidewalks, and roadsides at 518 to 722 m elevation.
Specimen examined. Indonesia: Java: **West Java**, Sumedang Regency, Jatinangor Subdistrict, Sayang Village, agricultural field, 6°56'12.8"S 107° 46'29.5"E, 16.IV.2022, *ASD Irsyam 702* (FIPIA); Sumedang Regency, Jatinangor Subdistrict, Hegarmanah, roadside, 6°55'42.2"S 107°46'47.4"E, 18.IV.2022, *ASD Irsyam 704* (FIPIA); Sumedang Regency, Jatinangor Subdistrict, Cibeusi, ITB campus, Situ 2, along the sidewalk, 6°55'58.1"S 107°46'07.2"E, 12.V.2022, *ASD Irsyam 713* (FIPIA); Sumedang Regency, Sumedang Selatan Subdistrict, Pasanggrahan Baru, Jl. Nasional V, roadside, 6°52'02.1"S 107°53'12.7"E, 18.IV.2022, *ASD Irsyam 705* (FIPIA); Bandung Regency, Rancaekek Subdistrict, Rancaekek Wetan, roadside, 6°57'58.7"S 107°45'12.2"E, 19.IV.2022, *ASD Irsyam 707* (FIPIA); Bandung Regency, Rancaekek Subdistrict, Rancaekek Wetan, paddy field, 6°57'55.3"S 107°45'05.6"E, 19.IV.2022, *ASD Irsyam 708* (FIPIA); Bandung City, Rancasari Subdistrict, Derwati Mas Estate, Jl. Derwati Mas VI, garden and roadsides, 6°58'05.0"S 107° 40'55.7"E, 05.V.2022, *ASD Irsyam 712* (FIPIA). **Central Java**, Temanggung Regency, Pringsurat Subdistrict, Pager Gunung, Jl. Krajan, roadside, 7° 18'59.1"S 110°17'25.5"E, 07.V.2022, *Peniwidiyanti 339* (FIPIA).
Vernacular names. Jotang (Sundanese); gletang (Javanese)

