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Rediscovery of *Dichoropetalum aureum* (*Umbelliferae*) in South Anatolia (Turkey)

By

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With 4 Figures

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Summary

ADIGÜZEL N., BANI B. & MAVI Ö. 2011. Rediscovery of *Dichoropetalum aureum* (*Umbelliferae*) in South Anatolia (Turkey). – Phyton (Horn, Austria) 50(2): 221–230, with 4 figures.

Dichoropetalum aureum (BOISS. & BALANSA) PIMENOV & KLJUYKOV was collected from Turkey for the first time in 1856 and described in 1859. Although the species was collected from Lebanon and Israel, it has not been recorded from Turkey since 1856. This study comprises the recollection of *Dichoropetalum aureum* from the type locality and neighbouring areas after 150 years and also an expanded morphological description. Ecological parameters such as soil and climatic features are given in addition to information about the anatomical characters of the mericarps (confirmation of the absence of commissural vittae) and the vegetative organs. As an IUCN red list category for *D. aureum* CR (critically endangered) is recommended.

Zusammenfassung

ADIGÜZEL N., BANI B. & MAVI Ö. 2011. Rediscovery of *Dichoropetalum aureum* (*Umbelliferae*) in South Anatolia (Turkey). [Wiederfund von *Dichoropetalum aureum* (*Umbelliferae*) in Süd-Anatolien (Türkei)]. – Phyton (Horn, Austria) 50(2): 221–230, mit 4 Abbildungen.

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Dichoropetalum aureum (Boiss. & Balansa) Pimenov & Kljuykov wurde in der Türkei erstmals 1856 gesammelt und 1859 beschrieben. Während die Art im Libanon und Syrien mehrmals gesammelt wurde, ist sie für die Türkei seit 1856 nicht mehr angegeben worden. Diese Studie berichtet über den Wiederfund an der Typuslokalität und an einigen benachbarten Stellen nach 150 Jahren und bringt eine etwas erweiterte morphologische Beschreibung. Neben einigen Informationen über die anatomischen Merkmale der Merikarpien (Bestätigung des Fehlens der kommissuralen Ölstriemen) und vegetativer Organe werden auch einige ökologische Parameter (Boden, Klima) erwähnt. Als IUCN Rote Liste Kategorie wird CR (vom Aussterben bedroht) vorgeschlagen.

1. Introduction

The generic name of *Johrenia* was published by Candolle 1829 (see Pimenov & al. 2007). *Dichoropetalum* Fenzl, based on *Dichoropetalum alpinum* Fenzl, was described in 1842, and synonymised under the genus *Johrenia* by Fenzl in 1843 (Pimenov & al. 2007). However, the genus *Dichoropetalum* was reassessed together with some species of *Peucedanum* L. and *Johrenia*, but also the members of the genera *Johreniopsis* Pimenov and *Holandrea* Reduron, Charpin & Pimenov (Pimenov & al. 2007). The genus now contains 26 species in six sections. In this most recent study (Pimenov & al. 2007), the Turkish species of *Johrenia* transferred to *Dichoropetalum* sect. *Dichoropetalum* include *Johrenia aurea* Boiss. & Balansa in Boiss. and *J. alpina* (Fenzl) Fenzl as well as *J. berytea* Boiss. as a synonym for *D. depauperatum* (Boiss.) Pimenov & Kljuykov and *J. porteri* Boiss. as a synonym for *D. junceum* (Boiss.) Pimenov & Kljuykov. *Dichoropetalum aureum* (Boiss. & Balansa) Pimenov & Kljuykov, formerly known as *J. aurea* in the Flora of Turkey, was firstly collected by Balansa in 1856 from the province of Kayseri (Turkey) and published as a new species by Boiss. & Balansa in Boissier 1859 (see Chamberlain 1972).

According to Pimenov & al. 2007, *D. aureum* is distinguished from the other three species of this section by morphological characters such as the shape of terminal leaf lobes (linear), the habit of the stems (low, up to 20 cm) and the sessile basal primary leaf segments. The absence of commissural vittae is a further distinguishing character (Chamberlain 1972, Pimenov & al. 2007). Despite comprehensive studies on the vegetative anatomy of the family *Umbelliferae* (Chakrabarty & Mukherjee 1986a, b), classification is mostly band on anatomical characters of fruits (Drude 1897-1898; Pimenow & Leonov 1993; Downie & al. 2001; Shneyer & al. 2003; Pimenov & al. 2003; Liu 2004; Liu & al. 2006).

