Contributions to the Hypericum L. section Oligostema (Boiss.) Stef. (Hypericaceae), and Hypericum turcicum sp. nov. as a new species from Turkey

Mehmet Ufuk ÖZBEK¹*, Murat KOÇ², Ergin HAMZAOĞLU³
¹Department of Biology, Faculty of Science, Gazi University, Ankara, Turkey
²Department of Traditional, Complementary, and Integrative Medicine, Institute of Public Health, Yıldırım Beyazıt University, Ankara, Turkey
³Department of Mathematics and Science Education, Gazi Faculty of Education, Gazi University, Ankara, Turkey

Abstract: Hypericum turcicum (Hypericaceae) is described and illustrated as a new species from Beypazarı in Ankara Province in Northwest Anatolia, Turkey. The new species belongs to the section Oligostema, and it is closely related to H. aucheri. Diagnostic characters, description, detailed illustrations, ecology, and pollen and seed morphology are presented in this study. In addition, this study evaluates H. kazdaghense, which was previously accepted as a synonym of H. aucheri, as a distinct species and discusses the similarities and differences between H. turcicum and H. aucheri.

Key words: Hypericaceae, Hypericum, new species, sect. Oligostema, taxonomy, Turkey

1. Introduction

Hypericum L. is an important genus of the family Hypericaceae, which consists of almost 500 species found throughout the entire world, except for Antarctica (Robson, 2012). The genus Hypericum was revised by Robson (1967) in Flora of Turkey and the East Aegean Islands, and a total of 84 taxa were evaluated under 19 sections. Since then, many new taxa from Turkey have been described. Currently, this genus is represented in Turkey by 20 sections and 107 taxa, of which 46% are endemic to the country (Robson, 1988; Dönmez, 2000; Ocak et al., 2009; Aslan, 2012; Yaylacci et al., 2013; Ocak et al., 2013; Babacan et al., 2017; Başköse and Savran, 2018).

Section Oligostema (Boiss.) Steph. is characterized by traits such as perennial or annual; usually glabrous; black glands present on the leaves (intramarginal only), sepals, petals, anthers, and sometimes stems; petals and stamens persistent; sepals fimbriate or long denticulate (teeth ca. 0.5–3 mm); styles 3(–5); and capsule valves with longitudinal vittae and seeds shallowly linear-foveolate. This section includes 6 species: Hypericum linariifolium Vahl, H. australi Ten., H. andjerinum Font Quer & Pau, H. repens L., H. kelleri Bald, and H. humifusum L., none of which are present in Turkey (Robson, 2010a).

During field investigations from 2016 to 2018, the second and third authors of this study collected some interesting Hypericum specimens around Beypazarı in Ankara Province. After examination of the specimens, it was determined that they belong to the species section Oligostema, which have fimbriate sepals and capsule valves with longitudinal vittae. Some taxonomic problems have been identified in the sect. Oligostema. In this study, taxa within sect. Oligostema were taxonomically revised and the specimens collected from Beypazarı were determined to be a new species for science.

2. Material and methods

The Hypericum specimens were compared with the relevant taxonomic literature (Boissier, 1867; Shishkin and Bobrov, 1949; Robson, 1967; Webb, 1968; Robson, 1977, 1981, 1985, 1987, 1988, 1990, 1993, 1996; Dönmez, 2000; Robson, 2001, 2002, 2003, 2006, 2010a, 2010b, 2012). These specimens were examined in the ANK, EGE, GAZI, HUB, NHM, and P herbaria (codes according http://sweetgum.nybg.org/ih/) and through the JSTOR Global Plants database (https://plants.jstor.org/).

Pollen slides were prepared for light microscopy according to Wodehouse (1935). Measurements and
photographs were taken with a Leica ICC50 HD light microscope. Measurements were taken from at least 30 pollen grains for each morphological characteristic. For scanning electron microscopy (SEM), dry pollen grains were transferred onto stubs, coated with gold, and then investigated and photographed with a JEOL JSM 6060 SEM. The pollen terminology of Faegri and Iversen (1992) and Punt et al. (2007) was followed. The class of pollen shape, based partly on the P/E ratio, was identified following Erdtman (1969). The seed terminology was adopted from Barthlott (1981) and Bojnansky and Fargasova (2007).