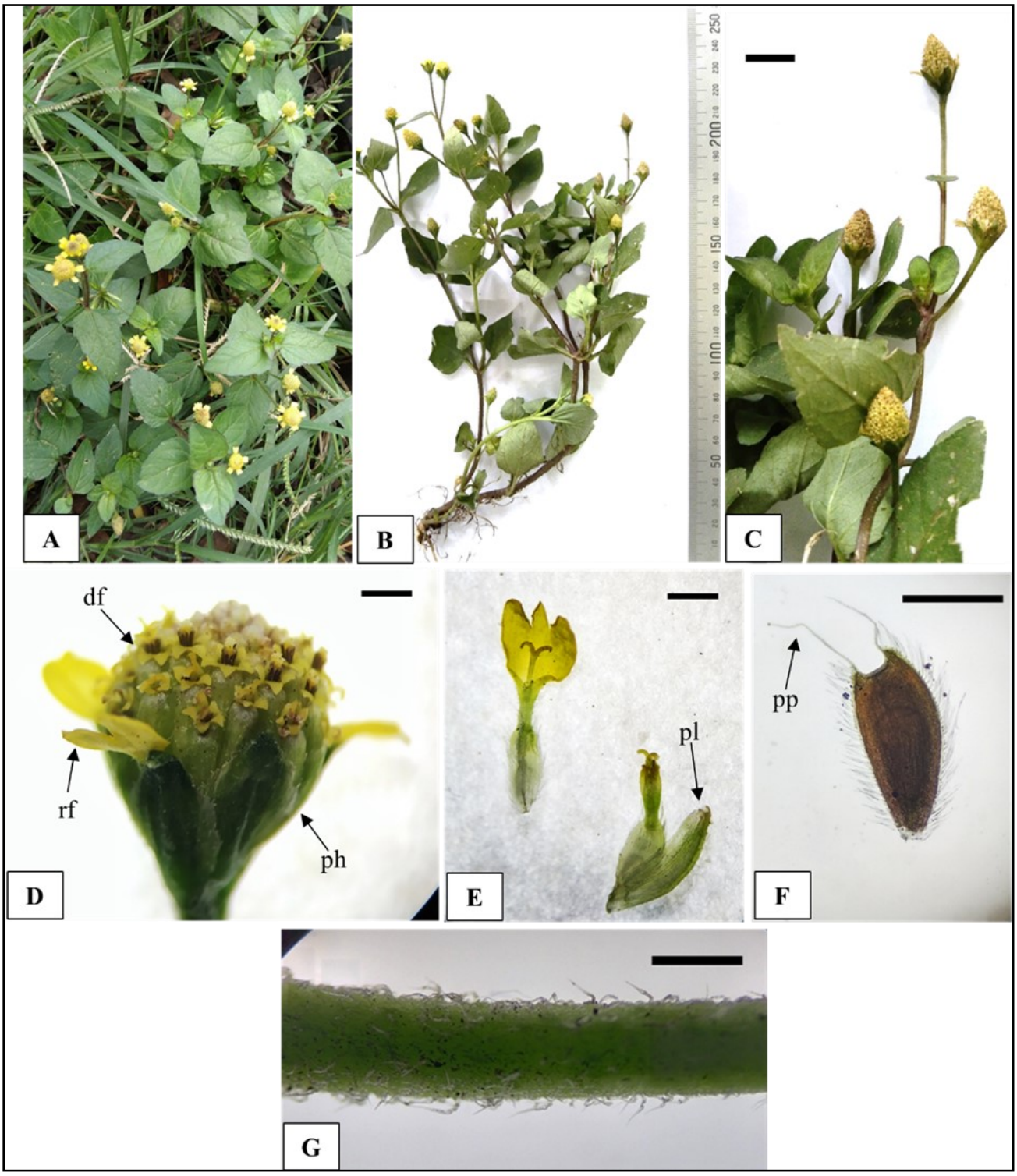

Figure 1. *Acmella brachyglossa* Cass. A–B. Habit; C. Axillary and terminal heads; D. Head (ph = phyllaries, rf = ray flower, df = disc flower); E. Ray flower and disc flower (pl = palea); F. Achene with pappus (pp); G. Hairs on the branchlet (scale bar = 5 mm for image C; 1 mm for images D–G).

