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The genus *Adenostyles* Cass. (Asteraceae) in Southern Italy and Sicily

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ABSTRACT This paper provides an update concerning the genus *Adenostyles* Cass. in southern Italy and Sicily, based on field, herbarium and literature data. In total, three taxa (*A. australis*, *A. alpina* subsp. *macrocephala* and *A. alpina* subsp. *nebrodensis*) occur in the study area. For each taxon detailed morphological description as well as information about taxonomy, distribution, ecology, phenology and conservation status are here reported. An identification key is provided, too. The recent presumptive extinction in the wild of *A. alpina* subsp. *nebrodensis* is here recorded.

KEY WORDS *Adenostyles,* endemism, extinction, southern Italy, taxonomy, vascular plants.

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INTRODUCTION

The genus *Adenostyles* Cass. belongs to the tribe Senecioneae of the sunflower family Asteraceae, which includes several perennial herbs endemic to Europe (Dillenberger & Kadereit, 2012) growing on the main mountain systems of southern Europe, i.e. the Alps, the Pyrenees, the Vosges, the Balkans and the Apennines, and on the islands of Corsica and Sicily (Meusel & Jäger, 1992; Palermo et al., 2002; Scafidi & Domina, 2016).

The taxonomy of the genus, especially in *A. alpina* aggregate, is rather problematic, due to high infraspecific variability and muddled nomenclature (Wagenitz, 1983). The taxa of this complex are characterized by high morphological diversity, especially remarkable in southern Italian populations, which have been treated either as varieties of *A. alpina* or as distinct species or subspecies (Fiori, 1925; Tutin, 1976; Wagenitz, 1983; Pignatti, 1982; Dillenberger & Kadereit, 2012; Iamonico & Pignatti, 2015, Pignatti et al., 2019).

As for Southern Italy, according to Dillenberger & Kadereit (2013), the genus includes three subspecies: *A. alpina* (L.) Bluff & Fingerh. subsp. *alpina*, *A. alpina* subsp. *macrocephala* (Huter, Porta & Rigo) M. Dillenberger & Kadereit and *A. alpina* subsp. *nebrodensis* (Wagenitz & I. Müll.) Greuter. More recently, Bartolucci et al. (2024) report three taxa for southern Italy, i.e. *A. australis* (Ten.) Iamonico & Pignatti, *A. alpina* subsp. *macrocephala* (Huter, Porta & Rigo) M. Dillenberger & Kadereit, and *A. alpina* subsp. *nebrodensis* (Wagenitz & I. Müll.) Greuter for Sicily.

The aim of this paper is to provide a detailed morphological description based on material collected in the field as well as information about the taxonomy, distribution, ecology, phenology and conservation status of these taxa.

MATERIAL AND METHODS

The present study is based on fieldwork carried out between 2014 and 2025 in southern Italy (from Molise to Calabria) and Sicily, as well as on the ex-

amination of herbarium specimens stored in BOZ, BM, FI, JE, G, K, MJG, NAP, P, PAL, WU (acronyms follow Thiers, 2025) and literature data. The collected plant material was stored in the Herbarium Mediterraneum Panormitanum (PAL) and in the Herbarium of Botanical Museum of the University of Mainz (MJG). The photos of this work, where not specified, were taken by the author. The nomenclature of the taxa follows Bartolucci et al. (2024). The specimens were identified according to Dillenberger & Kadereit (2012) and Iamonico & Pignatti (2015). For each taxon the following information is provided: currently accepted name; synonyms; detailed morphological description; ecology; phenology, conservation status, occurrence in southern Italy and list of the examined specimens.

RESULTS AND DISCUSSION

In southern Italy and Sicily the genus *Adenostyles* is so far represented by three taxa. In particular, *A. australis* occurs in Molise, Campania, Calabria and Basilicata, *A. alpina* subsp. *macrocephala* is endemic to Aspromonte and Sila (Calabria), while *A. alpina* subsp. *nebrodensis* is endemic to Sicily.

Adenostyles australis (Ten.) Iamonico & Pignatti in Willdenowia, 2015, 45: 450–451.

Cacalia alpina var. *australis* Ten., Syll. Pl. Fl. Neapol., App., 1842, 5: 40.
Adenostyles viridis subsp. *australis* (Ten.) Nyman, Consp. Fl. Eur., 1879: 396.
A. glabra var. *australis* (Ten.) Wagenitz in Phyton (Horn), 1983, 23: 148.
A. alpina subsp. *australis* (Ten.) Greuter in Willdenowia, 2003, 33: 247.

MATERIAL EXAMINED. ITALY • Molise, Monte Campo, Capracotta (Campobasso); 10-07-2015; F.

