

***Nasturtiopsis integrifolia* (Boulos) Abdel Khalik & Bakker (Brassicaceae), a New Combination, and *Cruciata articulata* (L.) Ehrend. (Rubiaceae), a New Record for the Flora of Egypt**

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Abstract: In Brassicaceae a new combination is made: *Nasturtiopsis integrifolia* (Boulos) Abdel Khalik & Bakker, and in Rubiaceae *Cruciata articulata* (L.) Ehrend. is a new record for the flora of Egypt. Descriptions, photographs, useful differential morphological characters, and a distribution map are given. Problems of nomenclature and synonymy are discussed.

Key Words: *Nasturtiopsis integrifolia*, *Cruciata articulata*, flora of Egypt.

Introduction

Generic delimitation in the Brassicaceae is one of the most difficult and controversial aspects in the classification of the family (Al-Shehbaz, 1984, 1999; Al-Shehbaz et al., 2006). The characters traditionally used at this rank are few in number, usually 1 or 2 morphological characters. These characters are variable within genera, or conflict with one another in their distribution patterns among genera and may not support natural groups. Fruit morphology has traditionally been used in taxonomic treatments of the Brassicaceae; the problem becomes more difficult among the numerous genera with relatively similar linear-shaped fruits. Therefore, the characters other than fruits such as vegetative, pollen, and seed characters together are of greater significance than fruit alone in distinguishing natural genera and species (Abdel Khalik et al., 2002). Franzke et al. (1998) studied the phylogenetic relationships based on nuclear (ITS) and nuclear coding chloroplast DNA sequences among the genera *Cardamine* L., *Dentaria* L., *Nasturtium* R.Br., *Rorippa* Scop., and *Armoracia* G.Gaertn., B.Mey. & Scherb., and elucidated that the *Rorippa* and *Armoracia* clade is separated as a monophyletic group from the *Nasturtium* group including

Cardamine. Muschler (1912) and Ramis (1929) reported 7 genera of rubiaceae from Egypt. These are *Gaillonia* A.Rich., *Oldenlandia* L., *Rubia* L., *Crucianella* L., *Galium* L., *Callipeltis* Stev., and *Vaillantia* Hoffm.

In Täckholm (1956), the family Rubiaceae is represented by 7 genera in the flora of Egypt. These are *Kohautia* Cham. & Schldtl., *Oldenlandia* L., *Gaillonia* A.Rich., *Galium* L., *Valantia* L., *Callipeltis* Stev., and *Crucianella* L.

In Täckholm (1974), the family Rubiaceae is represented by 8 genera in the flora of Egypt. She adds the genera *Rubia* L. and *Jaubertia* Guill. to the family and removes *Gaillonia* A.Rich. from the family. In Boulos (1995, 2000), the family Rubiaceae is represented by 8 genera in Egypt, i.e. *Kohautia* Cham. & Schldtl., *Oldenlandia* L., *Galium* L., *Valantia* L., *Callipeltis* Stev., *Crucianella* L., *Pterogaillonia* Lincz., and *Rubia* L.

Results

Nasturtiopsis integrifolia (Boulos) Abdel Khalik & Bakker *comb.nov.*

Basionym: *Rorippa integrifolia* Boulos, Candollea 19: 210 (1964).

Type: Wadi El-Arousiya, Gebel El-Maghara, North Sinai (CAI).