3. Results

Hypericum turcicum Özbek & Hamzaoğlu sp. nov. (Figures 1–3)

Type: Turkey, A3 Ankara: Beypazarı district, between Kırbaşı to Uşakbükü, salty floors on gypsum hills, 36 T 0395037-4429963, 810 m, 11.06.2016, Koç 2308 & Hamzaoğlu (Holotype: GAZI!, isotypes: ANK!, HUB!, GAZI!).

3.1. Diagnosis

Hypericum turcicum is related to H. aucheri Jaub. & Spach. However, it differs from this species in the following ways: stems with black scattered glands (not amber to reddish scattered glands); in leaves laminar glands are absent or scarcely punctiform (not pale, punctiform, dense); sepals 2–4 × 1–2 mm (not 4.5–6 × 1.5–3 mm); petals 5–6 × 2–2.5 mm (not 7–12 × 3–4 mm); in petals laminar glands are absent, marginal glands are absent or rarely consist of 1–2 black glands (laminar glands are not pale and rarely a few of them are black, marginal glands are black), and anther glands are black (not amber).

3.2. Description

Perennial herb, 10–23 cm tall, glabrous, glaucous, erect or decumbent, sometimes rooting and branching at the base, with stems few to numerous. Stems narrowly 2-lined, with black scattered glands (not on lines); internodes 4–14 mm. Leaves opposite, sessile to subsessile, ascending; lamina 8–19 × 2–8 mm, elliptic to narrowly elliptic or oblong-elliptic; apex acute, margin plane, rarely revolute, base cuneate to rounded, with obscure reticulate vernation; laminar gland absent or scarcely punctiform; intramarginal glands superficial black glands or sometimes absent. Inflorescence 3–20-flowered, with branching mainly monochasial; bract and bracteoles ovate-lanceolate, margin glandular or eglandular setaceous, without auricles. Flowers 7–10 mm in diameter. Sepals 5, equal, not or slightly imbricate, basally connate, 2–4 × 1–2 mm (excluding fimbria), lanceolate to ovate, irregularly black glandular-fimbriate or long denticulate (teeth 0.5–1.5 mm); laminar glands absent or sometimes pale; marginal glands black, on fimbriae. Petals 5, persistent, yellow, 5–6 × 2–2.5 mm; laminar glands absent; marginal glands absent or rarely 1–2 black glands, sessile or cilia. Stamen fascicles 3; anther glands black. Style 3. Capsule 3-valved, 5–6 × 2–3 mm, ovoid, longitudinal vittate. Seed are brown, oblong, not carinate, 0.86–1.08 × 0.4–0.5 mm.

3.3. Pollen morphology

The pollen grains of Hypericum turcicum are radially symmetrical and isopolar. The pollen grains are prolate

Figure 1. Distribution map of H. turcicum (★), H. aucheri (▲), and H. kazdaghense (◼).
Figure 2. *H. turcicum*. A- Habit; B- flower; C- petal; D- sepal; E- stamen; F- pistil; G- capsule; H- leaves; I- stem section.
with the polar axes 18.75–21.75 µm and the equatorial axes 14–17 µm. The P/E ratio is 1.33. The outline of the pollen grains is elliptic to obtusely rectangular in equatorial view and circular in polar view. The aperture type is trizonocolporate. Colpus is long, its length is 14–19 µm and width 3–5 µm. Colpus membrane is more or less granulate. The porus is 6–8 µm in length and 5.5–7 µm in width. The shape of porus is lalongate or lolongate. The exine and intine are 0.5–1 µm and 0.5–0.75 µm thick, respectively. The exine ornamentation is microreticulate in the polar and equatorial regions. In *H. aucheri*, the pollen grains are radially symmetrical and isopolar. The pollen grains are subprolate, with the polar axes 17–20 µm and the equatorial axes 14–16 µm. The P/E ratio is 1.17. The outline of the pollen grains is elliptic to obtusely rectangular in equatorial view and circular in polar view. The aperture type is trizonocolporate. Colpus is long, its length is 13–17 µm and width 4–5 µm. Colpus membrane is more or less granulate. The porus is 6–7 µm in length and 5.25–7 µm in width. The shape of porus is lalongate or lolongate. The exine and intine are 0.75–1 µm and 0.5–0.75 µm thick, respectively. The exine ornamentation is microreticulate in the polar and equatorial regions (Figure 4).