This manuscript describes the rediscovery of *D. aureum*, which has not been collected from Turkey for 150 years together with a morphological description of the anatomical characters of fruits and vegetative organs.

2. Material and Methods

EKIM & al. 2000 reported the IUCN redlist category for *D. aureum* as DD (Data Deficient). A floristic study was conducted by the authors in Tahtalı mountains between 2005 and 2009. During these field studies more than 4000 plant specimens belonging to different families were collected. The authors gave special interest to collect the DD categorised plants, such as *D. aureum*, only known from the research area.

The Flora of Turkey and recent publications were used for the identification of the species (CHAMBERLAIN 1972; DAVIS & al. 1988; GÜNER & al. 2000; PIMENOV & al. 2007). To confirm the identification of *Dichoropetalum aureum*, a photo of the isotype specimen kept in the Herbarium at Göttingen (GOET) was examined. Authorities for all cited names were given according to BRUMMITT & POWELL 1992. The herbarium vouchers are kept in GAZI.

For anatomical observations, all the samples were fixed in formalin-acetic-ethyl alcohol (F.A.A.) solution for 48 hours. After removing of the fixative, the specimens were dehydrated by increasing strenght of alcohol to prevent distortion due to shrinkage. These dehydrated specimens were embedded into paraffin and sliced by applying the JOHANSEN's paraffin sectioning method (JOHANSEN 1944). After hydration, safranine was used to stain these hydrated sections, which were then mounted in Entellan. The anatomical observations were made using a Leica DM1000 microscope and photographed using a Leica DFC280 type camera.

The threat category assessment of *D. aureum* was made according to IUCN criteria and categories (IUCN 2001).

3. Results

Dichoropetalum aureum (BOISS. & BALANSA) PIMENOV & KLJUYKOV in PIMENOV & al. 2007 (Fig. 1)

Syn: *Johrenia aurea* BOISS. & BALANSA

Description (expanded, based on recent collections): Decumbent glaucous perennial, stems 11–36 cm with basal fibrous collar. Basal leaves c. 3–6–8 cm long, 1-pinnate with 3–4 cm petiole, leaflets to 8 mm long, ovate in outline, 2-pinnatipartite, segments to 8 mm lomg, linear-elliptic, acute to mucronulate at apex. Cauline leaves c. 13 mm long, trisect with sheathed petiole. Umbels 3–6-rayed; rays unequal, up to 45 mm. Bracts absent. Bracteoles 1–6 mm, linear-triangular. Umbellules 7–9 flowered. Pedicels 1–3 mm, corolla yellow. Fruits c. 6×4 mm, oblong-elliptic to obovate, central area green and differentiated from the spongy margin. Mericarps with 3 oil ducts in the distal part of the ribs and 4 oil ducts in the furrows, without commissural oil ducts.

Type: Turkey B6 Kayseri: Aslantas Antitauri in Cappadocia, 06 August 1856, BALANSA 1007 [holotype G (not seen), isotype GOET photo !].

Examined specimens (compare Fig. 2): Turkey, B6 Adana: Tufanbeyli, above Tozlu village, Beydağ hill, around of Beşikkaya district, rocky slopes, 07.07.2006, B. BANI 4504. – Kayseri: Tomarza, above Kesir

