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Cover: *Geodorum laxiflorum* Griff.—inflorescence (Orchidaceae) © Ashish Ravindra Bhojar.



Aldama macbridei (Heliantheae: Compositae): notes on its distribution and vulnerable habitats in central Peru

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Abstract: *Aldama macbridei* (S.F.Blake) E.E. Schill. & Panero (Heliantheae: Compositae), endemic to Peru is updated in terms of its distribution in the Central Andes. Also presented is a brief description of the species and the environments it inhabits. It is proposed its conservation status according to IUCN Red List categories be upgraded to 'Near Threatened' (NT).

Keywords: Central Andes, conservation status, distribution, endemic, IUCN Red List.

The genus *Aldama* La Llave (1824: 14) (Heliantheae, Compositae) is native to tropical and subtropical areas and comprises 118 species extending from southwestern North America and Mexico to South America (Schilling & Panero 2011; Magenta et al. 2017). In Peru, the genus is represented by eight species (Schilling & Panero 2011) mainly distributed in subtropical dry and humid montane forests across the Andes.

During ongoing floristic studies in archaeological sites in the boundaries of the Alto Marañón region in Central Peru (Montesinos-Tubée 2016, 2017), some interesting specimens of *Aldama* were collected. These plants occur on rock crevices and steep slopes in the boundaries of Pasco and Huánuco departments at 2,300–2,450

m elevation. After examination the specimens were identified as *Aldama macbridei* (S.F.Blake) E.E.Schill. & Panero, which is endemic to Peru (Beltrán et al. 2006) and has not been recorded in the studied region so far. The habitat of the type locality, near Huacachi, Mito (Blake 1926), has been modified by agriculture conversion, forestation with exotic species, and burning of the slopes (Image 1). The objective of this study is to present a brief description of *Aldama macbridei* along with photo plates and other relevant information, to facilitate the correct identification of this species and define its conservation status in the light of present field observations and the diminishment of native ecosystems.

MATERIALS AND METHODS

This contribution is the result of a review of the published bibliography, field work in southern Peru, and the revision of Peruvian herbarium specimens. Additionally, digital specimens from USA herbaria were studied. Herbarium acronyms follow Thiers (2020). Frequent field surveys were carried out during the period from 2016–2017 in Marañón region in Central Peru

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(South America) and specimens of *Aldama macbridei* were collected, identified using relevant literature (Magenta et al. 2017; Pruski & Robinson 2018), and also compared with specimens from different herbaria (CPUN, COL, F, GH, HSP, HUT, K, MH, MOQ, OXA, TX, US). All voucher specimens are deposited in the herbaria of Cajamarca University (CPUN), Michael Dillon Institute (HSP), La Libertad-Trujillo National University (HUT), Moquegua National University (MOQ), and San Marcos National University (USM). Pictures of living individuals are presented.

Sampling strategy

After the study of herbarium specimens from Huánuco (Macbride 4078), Huancavelica (Tovar 1884), and Ancash (Cerrate 2135 & 3746), several expeditions to those provinces and neighboring areas allowed us to collect individuals from a population located 60 km from the type locality of *Aldama macbridei*. Based on data from sheet labels we were able to contrast the current variability of some morphological characters in the field, and to observe the typical habitats and ecological features for this taxon. Early and reproductive stages were measured for vegetative characters to assess phenotypic plasticity associated with soil characteristics and slope inclination. Juvenile, sexually immature but well-developed plants (>1.5 m tall) and adults, sexually mature plants, and flowering individuals were characterized at least once. An estimation of the number of individuals composing the population sampled was done. The species has been assessed for its conservation status based on the 14th version of the IUCN Red List (IUCN 2019). The locality sampled was recorded by Garmin Global Positioning System, allowing the first georeferenced population of *Aldama macbridei*.

RESULTS AND DISCUSSION

The description of the species with notes on its distribution, phenology, ecological aspects, details of specimens examined and conservation status along with colour photographs to facilitate accurate identification are given below.

Taxonomic treatment and amplified description

Aldama macbridei (S.F.Blake) E.E.Schilling & Panero
(Figure 1; Images 2 & 3)

in *Bot. J. Linn. Soc.* 167(3): 324 (2011). *Viguiera macbridei* S.F.Blake. in *J. Wash. Acad. Sci.* 16: 218 (1926).

Synonym

Rhysolepis macbridei (S.F.Blake) H.Robinson & A.J.Moore in *Proc. Biol. Soc. Washington* 117(3): 429

(2004).

Holotype: 4078, 20.v.1923–1.vi.1923, Peru, Huánuco, Pachitea, Huacachi, near Muña, at about 1,980 m, coll J.F. Macbride (F-535145!). **Isotypes:** GH barcode 00014012 image!, S-R6483 image!, US-1191485 image!.