### 3.4. Seed morphology

Seeds of *Hypericum turcicum* are brown, oblong, not carinate, 0.86–1.08 × 0.4–0.5 mm. Epidermal cells are polygonal with conspicuous and flat anticlinal walls showing a reticulate appearance and conspicuous, flat or concave and also striped periclinal walls. The surface ornamentation is reticulate-striate (Figure 5).

### 3.5. Etymology

The epithet is derived from the name Turkey.

### 3.6. Distribution and ecology

*Hypericum turcicum* is endemic to Turkey and grows in Northwestern Anatolia (Beypazarı, Ankara Province) and the Irano-Turanian phytogeographic region. It inhabits only salty floors on gypsum hills at an elevation of 810 m. The vegetation in this place is mainly composed of some halophytic plants, such as *Salvia halophila* Hedge, *Onosma halophila* Boiss. & Hildr., *Taraxacum farinosum* Hausskn. & Bornm. ex Hand.-Mazz., *Gypsophila oblanceolata* Barkoudah, and *Gypsophila parva* Barkoudah, and...
Figure 4. SEM micrographs of pollen grains of Hypericum turcicum (A, B) and H. aucheri (C, D). A, C- General aspect; B, D- exine ornamentation.

Figure 5. SEM micrographs of seeds of Hypericum turcicum. A- General aspect; B- surface ornamentation.
gypsophytes such as *Reseda germanicopolitana* Hub.-Mor. subsp. *germanicopolitana*. Other accompanying species are *Thymelaea passerina* (L.) Coss. & Germ., *Jurinea pontica* Hausskn. & Freyn ex Hausskn., *Plantago maritima* L., *Euphorbia macroclada* Boiss., *Thymus leucostomus* Hausskn. & Velen., and *Festuca valesiaca* Schlecht. ex Gaudin. *H. turcicum* flowers from June to July and bears fruit from July to August.

4. Discussion

The sections *Oligostema* and *Crossophyllum* are morphologically similar to each other. Robson evaluated the species belonging to the section *Crossophyllum* in Group F in *Flora of Turkey* and emphasized some characters such as leaves auriculate and gland fringed or sepal entire and broadly imbricate. The section *Oligostema* in Group E has fimbriate or long denticulate (teeth ca. 0.5–3 mm), and the sepal and the capsule valves have longitudinal vittae that were distinguished from the other sections (Robson, 1967). In the subsequent years, it was observed that the species belonging to both sections *Crossophyllum* and *Oligostema* are very close to each other and generally have 3 stamen fascicles and 3 styles as well as capsule valves with longitudinal vittae as described in Robson’s monograph on the genus *Hypericum*. However, it was observed that the *Oligostema* section has black anther glands and 3 styles. If there are 5 styles, then the plant is prostrate to ascending with leaves oblong-elliptic or (lower) oblanceolate and having dimorphic leaves on sterile and fertile shoots. The section *Crossophyllum* has black anther glands. *Hypericum* species have a dichasium inflorescence, anthers without black glands, having dimorphic leaves on sterile and fertile shoots, the which grows in the same area, but differs from it by having dimorphic leaves on sterile and fertile shoots, the dichasium inflorescence, anthers without black glands, and reticulate-foveate seeds (Gemici and Leblebici, 1995). However, *H. kazdaghense* was evaluated as a synonym of *H. aucheri* (Robson, 2010a). Robson deduced from the photographs of Dirmenci et al. (2007) that the shoots of *H. kazdaghense* are divergent-ascending rather than prostrate as described, and the dimorphic leaves are the only distinguishing character. Therefore, he stated that it seemed to be no more than a high-altitude form of *H. aucheri*. Our examination of the *H. kazdaghense* samples in the photos by Dirmenci et al. (2007) determined that the plants are not of *H. kazdaghense*, but instead of *H. aucheri*. Also, we understood that Robson had not seen type specimens of *H. kazdaghense*. When we examined the type specimens of *H. kazdaghense* (EGE26768), we observed that these 2 species are different (Figure 6). Therefore, we decided that *H. kazdaghense* is not synonymous with *H. aucheri*.