Icon.: Boulos, *Candollea* 19: 212, Figure 3 (1964). (Figure 2)

Annual herbs 8-21 cm, pubescent with simple hairs. Stem erect, simple or branched, cylindrical, hollow. Leaves 0.5-1.7 × 0.2-0.3 cm, sessile, narrowly linear-lanceolate, margin entire to dentate-crenate, apex obtuse to acute. Raceme ebracteate, simple or branched, 5.5-10 cm long. Flower pedicels 2-4 mm. Sepals pale green, 2 mm, oblong-lanceolate, hairy. Petals light yellow with brownish veins 3-3.5 mm, obovate to orbicular, apex rounded to truncate. Filaments 1.5-2 mm; anthers sagittate, 0.75 mm long. Ovary linear, constricted below; style short, thick, 1 mm long; stigma capitate or slightly 2-lobed. Fruiting pedicels 4 mm, usually longer than fruit, hairy, spreading. Fruit dehiscent, 3 × 1.5 mm, linear, slightly curved, glabrous; valves convex, with a weak

midrib; septum membranous. Seeds in two rows in each locule, orange-brown, ovoid to ellipsoid, compressed, 0.8-1 × 0.5-0.75 mm; radicle incumbent.

Fl. & fr.: March-April.

Habitat: Sandy soil.

Distribution: Endemic to Egypt (Sinai).

Material examined: Egypt, El Kantarah Lake, El Arish, Laurent s.n., March-April 1903 (BR); Sinai, about 5 km before Ras Sedr, K. Abdel Khalik 9 (SHG) (Figure 3).

New record

Cruciata articulata (L.) Ehrend. in *Notes Roy. Bot. Gard. Edinb.*, 22: 396 (1958).

Basionym: *Valantia articulata* L., *Sp. Pl.* ed. 1, 1052 (1753)

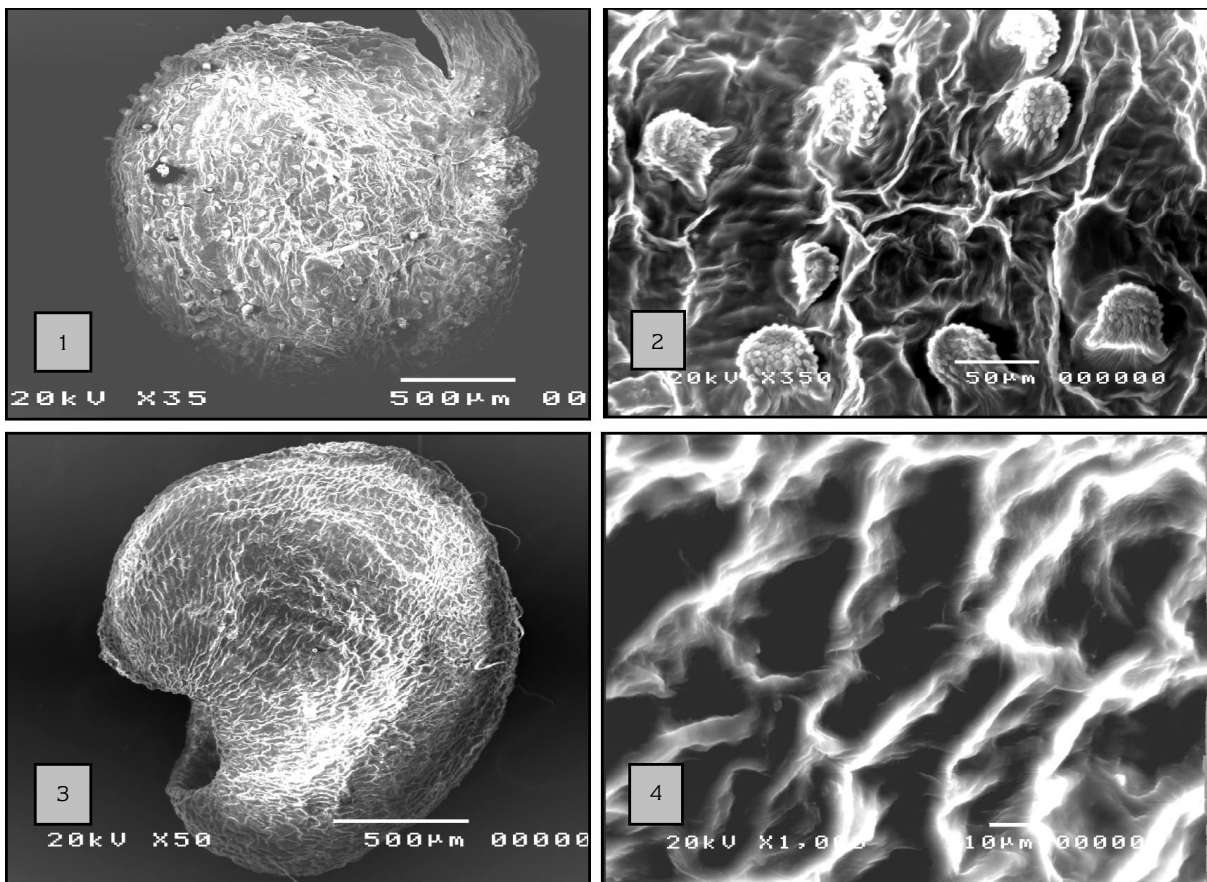


Figure 1. SEM photographs of *Cruciata articulata*, mericarp 1 & 2; seed 3 & 4.

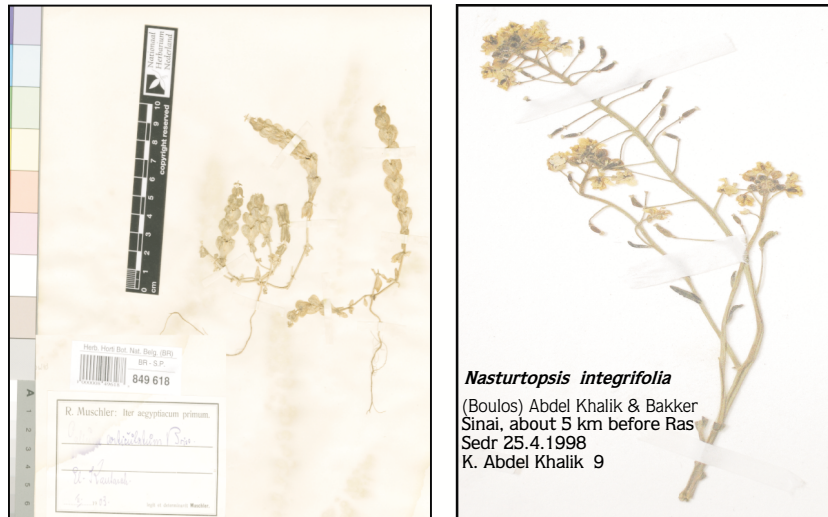


Figure 2. *Cruciatia articulata* (L.) Ehrend. and *Nasturtiopsis integrifolia* (Boulos) Abdel Khalik & Bakker.

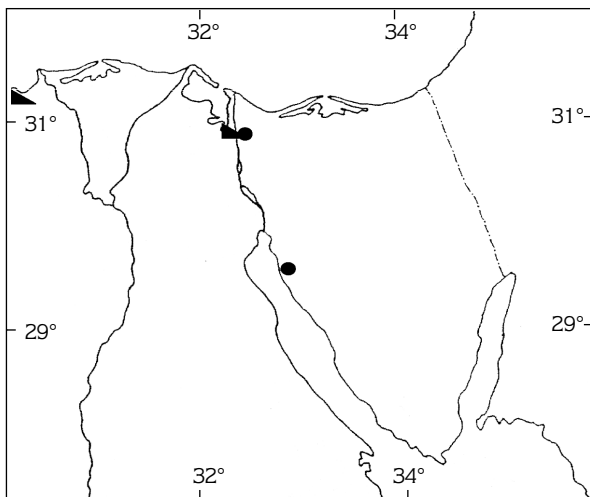


Figure 3. Distribution of *Cruciatia articulata* ► and *Nasturtiopsis integrifolia* ● in Egypt.

Galium articulatum (L.) Roem. Et Schultes, Syst. Veg. 3: 250 (1818); Boiss., Fl. Orient., 3: 81 (1875); Täckholm, