



## Contributions to the Systematics of the Genus *Adonis* L. (Ranunculaceae) in Turkey

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### Highlights

- Re- evaluated of the status of the *Adonis cyllenea* var. *paryadrica*
- Information of pollen structure, ecology, conservation status and distribution map of the taxon
- Information of relationships with other close species

### Article Info

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### Abstract

The status of the *Adonis cyllenea* var. *paryadrica* was re-evaluated and decided to change its taxonomic status to species level. In addition, information about pollen structure, ecology, conservation status and distribution map of the taxon were presented.

### Keywords

*Adonis*  
Erzincan  
stat. nov  
Ranunculaceae

## 1. INTRODUCTION

The genus *Adonis* is represented by approximately 40 species and two hybrids in the world [1-4]. 10 taxa are grown in Turkey (eight species, one subspecies, and one variety) [5]. Among these taxa, only *A. cyllenea* Boiss. Heldr. & Orph. var. *paryadrica* Boiss. is endemic to Giresun/Gümüşhane provinces (Turkey). It was collected by Tchihatcheff in 1858 from Giresun.

*Adonis annua* L. is Mediterranean element; *A. aleppica* Boiss. and *A. eriocalycina* Boiss. are Ir.-Tr. elements and the others are widespread in Turkey. The petals colors of *Adonis* L. are usually scarlet in the genus members, but yellow in *A. wolgensis* Stev. ex DC, *A. cyllenea* var. *paryadrica* and *A. dentata* Del.; scarlet to rarely yellow in *A. microcarpa* DC. in Turkey [6].

Except for *A. wolgensis* and *A. cyllenea* var. *paryadrica*, all Turkish *Adonis* species are annual. *A. wolgensis* is different from *A. cyllenea* with reduced to the scale of lower leaves and subuncinate achene beak [6].

The chromosome numbers of annual species change from  $2n= 16$  to 48 and this number is  $2n= 16$ ; 24 or 40 in perennials [7].

Anatolia was visited many times by foreign nature researchers, especially between the years 1800-2000 [8]. During these visits, biological, geological and archaeological samples were collected from different parts of Anatolia. Tchihatcheff was one of these researchers and collected many plant specimens especially from northern and eastern Anatolia. He published his plant samples in "Flore De Asie Mineure" [9]; but his plant

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samples were not well known in Turkey due to so many specimens placed in Flora orientalis and Flora of Turkey and the East Aegean Islands and some of them as only type specimens [9].

While Tchihatceff was traveling between Şebinkarahisar (Giresun) and Gümüşhane, he collected many plant specimens from the Paryados Mountains (now, between Lice and Kümbet near Şebinkarahisar); one of them belonged to the genus *Adonis*. This specimen was published as a new taxon by Boissier *A. cyllenea* var. *pariyadrica*. [10]. *Adonis cyllenea* is endemic to Mount Killini (parts of Patras Island–Greece) [11]. Therefore, it would be more accurate to publish it as a taxonomic subspecies. However, it was published in Flora Orientalis as variety and its taxonomic situation in Flora of Turkey should be re-evaluated [6, 10].

In 2014, Dr. Ali Kandemir collected similar specimens from Munzur Mountains (Erzincan part). These two samples were very similar to each other. However, the situation of *A. cyllenea* var. *pariyadrica* has not been investigated in detail so far since additional samples was not collected after the type collection in 1856. After our examination, it is understood that the specimens in these two locations (Kandemir and Tchihatceff collections) belonged to *A. cyllenea* var. *pariyadrica* when compared to each other. In this paper, we re-evaluated the specimens and suggested to change the status of *A. cyllenea* var. *pariyadrica* to the species level.

## 2. MATERIALS AND METHODS

The samples belonging to this species were collected in 2014 and 2017 in Kemah, Mercan Suyu, 1900 m, on a rocky place, Erzincan Province and Şebinkarahisar, Tutak Mountain, 2057 m, rocky slopes, Giresun Turkey. *A. cyllenea* var. *pariyadrica* was re-described according to the collected materials, using Flora Caucasia [12], Flora Europaeae [13], Flora of Turkey [6], Flora of USSR [14], Flora Orientalis [10] and Flora Hellenica [15]. The pollen and seed morphology of the species were examined with scanning electron microscopy (SEM) and photomicrographs were taken with the JEOL JSM 6060 SEM at the laboratory of Gazi University.

The names of the plants were checked from IPNI [4]. The terminology for pollen and seeds morphology was used in accordance with Faegri and Iversen [16] and Punt et al. [17]. The specimens used in this study are deposited at GAZI, ANK and NGBB. The author of plant names was used according to Brummitt and Powell [18].

## 3. RESULTS

### 3.1. Taxonomic Order

**Familia:** Ranunculaceae

**Subfamilia:** Ranunculoideae

**Tribus:** Adonideae

**Genus:** *Adonis* L.

**Section:** *A. sect. Consiligo* DC.

*A. pariyadrica* (Boiss.) Kandemir & Aytaç stat. nova. (Figure 1).

Type: TURKEY. A7 Giresun/Gümüşhane: In jugo Paryodrico Ponti austra., 1600 m, Tchihatceff (G) photo!.

**Second collection:** TURKEY. A7 Giresun: Şebinkarahisar Tutak Mountain, 2057 m, rocky slopes, 13.07.2017, Kandemir 10928; B7 Erzincan: Kemah, Mercan Suyu, 1900 m, 1900 m, rocky place, 26.05.2014, Kandemir 10548 and Y. Ünal.

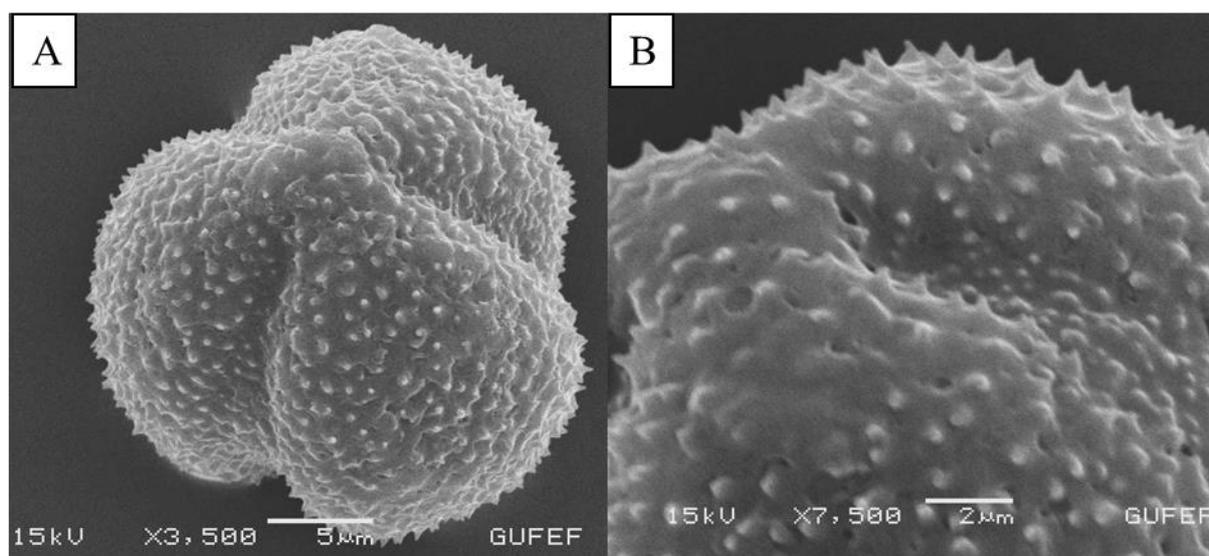
**Re-description according to collected materials:** Perennial, rhizomatus, branched from base; stem 50–70 cm, sulcate, villose. Basal and lower leaves petiolate; petioles 5–15 cm; blade 10–14 cm long, with laciniae linear–setaceous, glabrous; upper cauline leaves similar to below, but smaller and sessile. Inflorescence always solitary; flowers 5–7 cm across. Sepals 2–2.5 cm, yellowish, membranous, glabrous. Petals 4–4.5 cm, yellow, with apiculate at apex. Stamens numerous; filaments  $\pm$ 15 mm, anthers 3–5 mm, villose. Achens numerous on globose receptaculum, 6–7  $\times$  3–4 mm, glabrous,  $\pm$  pubescent, reticulate; beak 2.5–3 mm, circinnate. Fl. and Fr.: 5–6.