*Hypericum turcicum* resembles *H. aucheri* and *H. kazdaghense*. However, it can be easily distinguished from both species by several noticeable morphological characters. *H. turcicum* differs from *H. aucheri* in having black scattered glands at the stem, elliptic to narrowly elliptic or oblong-elliptic leaves, not having laminar glands (on the leaves) or having them scarcely punctiform and smaller than the sepal and petals, and anther glands that are black. *H. turcicum* differs from *H. kazdaghense* in having erect or decumbent stems and scattered glands, not having dimorphic leaves, and having monochasium inflorescence. More detailed differences are given in the Table. The habitat of *H. turcicum* is quite remarkable. This new species was collected from salty floors on gypsum hills, and it has been observed that this new species grows along with some other species specific to this habitat.

The pollen morphology of *H. turcicum* and the closely related species *H. aucheri* is rather similar, but the pollen shape is different. The shape of pollen grains is prolate in *H. turcicum*, while it is subprolate in *H. aucheri*.

4.1. Identification key to *Hypericum turcicum* and related taxa

1. Leaves dimorphic; anthers without glands
   ................................................................................................................................. *H. kazdaghense*

2. Leaves elliptic to narrowly elliptic or oblong-elliptic; stem black glands; anther glands black; petals not laminar glands
   ................................................................................................................................. *H. turcicum*

3. Leaves linear to lanceolate or narrowly elliptic or oblong-elliptic or (lower) oblong-elliptic; stem amber to reddish glands; anther glands amber; petals with laminar glands
   ................................................................................................................................. *H. aucheri*

Acknowledgments

The authors are grateful to the curators of ANK, EGE, GAZI, and HUB for access to *Hypericum* materials for this study. We would especially like to thank Prof. Dr. Tuncay Dirmenci (Balıkesir University), who allowed us to study the specimens of *H. aucheri*. We wish to thank Dr. Funda Özbek for her comments on pollen structure and Damla...
Figure 6. *Hypericum kazdaghense*. A- Holotype (EGE26768); B- isotype (EGE26768).

Table. Diagnostic morphological characters of *Hypericum turcicum* and 2 closely related species, *H. aucheri* and *H. kazdaghense*.

| Characters                      | *H. turcicum* (this paper) | *H. aucheri* (Robson, 2012) | *H. kazdaghense* (Gemici and Leblebici, 1995) |
|--------------------------------|-----------------------------|-----------------------------|-----------------------------------------------|
| Stem                           | Erect or decumbent; black scattered glands | Erect or decumbent; amber to reddish scattered glands | Prostrate; without black glands |
| Leaves                         | Elliptic to narrowly elliptic or oblong-elliptic; not dimorphic | Linear to lanceolate or narrowly elliptic or oblong-elliptic or (lower) oblanceolate; not dimorphic | Narrowly oblong to elliptic; dimorphic |
| Laminar glands (at leaves)     | Absent or scarcely punctiform | Pale, punctiform, dense | Absent |
| Inflorescence                  | Monochasium, 3–20-flowered | Broadly pyramidal to cylindrical, 3–50-flowered | Dichasium, (1–)3–14-flowered |
| Bracts                         | Ovate-lanceolate            | Ovate–lanceolate to linear-lanceolate | Narrowly oblong to linear |
| Sepals                         | 2–4 × 1–2 mm                | 4.5–6 × 1.5–3 mm            | 5–6 mm |
| Petals                         | 5–6 × 2–2.5 mm; laminar glands absent, marginal glands absent or rarely 1–2 black glands | 7–12 × 3–4 mm; laminar glands pale and rarely a few black, marginal glands black | 10–12 mm; laminar glands absent, marginal glands black |
| Anther glands                  | Black                       | Amber                       | Absent |
| Seed ornamentation             | Reticulate-striate          | Reticulate-scalariform      | Reticulate-foveolate |
| Habitat                        | Salty floor on gypsum hills | Stony or sandy open habitats, usually on calcareous ground but also on siliceous soil, field weed | Scree |
Amutkan Mutlu for the SEM photos. Also, the authors are grateful to Fatma Şen for the illustration.