Perennial herbs with multiple stems, densely ramified at the base, 0.5–2 m tall. Stems and leaves densely covered by sericeous trichomes of about 2 mm long. Alternate arrangement of leaves, sessile, narrowly lanceolate to linear-lanceolate, blades 2–11 cm long, 3–15 mm wide, subcoriaceous, upperside bright dark green to yellowish-green at maturity, shallowly bullate, mostly glabrous except by a few, scattered glandular trichomes resembling resinous dots, underside densely sericeous, base truncate, apex acute, margins revolute, subentire. Capitulescences in paniculiform cymes, pedicels 3–15 cm long, densely sericeous. Capitula radiate, 2.8–5 cm wide including ray corollas. Involucre campanulate with phyllaries arranged in 4 or 5 series, lanceolate, 2–3 mm long, acute-mucronate, fimbriate, underside densely pubescent and upperside glabrous except at the margins. Ray florets 8–18, corolla 13–26 mm long, 40–75 mm wide, limb oblong, bilobulated or trilobulated (slightly curved towards the tip), golden yellow, bearing 11–13 dark yellow parallel veins; disk florets fertile ca. 55–65, 1.2–1.8 long, tubular, tube shortly pubescent; stamens 4–5.5 mm long, anthers black, styles 2.5–3.5 mm long, bifurcated, yellow, apex glabrous and acute. Cypselae 4 mm long, narrowly obovate, black, pappus of 2 awns, unequal, and several squamellae in between.

Flowering: Flowers and fruits were observed between March and May.

Ecology: This species was found on the lower mountain slopes close to the Huertas river, tributary of the Huallaga river, between the cities of Ambo (Huánuco) and Yanahuanca (Pasco) at an altitudinal range of 2,320–2,410 m. The species inhabits the tropical dry low montane forest (bs-MBT, MINAM 2009), considered a life zone located in the Meso-Andean region and characterized by the predominance of mountainous steep slopes. The prevailing climate is characterized by its dryness during several months of the year. The total annual precipitation fluctuates between 500 and 600 mm. The vegetation cover is deciduous as well as evergreen shrub species, and there is evidence of fire occurrence (mostly by anthropic action), influenced by the dominance of grasses. The following species were observed in the environment of *Aldama macbridei* in the boundary of the Huánuco-Pasco departments: *Caesalpinia spinosa* (Molina) Kuntze (Fabaceae), *Dodonaea viscosa* Jacq.