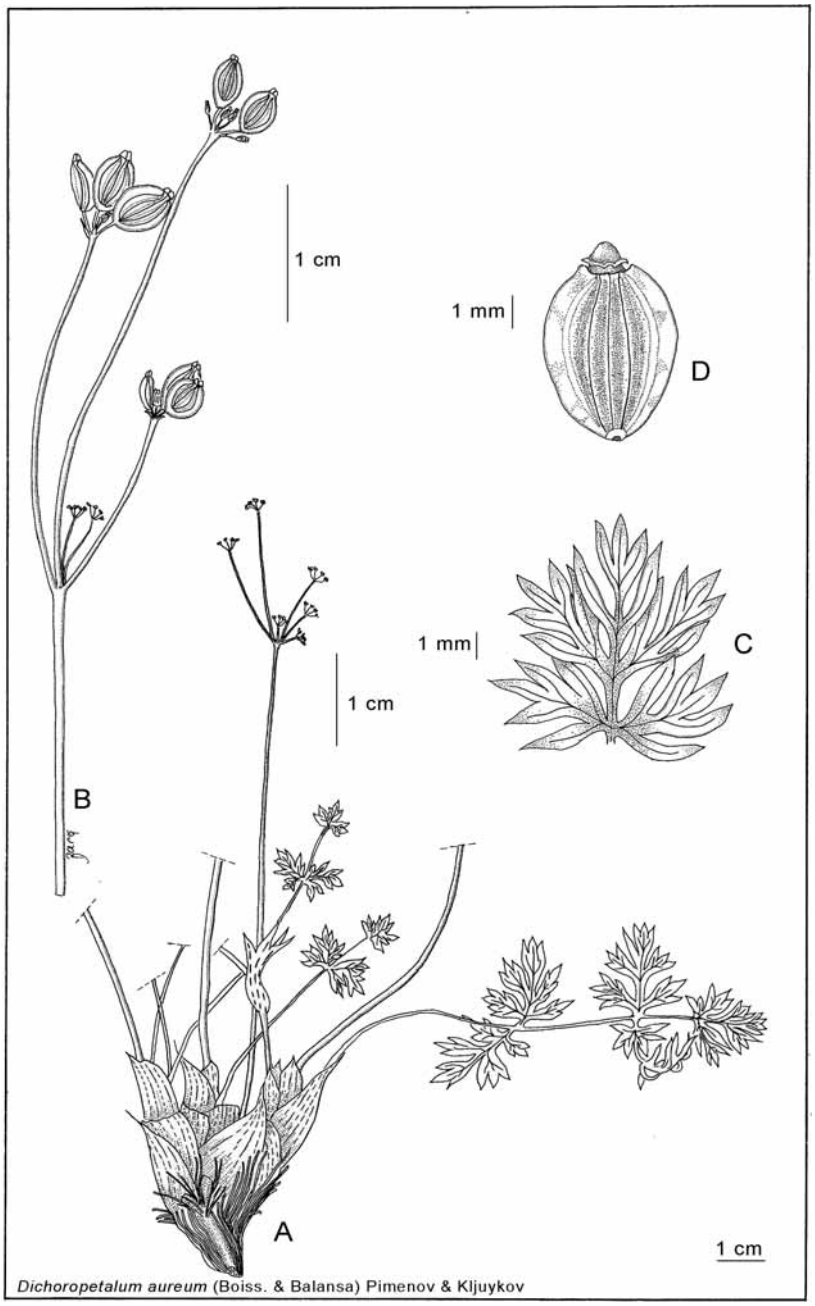

Fig. 1. *Dichoropetalum aureum*, drawing of a herbarium specimen. – A habit. – B rays and umbellules. – C leaflet. – D fruit.

village, Beydağ hill, rocky slopes, 2800–3000 m, 24.08.2006, B. Bani 4693. – ibid., 03.07.2008, B. Bani 6516. – ibid., above Aslantaş village, Kurubel yayla, steppe, 2300 m, 05.08.2009, B. Bani 6733. – Pınarbaşı, Mezgitli-Değirmentaş villages, Soğanlı mountain, above Aslanbeyli yayla, Kurubel-Kırınsivri hills, rocky slopes, 2300–2600 m, 31.07.2008, B. Bani 6630.

Phenology: flowering from July to early August, fruiting in late August.