Figure 1. *Adenostyles australis*, Montevergine, municipality of Mercogliano, province of Avellino (Campania), July 11, 2015.

Scafidi (PAL) • Campania, In montosis Campaniae, Matese, nelle vallate di Rocca Mandolfi; Julio 1873; da N. Terracciano; Apr. 1875; (FI 570707, sub *Adenostyles albifrons* Comoll.?) • Campania, Montevergine (Avellino); 11 Jul. 2015; F. Scafidi legit; MJG 018188 • Campania, Mount S. Angelo, Tre Pizzi, Regional Park Lattari Mountains (Napoli); 7 Jul. 2015; F. Scafidi legit; MJG 018205 • Campania, Mount Gelbison, Cilento National Park (Salerno); 7 Jul. 2014; F. Scafidi legit; MJG 018172 • Campania, Mount Cervati, Cilento National Park (Salerno); 9 Jul. 2015; F. Scafidi legit; MJG 018196 • Campania, Mount Terminio, Regional Park Picentini mountains (Avellino); 8 Jul. 2015; F. Scafidi legit; MJG 018202! • Campania, In montosis Campaniae, Matese, al Campo dell'Arco presso la grotta; Julio 1821; N. Terracciano; FI 570706 • Campania, Monte Alburno, da Postiglione a Campo d'Amore, Cresta rocciosa; 1450 m a.s.l.; 29 Jul. 1939; De Philippis A. legit, G. Moggi det.; (FI 570705) • Campania, Faggete, Monte Polveracchio, North exposure; 900–1000 m a.s.l.; 16 Jul. 1975; B. Moraldo legit; FI 570704 • Basilicata. Appennino lucano, Serra del Prete; 16 Aug. 2011; Klein J. legit; MJG 004230 • Basilicata, Chiaromonte forest, Pollino National Park (Potenza); 31 Jul. 2015; F. Scafidi legit; MJG 018195 • Basilicata, Mount Pollino, Varco del Pollino, Pollino National Park (Potenza); 11 Jul. 2015; F. Scafidi legit; MJG 018174 • Lucania [Basilicata], M. Pollino, in silvis ad pendices montis Serra Crispo alt. C. 1800 m; 4 Aug. 1929; O. Gavioli legit; FI 570702 • Calabria, In humentibus montosis Calabriae: Monte Pollino; Julio 1855; N. Terracciano; FI 570710 • Calabria, Mount Pollino; 1540 m a.s.l.; damp river margins in beech forest, cf. var. *australis*; 14 Jun. 1999; H.P. Comes legit; MJG 000487.

Description. Perennial herb, rhizomatous. Stem erect, 40–80 cm high, pubescent for simple appressed hairs, more abundant in the upper part of the stem and branches. Leaves alternate, coriaceous, usually densely hairy below and sparsely hairy on the mid-vein of the leaves, regularly dentate with acute teeth. Basal leaves reniform, 8–26 × 11–24 cm, carried by a petiole 5–10 cm long; middle cauline leaves similar to basal leaves but smaller, 3–19 × 4–20 cm, petiole 1–6 cm; upper leaves exauriculate, sometimes with two amplexicaul auricles 1–10 × 1–12 mm, cordate or ovate-lanceolate to oblong-lanceolate, 3–8 × 3-5(–6) cm, petiole 0.7–3 cm. Inflorescences densely corymbose. Capitula cylindrical 6-8 mm; 3–5 involucral bracts glabrous, lanceolate or linear-lanceolate, 6–8× 1–2 mm. Receptacle flat, without scales. Flowers 3–5(8), reddish or purple, longer than the involucre, tubulose, hermaphrodite, corolla 7–8(–9) mm long with 4–5 lobes 1.1–2.9 mm long, corolla tube 2–4 mm, corolla flap 1.3–4 mm. Achene obovate, 10-ribbed, (3–)3.5–4.5 × 0.9–1.2 mm, brownish, glabrous. Pappus simple, 5.4–7.5 mm long, persistent, with white setae in 1–2 rows, denticulate (Fig. 1).

Ecology. Wet beech forests or along watercourses, on calcareous or siliceous substrate, from 1100 to 2000 m a.s.l.

Phenology. Flowering and fruiting from July to August.

Distribution. Southern Italy: Molise, Campania, Basilicata and Calabria (Fig. 2).

Conservation status. Least Concern (LC) (Orsenigo et al., 2018).