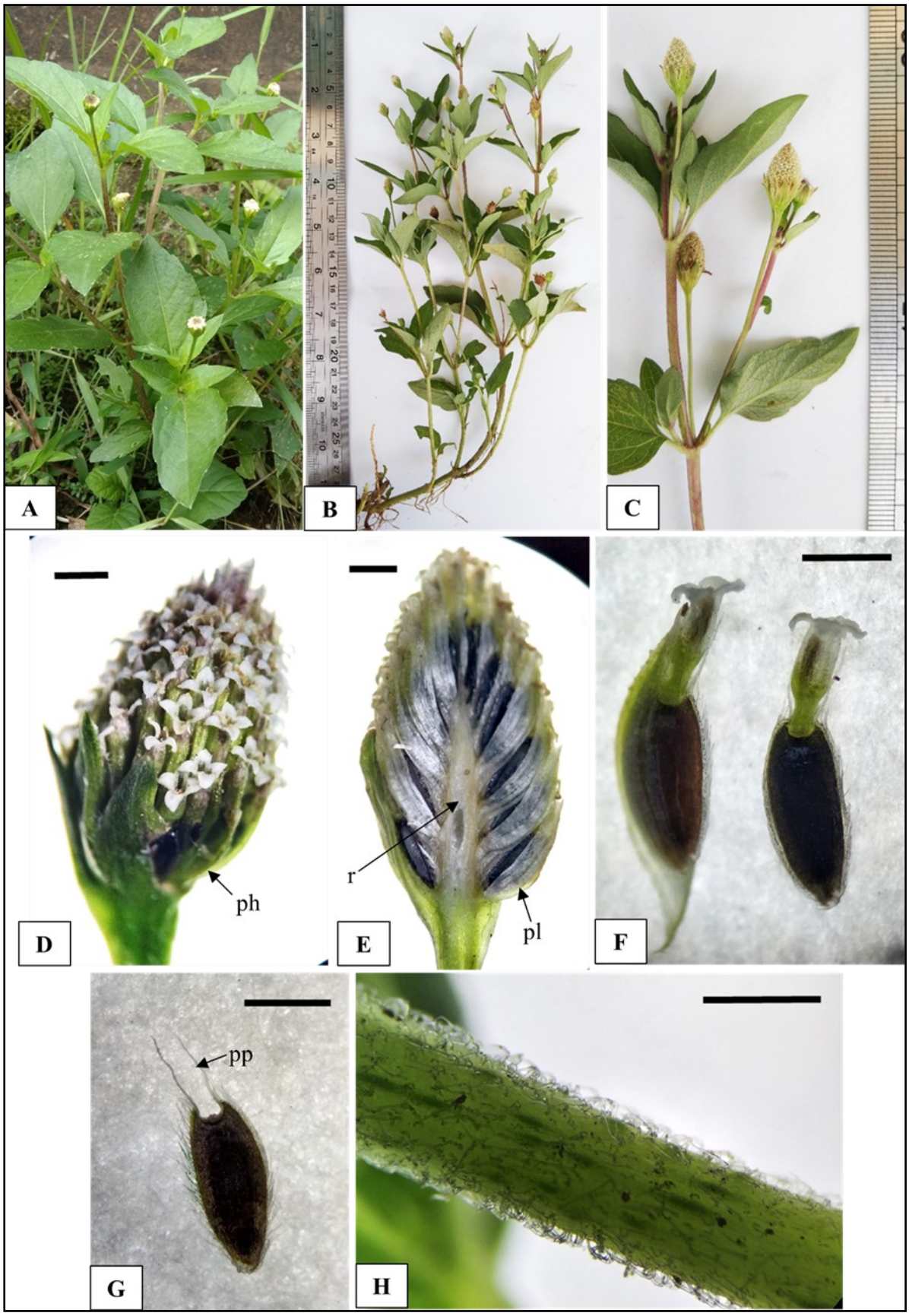

Figure 2. *Acmella radicans* (Jacq.) R.K. Jansen. A–B. Habit; C. Axillary heads; D. Head; E. Longitudinal section of the head (pl = palea, r = receptacle); F. Disc flowers (ph = phyllaries); G. Achene with pappus (pp); H. Hairs on the branchlet (scale bar = 1 mm).

Key to *Acmella* in Java (modified from Backer & Bakhuizen van den Brink (1965) and Jansen (1985))

1 Heads radiate 2
1 Heads discoid 4
2 Phyllaries 1-seriate, disc flowers 4-merous ..... A. uliginosa
2 Plants otherwise 3
3 Phyllaries 2-seriate, ray flowers shorter than the phyllaries, disc flowers 4–5-merous, corolla pale yellow ..... A. brachyglossa
3 Phyllaries 3-seriate, ray flowers 3–10 times longer than the phyllaries, disc flowers 5-merous, corolla yellow ..... A. grandiflora
4 Pappus absent, achene glabrous ..... A. calva
4 Pappus 2–3, achene ciliate 5
5 Disc flowers 4-merous, white ..... A. radicans
5 Disc flowers 4–5-merous or 5-merous, yellow 6
6 Phyllaries 2-seriate, disc flowers up to 200, anthers brown ..... A. paniculata
6 Phyllaries 3-seriate, disc flowers more than 200, anthers black ..... A. oleracea

Acmella L. is a member of Asteraceae, which consists of 30 species, and ten are pantropical (Jansen 1985). The genus is closely related to the *Spilanthes* Jacq. (Jansen 1981). In the classical system, *Acmella* is placed as a section of *Spilanthes*. Therefore, all species in Java were classified under the genus *Spilanthes* (Backer & Bakhuizen van den Brink 1965). However, morphological and chromosomal studies suggest that these sections can be separated into generic levels (Jansen 1981). *Acmella* is recognized by its petiolated leaves, heads radiate or discoid with orange-yellow to pale yellow or white colour, palea with narrowed apex, corolla tube gradually expanding into the throat, dimorphic achenes, and achenes without cork-like margin (Jansen 1981).