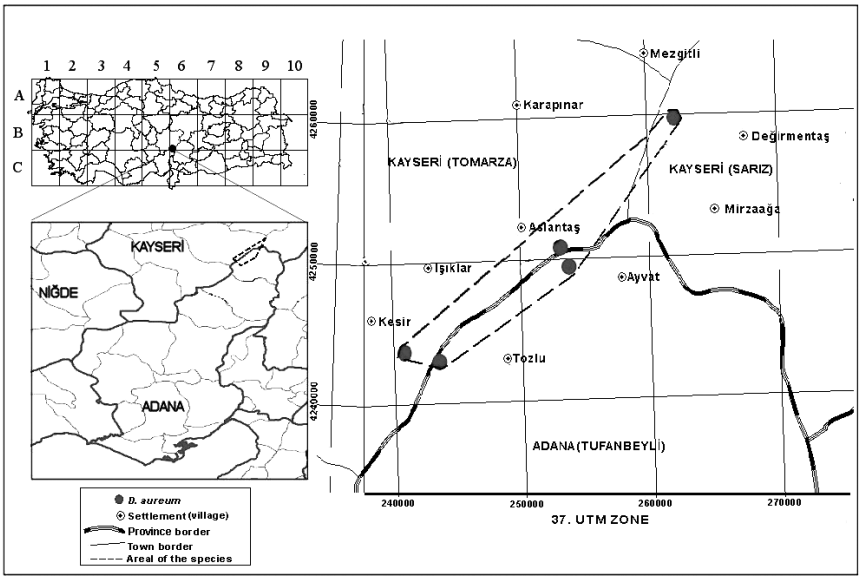

Fig. 2. Distribution map of *Dichoropetalum aureum* in Turkey.

Mericarp anatomy: Anatomical characters of fruits such as the position and number of oil ducts are essential in *Umbelliferae* for the classification even at a suprageneric level. According to the most recent study (Pimenov & al. 2007) the most important and distinctive fruit character of *D. aureum* in relation to the other three members of sect. *Dichoropetalum* is the absence of commissural vittae (commissural oil ducts; Fig. 3 A–B). Otherwise, the mericarps show 3 oil ducts in the distal part of the ribs and 4 oil ducts in the furrows.

Vegetative anatomy: The secretory canals were also observed in transections of the vegetative organs. The cross sections of stems were taken from the middle part of the tissue and demonstrate that the epidermis is composed of a single layer of irregularly shaped cells, which are generally covered with a thin cuticle (Fig. 4 A–B). The stems, containing 9–14 vascular bundles and 7 or 8 secretory canals, are almost ribbed. Two or