**Figure 1.** Habitus of *A. paryadrica* in the field with *Prangos Lind. sp.* population (Kandemir 10548 and Y. Ünal)

### 3.2. Pollen Structure

Pollen grains of *Adonis paryadrica* are oblate-spheroidal, aperture tricolpate and ornamentation microechinate–perforate. P ( $\mu$ m) = (23.04) 25.73  $\pm$  1.72 (28.8). E ( $\mu$ m) = (24) 27.19  $\pm$  1.57 (29.76) (Figure 2).

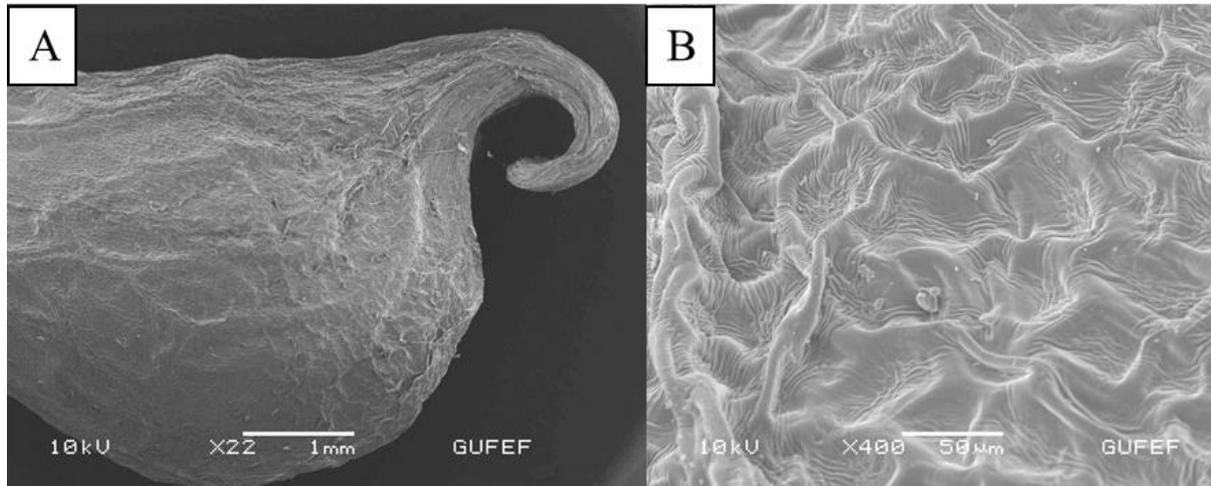


**Figure 2.** Pollen micrographs of *A. paryadrica* (A) Polar view, (B) Ornamentation. (Kandemir 10548 and Y. Ünal)

The pollen grains are isopolar and tricolpate in annual and perennial species, but differ in size, shape and exin sculpturing. They are circular in polar view and elliptical in equatorial view in annual species; with prolate-suboblate shape and echinate sculpturing in *A. wolgensis* [3] also, oblate-spheroidal and microechinate-perforate in *A. paryadraca*.

### 3.3. Seed Structure

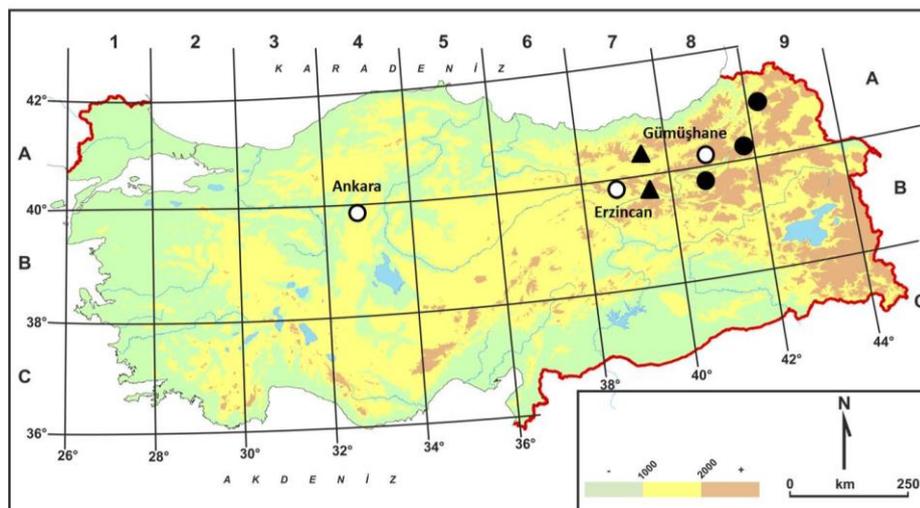
Achenes are aggregate, sessile, nearly globose, rugose; beak is terminal, circinate (Figure 3).