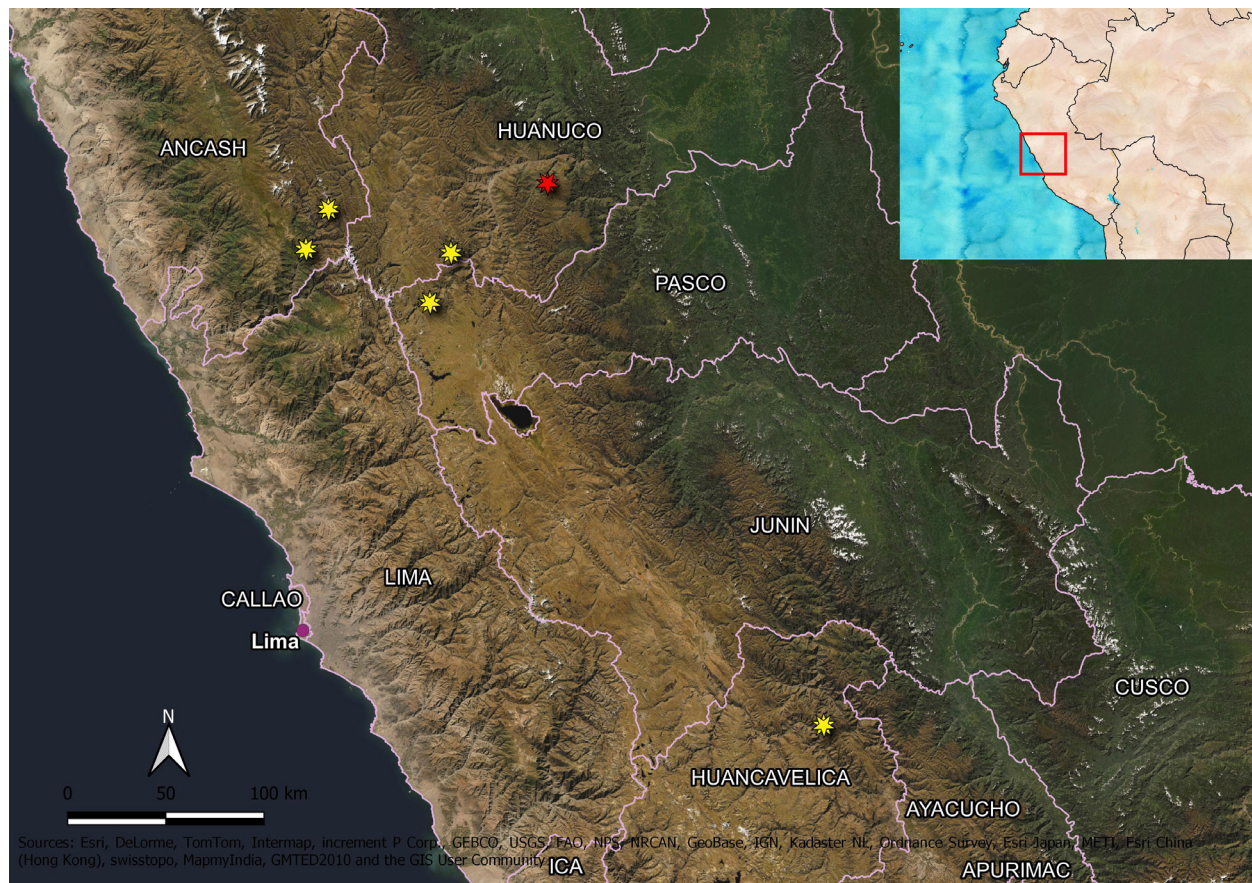


Figure 1. Distribution map of *Aldama macbridei*. The yellow asterisks indicate the distribution of the species according to the herbarium specimens examined (Ancash, Huancavelica, Huánuco, and Pasco departments). The red asterisk indicates the approximate location of the type specimen in the Huánuco department.

(Sapindaceae), *Espositoa huanucoensis* H. Johnson ex F. Ritter (Cactaceae), *Furcraea andina* Trel. (Asparagaceae), *Heliotropium arborescens* L. (Boraginaceae), *Myriopteris myriophylla* (Desv.) J. Sm. (Pteridaceae), *Schinus molle* L. (Anacardiaceae), *Spermacoce remota* Lam. (Rubiaceae), *Tillandsia usneoides* (L.) L. (Bromeliaceae), among others. Three additional specimens were observed at USM herbarium, two of them are from Bolognesi province, Ancash department, between 2,900 and 3,060 m in tropical dry low montane forest (bs-MBT). The other specimen corresponds to the Colcabamba district, Tayacaja province, Huancavelica department, in humid montane forests (bh-MT, tropical montane humid forest), at 2,300 m. An altitude of 1,980 m is indicated on the label of the type specimen, in Pachitea, Huánuco. Considering new collections, it is therefore concluded that the altitudinal distribution range for *Aldama macbridei* is from 1,980 to 3,060 m in tropical dry low montane forests (Figure 1).

Distribution: Central Peru, new to Ancash,



Image 1. Burning of slopes in the boundary of the Huanuco and Pasco departments, near the Huertas river, June 2018.

Huancavelica and Pasco departments. Prospections on herbaria out from Peru (example COL) allow us to reaffirm that the taxon does not surpass the Peruvian



Image 2. *Aldama macbridei* growing in the boundaries of the Huánuco-Pasco departments (2,320–2,410m): A—Environment near the Huertas river where the species grows | B—Habit near the road from Yanahuanca to Ambo, close to the Huertas river | C—Suberect flowering stems | D—Detail of the underside of the capitulescences | E—Upperside of the capitulescences | F—Size of a collected stem (ruler reference of 1m) | G—Detail of the underside and upperside of the leaves (in mm) | H—Detail of a capitule cut where the florets and immature pappi are observed (in mm) | I—Detail of the capitule rays with bilobulated tips (in mm). © Daniel B. Montesinos Tubée

territory and is endemic to the mountains of the Central Andes. According to our ongoing expeditions in these geographic high-altitude systems, the species distribution boundaries lie between Huánuco province to the north, and Huancavelica province to the south, and is limited to the high altitude plateaus or Andes mountains.