In this study, *A. brachyglossa* and *A. radicans* are newly recorded alien species in Java. The occurrences of these species were not recorded by Jansen (1981, 1985), Koster & Philipson (1950), and Backer & Bakhuizen van den Brink (1965). The history of their introduction to Java is not known. We assumed these species might be unintentionally introduced to the island as soil contaminants. Their occurrence in Java has only been recorded and reported, although it may have been introduced long ago. *Acmella brachyglossa* and *A. radicans* were naturalized in several locations in Java (Figure 3) and like to grow in open areas with direct sunlight. *Acmella brachyglossa* was found growing along the side of Jl. Nasional V in Sumedang Regency at 518 m elevation. *Acmella radicans* has more encounters in West Java (Bandung Regency, Bandung City, and Sumedang Regency) and Central Java (Temanggung Regency). It has been naturalized in agricultural fields, gardens, sidewalks, and roadsides at 518 to 722 m elevation.

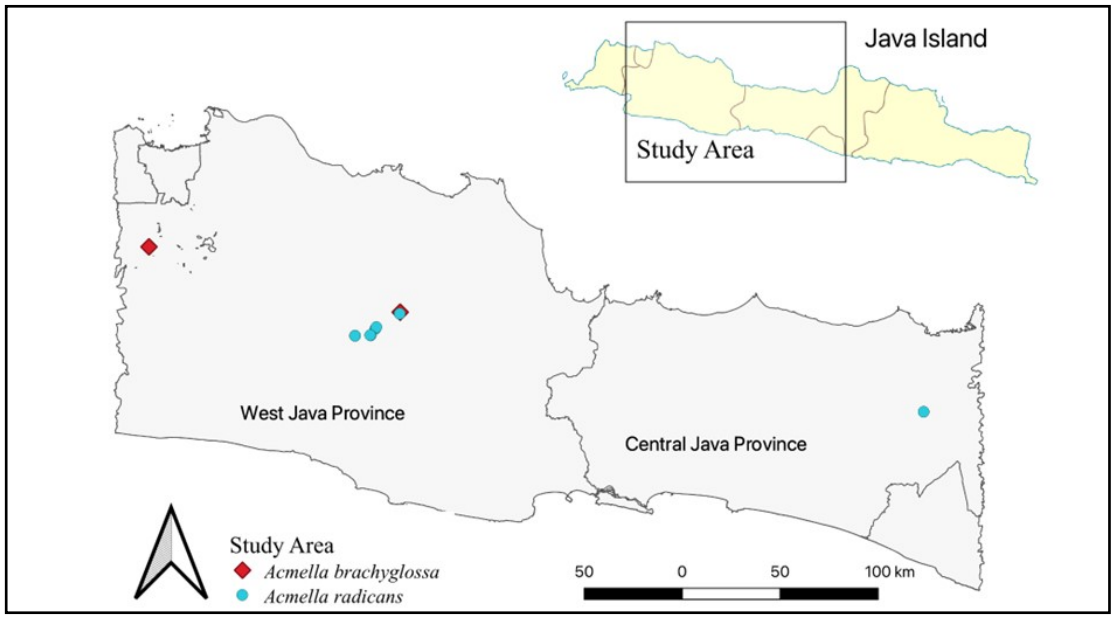

Figure 3. Distribution map of *Acmella brachyglossa* and *Acmella radicans* in Java.

Acmella brachyglossa is native to Central America, South America, and the West Indies (Jansen 1985; POWO 2022). The species are also reported to have become naturalized in Taiwan (Chung et al. 2008) and Thailand (Panyadee & Inta 2022) (Figure 4A). The other species, *A. radicans*, is distributed from Mexico, Central America, to Colombia (POWO 2022) (Figure 4B). The introduced population is also common in Cuba, Curacao, and Tanzania (Jansen 1985). Currently, *A. radicans* has spread to several tropical countries (Hyde *et al*. 2022), including India (Bhowmik *et al*. 2013; Maity *et al*. 2017; Bagga & Deshmukh 2018), Bangladesh (Rahman *et al*. 2016), and Thailand (Jansen 1985; Panyadee & Inta 2022). In their native area, both species are found in disturbed habitats along roadsides, streambanks, fields, and pastures. They are expected to become stubborn weeds outside their natural range (Jansen 1985; Chung *et al.* 2008; Maity *et al*. 2017; Panyadee & Inta 2022).