**Additional specimens examined**

*Hypericum kazdaghense*: Turkey, B1 Balıkesir: Edremit, Kazdağ, NE of Sarıkız Tepe, scree, 1400 m, 24.10.1993, ÖZBEK et al. / Turk J Bot

---

**References**

Aslan S (2012). *Hypericum* L. In: Güner A, Aslan S, Ekim T, Vural M, Babaç MT (editors). *Türkiye Bitişleri Listesi (Damarlı Bitişler)*. Istanbul, Turkey: Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayınları, pp. 523-530 (in Turkish).

Babacan EY, Aytaç Z, Pınar NM (2017). *Hypericum ekerii* (Hypericaceae), a new species from Turkey. Pakistan Journal of Botany 49: 1763-1768.

Barthlott W (1981). Epidermal and seed surface characters of plants: systematic applicability and some evolutionary aspects. Nordic Journal of Botany 1: 345-355.

Başköse İ, Savran A (2018). A new species from southern Anatolia *Hypericum ericoides* (Hypericaceae) growing naturally in Turkey. Plant Systematics and Biodiversity 4 (2). Section 9. *Erecta sensu lato* (part 2). subsection 1. *Hypericum series 1. Hypericum*. Bulletin of the British Museum (Natural History) Botany 32: 37-88.

Gemici Y, Leblebici E (1995). *Gemici & Leblebici spec. nov. Candollea* 50: 46.

Gemici L. (Clusiaceae). Sacha Bengochea (2013). *Hypericum sechmenii* (Hypericaceae), a new species from central Anatolia, Turkey. Annales Botanici Fennici 46: 591-594.

Punt W, Hoen PP, Blackmore S, Nilsson S, Le Thomas A (2007). Glossary of pollen and spore terminology. Review of Palaeobotany and Palynology 143: 1-81.

Robson NKB (2002). Studies in the genus *Hypericum* L. (Guttiferae). 4(2). Section 9. *Hypericum sensu lato* (part 2): subsection 1. *Hypericum series 1. Hypericum*. Bulletin of the British Museum (Natural History) Botany 32: 61-123.

Robson NKB (2003). *Hypericum botany*. In: Ernst E (editor). *The Genus Hypericum*. New York, NY, USA: Taylor and Francis, pp. 196-241.

Robson NKB (2006). *Robson NKB*. Studies in the genus *Hypericum* L. (Guttiferae). Section 9. *Hypericum sensu lato* (part 3): subsection 1. *Hypericum series 2. Senanensia*, subsection 2. *Erecta* and section 9b. *Gravvoletia*. Systematics and Biodiversity 4 (1): 19-98.
Robson NKB (2010a). Studies in the genus *Hypericum* L. (Hypericaceae) 5 (1). Sections 10. Olympia to 15/16. Crossophyllum. Phytotaxa 4: 5-126.

Robson NKB (2010b). Studies in the genus *Hypericum* L. (Hypericaceae) 5 (2). Sections 17. Hirtella to 19. Coridium. Phytotaxa 4: 127-258.

Robson NKB (2012). Studies in the genus *Hypericum* L. (Hypericaceae) 9. Addenda, corrigenda, keys, lists and general discussion. Phytotaxa 72: 1-111.

Shishkin BK, Bobrov EG (1949). *Hypericum* L. In: Flora of the U.S.S.R., Vol. XV. Jerusalem, Israel: Israel Program for Scientific Translations, pp. 152-193.

Webb DA (1968) *Guttiferae* (Clusiaceae). In: Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH et al. (editors). Flora Europaea, Vol. 2. Cambridge, UK: Cambridge University Press, pp. 261-269.

Wodehouse PP (1935). Pollen Grains. New York, NY, USA: McGraw-Hill.

Yaylaci ÖK, Özgüşi K, Sezer O, Orhanoğlu G, Öztürk D et al. (2013). Anatomical studies and conservation status of rare endemic *Hypericum sechmenii* Ocak & Koyuncu (Sect: Adenosepalum) from Eskişehir-Turkey. Journal of Selçuk University Natural and Applied Science 2: 1-11.