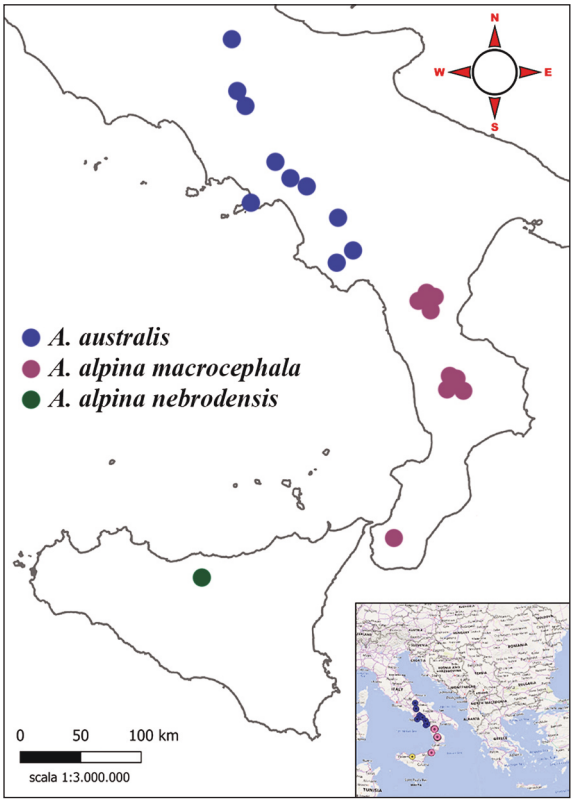

Figure 2. Distribution map of the genus *Adenostyles* in southern Italy and Sicily.

REMARKS. According to Iamonico & Pignatti (2015) *A. australis* is an Italian endemic species. Bartolucci et al. (2024) also report its presence for Lombardy, Liguria, Emilia-Romagna, Tuscany, Latium, Umbria, Abruzzo and Marche. In addition, the taxon is reported as doubtful for Apulia, but field and herbarium surveys have ruled out its presence in this region.

Adenostyles alpina subsp. ***macrocephala*** (Huter, Porta & Rigo) M. Dillenberger & Kadereit, Willdenowia, 2012, 42: 60.

A. macrocephala Huter, Porta & Rigo in It. Ital., 1878, 3: [in schedis] No. 450.
A. alpina var. *macrocephala* (Huter, Porta & Rigo) Fiori in Fiori & Béguinot, Fl. Ital., 1903, 3: 205.
A. alliariae subsp. *macrocephala* (Huter, Porta & Rigo) Wagenitz & I. Müll., Phyton (Horn), 1983, 23: 154.

MATERIAL EXAMINED. ITALY • Calabria, Aspromonte, Tre Limiti; nahe Flussufer, feuchter, schattiger Standort im Wald ; 20 Jun. 2010; Dillenberger M.S. legit; MJG 011223 • Calabria, Mount Botte Donato, Sila National Park (Cosenza); 12 Jul. 2015; F. Scafidi legit; MJG 018206, MJG 018207, MJG 018208, MJG 018178 • Calabria, Telese river near Gambarie, Aspromonte National Park (Reggio Calabria); 12 Jul. 2015; F. Scafidi legit; MJG 018209, MJG 018177 • Calabria, Piani di Aspromonte; in covalle umbrosa aquosa torrentis Telesi haud raro - sed rarissime floresc.[it] occasione a bestiis laesa. sol.[o] granit.[ico] 11–1200 m.; 03 Jul. 1877; Huter R., Porta P. & Rigo G. WU-Kerner; 0071554 • Calabria, Sila; 2 Aug. 1921; Fiori A. legit; FI 570711, 570712, 570713 • Calabria, Sila, Mount Curcio; beech forest in humid places; 28 Jul. 1952; Sarfatti G. legit; FI 570715 • Calabria, Sila, Botte Donato; beech forest; 1900 m a.s.l.; 10 Aug. 1951; Sarfatti G. legit; FI 570714 • Calabria, Sila, Camigliatello, in the woods going up towards Mount Curcio; 1300–1600 m a.s.l.; 10 Jul. 1951; Sarfatti G. & Contardo A. legit; FI 570716 • Calabria, Piani di Aspromonte, in covalle umbrosa aquosa torrentis Telesi haud raro - sed rarissime floresc.[it] occasione a bestiis laesa. sol.[o] granit.[ico] 11–1200 m.; 03 Jul. 1877; Huter R., Porta P. & Rigo G.; BO Z 001096.