Specimens examined: 4078 (F), Peru, Huánuco, Pachitea, Huacachi, near Muña, 1,980 m, 20.v.1923–

1.vi.1923, coll. J.F. Macbride; 1884 (USM), Peru, Huancavelica, Tayacaja, Colcabamba, Hacienda Villa Azul, abajo de Colcabamba, 2,300 m, 17.iv.1954, coll. O. Tovar; 2135 (USM), Peru, Ancash, Bolognesi, Paillon, Mashcash, punto de unión de los ríos Llamac y Chiquián, 3,060 m, 18.v.1954, coll. E. Cerrate; 3746 (USM), Peru, Ancash, Bolognesi, Huaraumapata, 2,900 m, 15.iv.1961, coll. E. Cerrate (USM); 7357 (CPUN, CUZ, HSP, HUT, TX), Peru, Huánuco, Ambo, San Francisco, road between San

Francisco de Mosca and Parcoy, Lat. 10.27, Long. 76.33, 2,317 m, 14.v.2018, coll. D.B. Montesinos & G. Sancho; 7537 (CPUN, HSP, HUT, MOQ, OXA, USM, TX), Peru, Pasco, Daniel Alcides Carrión, Santa Ana de Tusi, Centro Poblado de Antapirca, roadside vegetation, Lat. 10.308, Long. 76.32, 2,406 m, 25.iv.2019, D.B. Montesinos (Figure 2).

Conservation status: With nearly 724 endemic Composite species, Asteraceae is the second biggest family in terms of endemism, in Perú (León et al. 2006). Endemism is a significant attribute of any taxon with reference to its restricted distribution, and endemic species of Peruvian Andes mountains located between Huancabamba deflection, an important biogeographic boundary, and Atacama Desert, hold immense significance. An assessment of their geographical distribution within remote Andean areas is of great conservation concern. Assessments are always done using the best available information, however, there is a dearth of knowledge in the case of the distribution pattern for many high-altitude endemic species, especially those in some Andean mountains with difficult access, as those explored as part of the ongoing prospection of Asteraceae from Perú.

The study by Beltrán et al. (2006) regarding conservation status on Peruvian Asteraceae has provided valuable information for most of endemic Composites in the country. In the present survey, an attempt has been made to assess the population and conservation status of one of the species omitted from this work (*Aldama macbridei*), because of the scarce exploration of some remote Andean areas, as those considered and sampled here.

Also, a perusal of herbarium consultation in local (CPUN, HSP, HUT, MOQ, OXA, USM, TX) and international herbaria has revealed interesting new information about the species distribution. A new record from Huancavelica province (Tovar 1884) allows us to broaden the current knowledge for the distribution of the species, thought to be limited to Andean high-altitude plateaus located to the North of Lima, the Capital city (provinces of Ancash, Huánuco, and Pasco).

According to the criteria and categories of IUCN (2019), it is proposed as 'Near Threatened' (NT) following Red List criteria. This taxon has a reduced distribution area (less than 10,000 km²). For the locality sampled, less than 500 individuals were counted for the whole population at this site. Only four other populations are known, and the absence of other collections allow us to consider that the species may be restricted to the localities referenced in this work. Nevertheless, one



Image 3. *Aldama macbridei* type specimen stored at (Swedish Museum of Natural History)

of these populations is located near the Huayhuash reserve, in a private protected area (Sernanp 2021), so the category NT is defined preliminarily, to move to an eventual threatened category (ex. EN B1-b) if future assessments of population dynamics firmly establish a high risk of extinction. Suitable habitats for *Aldama macbridei* are regarded as near threatened because of slope burning in all the areas where its occurrence is known. Also, agriculture expansion, changes in annual rainfall, landslides, and forestation with exotic species are quite common ongoing processes outside the protected area where one occurrence is registered. These factors, together with exploitation of natural resources (especially mining in Ancash, Huanuco, and Pasco provinces) and the expansion of roads (MTC, 2020) due to the explosive demographic growth of Lima's vicinities (the capital city) may all potentially reduce the current extent of *Aldama macbridei*'s populations. Interestingly, several degraded areas with steep slopes (the current habitat for *Aldama macbridei*, ex. Figure 3B) documented during our expeditions, present a potential

for reforestation with native species for watershed protection purposes.

Notes: *Aldama macbridei*, was originally described by Blake (1926) under the species *Viguiera macbridei* S.F.Blake from Pachitea region, Huánuco province. According to Schilling & Panero (2011), *Aldama macbridei* was better placed into *Aldama* group than within *Viguiera* traditional concept. *Aldama macbridei* is allied to *Aldama linearifolia* (Chodat) E.E.Schill. & Panero (2011: 324), differing by the glabrous stems, narrower leaves, glabrous pedicels, larger phyllaries and ray limbs, and by the distribution of the latter in Brazil and Paraguay. *Aldama macbridei* also differs from *Aldama linearis* (Chodat) E.E.Schill. & Panero (2011: 324), another similar species, by its relatively shorter leaf size, hispidulous pubescence of leaves, broader phyllaries, shorter capitules and by the distribution of the latter in Mexico. Lastly, it differs from *Aldama tenuifolia*, (Gardner) E.E.Schill. & Panero (2011: 325), a brazilian representative of the genus, by the narrower leaves, glabrous underside of the leaf blades, glabrous stems, and pedicels.

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