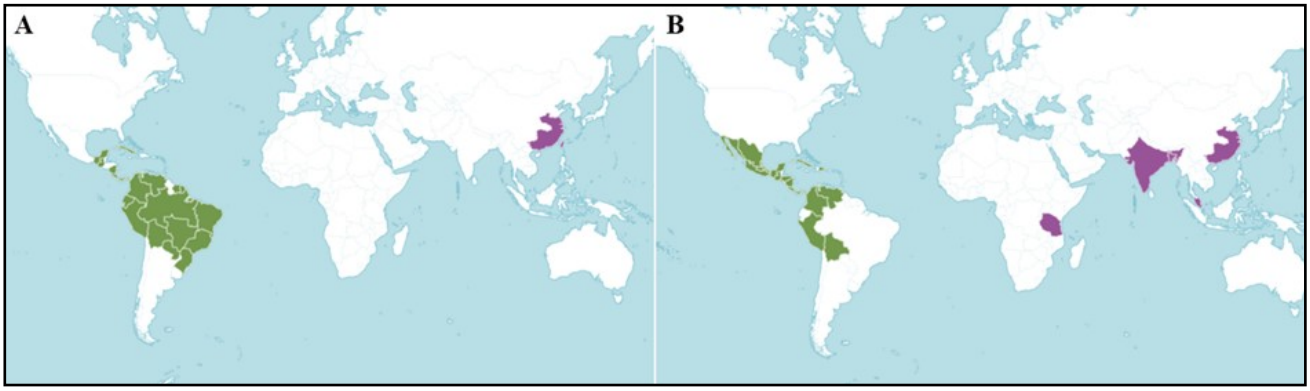

Figure 4. Distribution of *Acmella brachyglossa* and *Acmella radicans* (POWO 2022)

Acmella brachyglossa can be mistakenly identified with other species from its leaf morphology (Chiu & Chang 1998; Chung *et al.* 2008). Morphologically, *A. brachyglossa* has pale yellow or greenish heads and inconspicuous ray florets. Other species with radiate heads, such as *A. ciliata* and *A. uliginosa*, have yellow or orange-yellow heads. Moreover, the achenes of *A. brachyglossa* are densely ciliate without a cork-like edge (Panyadee & Inta 2022). They also have a well-developed pappus of 3 or 2 subequal bristles, which is especially valuable for identification in dried specimens. *Acmella radicans* is characterized by their white discoid heads. The white florets are clustered in an axillary or terminal inflorescence consisting of 2–3 heads and are solely 4-merous in symmetry (Panyadee & Inta 2022).

Acmella brachyglossa and *A. radicans* are annual plants that can produce flowers throughout the year (Jansen 1985). Both species can spread rapidly in Java due to the bristly pappus on their achenes (Fig. 1F & 2G). Pappus facilitates the seeds to be dispersed by wind, water, or attached to animals and humans. The seeds are also dispersed as a contaminant in soil, crops, and agricultural machines. These mechanisms can be observed in other species, such as *A. paniculata* and *A. uliginosa* (Sw.) Cass. (Soerjani *et al.* 1987; Chung *et al*. 2007).

In general, the species of *Acmella*, including *A. brachyglossa*, are known as *jotang* by the Sundanese ethnic community in West Java. The plant is often eaten as a raw vegetable (*lalab*) and as toothache medicine. This utilization also occurs in other Asian countries. *A. brachyglossa* has been cultivated for over a decade by Taiwanese folk herbalists as a medicinal plant to treat curvy, toothache, throat and gum infections (Chung *et al.* 2008). In Thailand, *A. brachyglossa* and *A. radicans* are eaten raw as a vegetable and commonly sold in the traditional markets with other species of *Acmella* (Panyadee & Inta 2022).

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