DESCRIPTION. Perennial herb, rhizomatous. Stem erect, 20–60(–70) cm high, pubescent for simple appressed hairs, more abundant in the upper part of the stem and branches. Leaves alternate, coriaceous, usually densely hairy below and sparsely hairy on the mid-vein of the leaves, irregularly dentate with acute teeth. Basal leaves triangular-cordate to reniform, 13–20 × 14–30 cm, carried by a petiole 5–15 cm long; middle cauline leaves similar to basal leaves but smaller, 7–17 × 10–18 cm, petiole 1–9 cm; upper leaves with two amplexicaul auricles 2–15 × 0.8–10 mm, cordate to lanceolate or oblong-lanceolate to obovate-lanceolate, 1.2–9 × 2–9 cm, petiole 0.7–5 cm. Inflorescences densely corymbose. Capitula cylindrical; 8–9(–10) involucral bracts pubescent, lanceolate or linear-lanceolate, 7–8.5 × 1.5–2 mm. Flowers (17)19–23(25), reddish or purple, more longer than the involucre, tubulose, hermaphrodite, corolla (8)9–10 mm long with 4 lobes 0.7–2 mm long, corolla tube 3.1–6.7 mm, corolla flap (2–) 2.5–5.5 mm. Achene obovate, 10–ribbed, 6.5–7.5 × 1–1.4 mm, brownish, glabrescent. Pappus simple, 8–9 mm long, persistent, with white setae in one-two series, denticulate (Fig. 3).

HABITAT. Wet beech forests or along watercourses, on siliceous substrates, from 1400 to 1900 m a.s.l.

PHENOLOGY. Flowering and fruiting from July to September.

DISTRIBUTION. Southern Italy: endemic to Aspromonte and Sila (Calabria) (Fig. 2)

CONSERVATION STATUS. Endangered (EN): B1ab(iii,v)+2ab(iii,v) (Orsenigo et al., 2018).

REMARKS. Dillenberger & Kadereit (2012) report this subspecies as restricted only to the Aspromonte National Park. Field and literature surveys and a critical review of herbarium specimens have shown that its range also includes the Sila National Park (central Calabria, southern Italy), as already pointed out by Gianguzzi et al. (2023).

Adenostyles alpina subsp. ***nebrodensis*** (Wagenitz & I. Müll.) Greuter, Willdenowia, 2007, 37: 140.

A. glabra subsp. *nebrodensis* Wagenitz & I. Müll., Phyton (Horn), 1983, 23: 149.

Figure 3. *Adenostyles alpina* subsp. *macrocephala* in full bloom at Mt. Botte Donato, municipality of Casali del Manco, province of Cosenza (Calabria), July 12, 2015.

Figure 4. The last individual of *Adenostyles alpina* subsp. *nebrodensis* flowering at Passo della Botte, municipality of Petralia Sottana, province of Palermo (Sicily), June 29, 2018.

A. hybrida Guss., Fl. Sic. Syn. 2: 449. 1844. [& (Vill.) DC., Prodr., 1836, 5: 204 [descr. inval., nom. prov.].

A. nebrodensis Strobl, Flora, 1882, 65: 196 [nom. illeg.].

Material examined. ITALY • Sicily, in regione nemorosa montium Madoniarum (Palermo); 18 Jul. 1874; Strobl G.; FI001886 • [Sicily] Sicilia, in regione nemorosa montium Madoniarum, solo calc., 600–1000 m; 18 Jul. 1874; Strobl G.; JE 00016916, WU-Kerner 0071553, K 000797430 • Sicily, Madonie, Passo della Botte; 17 Jun. 2010; Dillenberger M.S. legit; MJG 013774 • Sicily Sicilia, Madonie, Passo della Botte, VII 1895; Ross; PAL 85278 • Sicily, In regione nemorosa montium Madoniarum, solo calc.[areo], 600–1000 m; 18 Jul. 1874; Strobl G.; BM 001025945 • Sicily, Madonie al Passo della Botte; In rupibus calcareis rivibus elatis; Junio 1819; Lojacono M.; MNHN-PP02839371 • Sicily, Madonie; 1832; Duby M., G00495567 • Sicilia, Madonie; 1831; Gusson e G.; G 00495473.

Description. Perennial herbs, rhizomatous, 20–60(–70) cm high. Stem erect, cylindrical, pubescent for simple appressed hairs, more abundant in the upper part of the stem and branches. Leaves alternate, coriaceous, usually densely hairy below and sparsely hairy on the mid-vein of the leaves, regularly dentate with acute teeth. Basal leaves reniform, 13–22 × 15–23 cm, carried by a petiole 5–10 cm long; middle cauline leaves similar to basal leaves but smaller, 8–12 ×9–14 cm, petiole 1–6 cm; upper leaves exauriculate, sometimes with two amplexicaul auricles 1–2 ×1–2 mm, cordate to oblong-lanceolate, 3–8×3–5(–6) cm, petiole 0.7–3 cm. Inflorescences densely corymbose. Capitula cylindrical; (6–)7–8 involucral bracts glabrous, lanceolate or linear-lanceolate, 7–8 × 1.5–1.8 mm. Flowers (9)10–12(15), reddish or purple, more longer than the involucre, tubulose, hermaphrodite, corolla (7.5–)8–9 mm long with 4–5lobes 1.1–1.5 mm long, corolla tube 3.5–5.5 mm, corolla flap 2–4 mm. Achene obovate, 10–ribbed, (4–)4.5–6(–6.5) mm, brownish, glabrous. Pappus simple, 6–7.5 mm long, persistent, with white setae in one-two series, denticulate (Fig. 4).