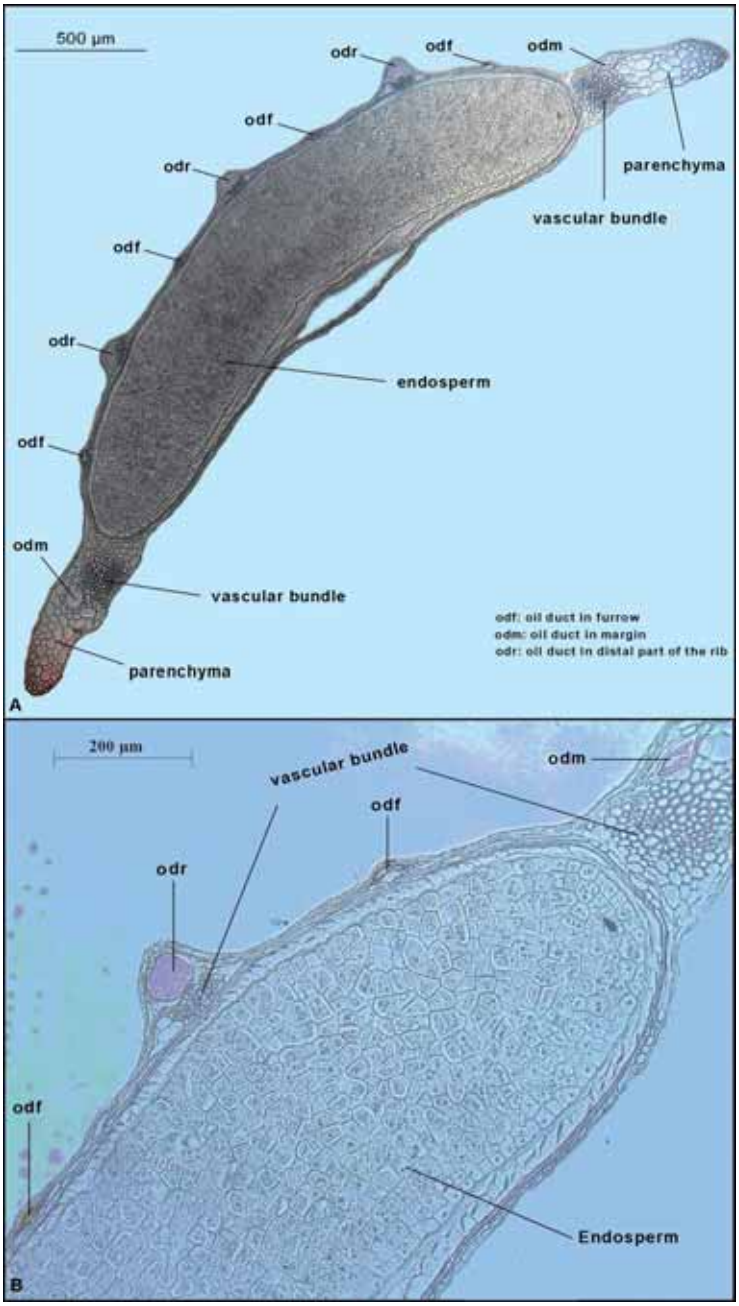

Fig. 3. *Dichoropetalum aureum*. General view of the transverse sections of the mericarp. – A overview. – B detail from A.

three layers of irregularly shaped collenchymatic cells are located below the epidermis. The cortex tissue also consists of parenchymatous cells towards the phloem of vascular bundles. The vascular bundles are arranged in a ring and connected to each other by sclerenchymatic cells. There are 4–5 layers of sclerenchymatic cells through the ground tissue. The xylem of the vascular bundles is embedded in ground tissue. The centre of pith is composed of parenchymatous cells.

The cross section of the midrib of the leaf is shown in Fig. 4 C. Both epidermal surfaces are covered with a thin cuticle. The epidermal cells of abaxial and adaxial sides are large and irregularly shaped. Homogenous mesophyll with large intercellular cavities includes the vascular bundles and the secretory canals. The canals are surrounded by 1 or 2 layers of regularly arranged parenchymatous cells.

The root sections in Fig. 4 D–E show a multilayered periderm on the outermost layer as a protective tissue. The cortex is composed of thin walled parenchyma cells and more or less broken into convoluted radiating strands and contains numerous secretory canals. The secretory canals are variable in size within the cortex. The endodermis and pericycle are not readily distinguishable. The central part of the root contains metaxylem and primary phloem elements.

Habitat and ecology: *D. aureum* grows on rocky and stony slopes in the alpine region. Its altitudinal range varies between 2300 and 3000 m. Other species sharing the habitat with *D. aureum* are *Androsace armeniaca* Duby var. *macrantha* (Boiss. & Huet) Martelli, *Anthyllis vulneraria* L. subsp. *pulchella* (Vis.) Bornm., *Astragalus dumanii* Ekici & Aytaç, *Asyneuma ekimianum* Kit Tan & Yildiz subsp. *beritense* Kit Tan & Yildiz, *Cirsium leuconeurum* Boiss. & Heldr., *Hedysarum laxum* Boiss., *Jacobaea cilicia* (Boiss.) B. Nord., *Jacobaea inops* (Boiss. & Balansa) B. Nord., *Omphalodes luciliae* Boiss. subsp. *cilicica* (Brand) Bornm., *Oxyria digyna* Hill, *Oxytropis engizekensis* H. Duman & Vural, *Stachys citrina* Boiss. & Heldr. subsp. *chamaesideritis* (Boiss. & Balansa) R. Bhattacharjee, *Nepeta trichocalyx* Greuter & Burdet and *Vavilovia formosa* (Steven) Fed.

D. aureum grows on loamy soils; water-saturation 75 %, sand 49.3 %, silt 40.4 %, clay 10.3%, total salinity 0.03%, pH 7.7, lime ($CaCO_3$) 5.6 %, phosphorus (P_2O_5) 2.8 kg/da, potassium (K_2O) 52.6 kg/da, organic matter 7.0 %, total nitrogen – N, 0.4 %, organic carbon 4.1 %. *D. aureum* prefers soils which are slightly alkaline, medium limy, very low in phosphorus, with medium levels of potassium and high content of organic matter.

The characterisation of climate in the distribution area was evaluated by using the data from 5 meteorological stations (Develi, Pınarbaşı, Sarız, Tomarza, Tufanbeyli; DMI 2007), located in the surroundings of the Tahtalı mountains. In this region, the annual mean precipitation varies from 440 to

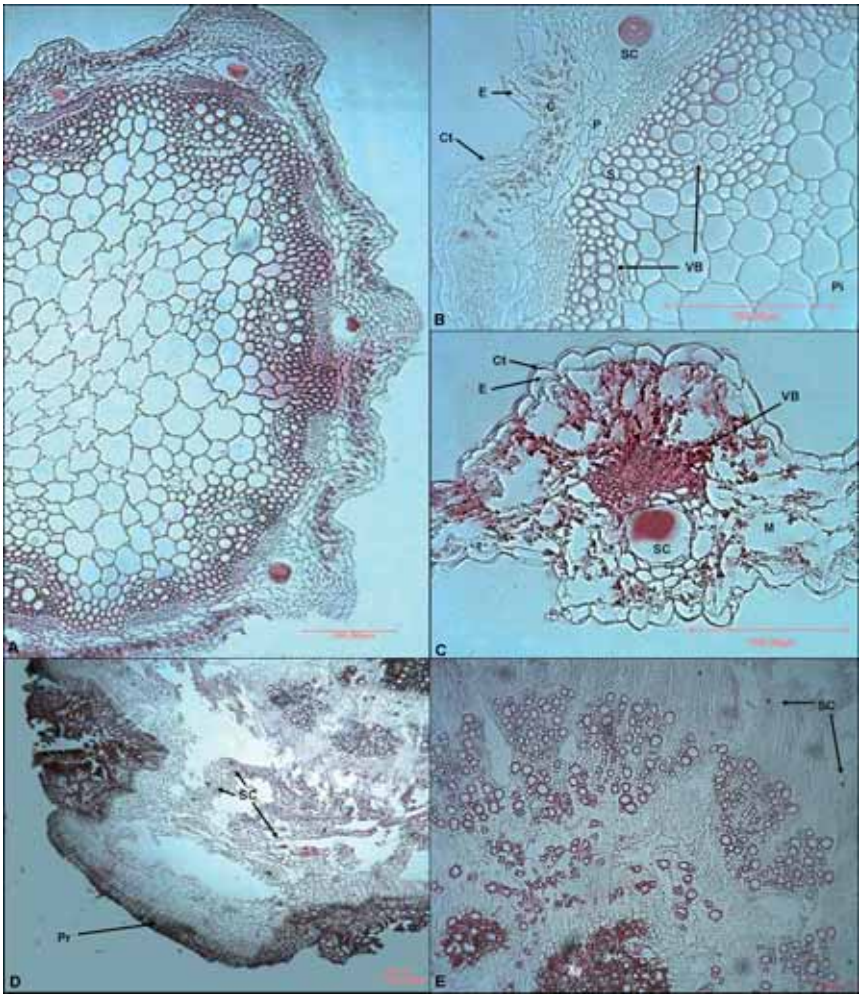

Fig. 4. *Dichoropetalum aureum*. Transverse sections of the vegetative organs. – A–B stem. – C leaf. – D–E root. **C:** Collechyma, **Ct:** Cuticle, **E:** Epidermis, **M:** Mesophyll, **P:** Parenchyma, **Pi:** Pith, **Pr:** Periderm, **S:** Sclerenchyma, **SC:** Secretory Canal, **Xy:** Xylem, **VB:** Vascular Bundle.

623 mm, the annual mean temperature from –2.5 to 1.5 °C, maximum mean temperature is between 17.5–21°C and minimum mean temperature is between –16 and –19.5 °C (time span of observations 1976–2007).

4. IUCN Red List Assessment

D. aureum, was collected from Lebanon and Israel as well. In Turkey it is only known from its type locality where Balansa collected it from the

northwest slope of Kızılgöl mountain in Kayseri province (CHAMBERLAIN 1972). In this study, specimens of *D. aureum* were collected from different places in the same range. The extent of occurrence is determined as 84 km^2. As mentioned in criterion CR B1, the extent of occurrence is less than 100 km^2 in the Tahtalı range only (criterion CR B1a). Almost the whole Tahtalı range is over-grazed by the great number of goats, sheep and cattle, especially during summer. This results in a change in natural habits of the plants and seriously habitat degradation [criterion CRB1b(iii)]. According to the IUCN criteria [CR B1a+b(iii)], the revised threat category of the species should be CR (Critically Endangered).

5. Acknowledgements

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