**Figure 3.** Achene micrographs of *A. paryadraca*. (A) general appearance, (B) ornamentation of seed coat surface (Kandemir 10548 and Y. Ünal)

### 3.4. Distribution

It is known from two collections, endemic. Irano.-Turanian element. (Figure 4).



**Figure 4.** Distribution of (●) *A. wolgensis* and (▲) *A. paryadraca*.

### 3.5. Ecology

It grows on calcareous rocky slopes on the steppe, 1900 m altitude, the *Prangos ferulacea* Lindl is dominant species of the steppe.

### 3.6. Recommended IUCN Threat Category Listing

It is known from two collections, B7 Kemah (Erzincan) and Şebinkarahisar (Giresun) (Figure 5). Additionally, it is Irano.-Turanian element. The estimated whole range is less than 10 km<sup>2</sup>. The population is unhealthy with less than 250 individuals due to grazing; the population of the species is threatened by extinction. Therefore, we recommend that the threatened categories of this species should be “Critically Endangered (CR)”, (criteria B2 a b (i, iii) of IUCN 2010) [19].

## 4. DISCUSSION

In Turkey, four species of *Adonis* have yellow petals (*A. microcarpa* DC. rarely yellow, *A. dentate* Del., *A. wolgensis* Stev. ex DC and *A. paryadrica* (Boiss.) Kandemir & Aytaç. Two of them are annual (*A. microcarpa* and *A. dentate*) and other two are perennial [6]. *A. wolgensis* and *A. paryadrica* are distinguished from each other by lower leaves and achene structure (Table 1).

*A. cyllenea* var. *cyllenea* grows in Killini Mt. (Greece). *Adonis cyllenea* var. *paryadrica* is known from Giresun and Gümüşhane provinces. These locations in Greece and Turkey are very distant from each other. In addition, the number of its leaves is less and the distribution of the leaves along the stem is more spaced in *A. cyllenea* var. *cyllenea* (Figure 5A), compared to *A. cyllenea* var. *paryadrica*.

*A. paryadrica* is distinguished from *A. cyllenea* by its more leafy stems, young carpels more densely pubescent, sepals ½ to petals, and tall rhizomatous. The comparison of *A. wolgensis*, *A. paryadrica* and *A. cyllenea* are given in Table.

*A. paryadrica* (type specimen) is stored in G herbarium (Tchichatcheff, P. A., 464, 1858, Asia Minor Est. Mt Paryadras Ponti, Turkey, (G), G00330533). The photo of type material was examined (Figure 5 B). As a result of the examination, taxon was raised to the species level.

**Table 1.** Comparison of *A. wolgensis* and *A. paryadrica*

	<i>A. paryadrica</i>	<i>A. cyllenea</i>	<i>A. wolgensis</i>
Lower leaves	Laminate and petiolate	petiolate	reduced to scale
Sepals length	½ to petals	as long as petals	2–3 × shorter than petals
Achenes	pubescent, reticulate, with strongly circinate beak	pubescent reticulate, with uncinated beak	pubescent, not reticulate, with subuncinate

The key of *A. wolgensis* and *A. paryadrica* was prepared according of Flora of Turkey [6].

- 1- Perennial and rhizomatous; anthers yellow (sect. Consiligo)
  - 2- Lower leaves reduced to scales; achenes not reticulate, beak bent down-wards, subuncinate.....*A. wolgensis*
  - 2- Lower leaves laminate and petiolate; achenes reticulate, with long circinnate beak.....*A. paryadrica*
- 1- Annual; anthers blackish (sect. Adonis, Turkish annual species)..other Turkish species



**Figure 5.** (A) holotype of *Adonis cyllenea* and (B) *A. paryadrica*

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## CONFLICTS OF INTEREST

No conflict of interest was declared by the authors.

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