Habitat. Beech forests on calcareous substrates, from 1300 to 1450 m a.s.l.

Phenology. Flowering and fruiting from June to August.

Distribution. Endemic to Madonie Mountains (Northern Sicily) (Fig. 2).

Conservation status. This taxon was classified as "Critically Endangered" (CR): B1ab(iii,iv,v) +2ab(iii,iv,v) by Orsenigo et al. (2018). However, recent field surveys have not confirmed the presence of the species, which can therefore be considered extinct.

REMARKS. During field monitoring in July 2025, the last surviving individual of *A. alpina* subsp. *nebrodensis* was no longer found. The taxon can be assumed to be extinct (Fig. 5).

Until July 2023, this plant was still alive and therefore very likely to have died during summer 2024 due to repeated heatwaves and long-lasting drought or due to grazing deers.

More in detail, this single plant, the only living on the Madonie mountains since at least twenty years, grew in a damp ravine gorge of a beech forest at "Passo della Botte", municipality of Petralia Sottana, province of Palermo, Madonie Regional Park. Monitoring activities carried out during the last decade have shown that this plant was unable to reproduce sexually; in fact, it flowered irregularly (the latest bloom event was observed in June 2018) and the seeds (Fig. 6) were sterile (Scafidi, 2017).

The population was probably much larger in the past, as testified by the numerous exsiccata preserved in PAL and other European herbaria (Pasta & Jeanmonod, 2024). With no doubt the extreme rarefaction of this species was a direct consequence of human pressure, namely the disruption of the local hydrographic network. In fact, in the 1950s, the building of a water collection system at Passo Botte drastically reduced local running water intake during the dry summer season.

Identification key for the genus **Adenostyles** *in southern Italy and Sicily*

1a. Capitula with (15–)18–25 flowers; corolla 9–10 mm long; cauline leaves auriculate; 8–10 involucral bracts pubescent; achene 6.5–7 mm long; pappus 8–9 mm long.....*A. alpina* subsp. *macrocephala*

1b. Capitula with 3–15 flowers; corolla 7–9 mm long; cauline leaves auriculate or exauriculate; 3–8 involucral bracts glabrous; achene 3–6.5 mm long; pappus 5.4–7.5 mm long…….....……2

2a. Capitula with 3–5(–8) flowers; flowers longer than the involucre; achene (3–)3.5–4.5×0.9–1.2 mm; 3–5 involucral bracts of 6–8×1–2 mm.....*A. australis*

Figure 5. The last individual of *Adenostyles alpina* subsp. *nebrodensis* at Passo della Botte, June 30, 2014 (left). The plant does not exist anymore in the very same site, 2 July, 2025 (right).

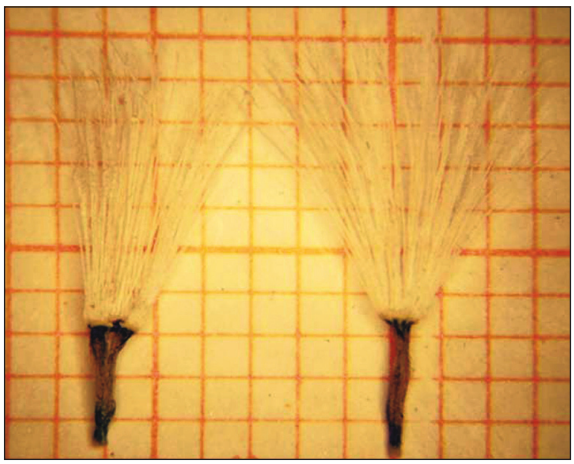

Figure 6. Malformed and sterile achenes of *A. alpina* subsp. *nebrodensis*.

2b. Capitula with (9–)10–12(–15) flowers; flowers more longer than the involucre; achene (4–)4.5–6(–6.5) × 1–1.5 mm; 6–8 involucral bracts of 7–8 × 1.5–1.8 mm…...…....*A. alpina* subsp. *nebrodensis*

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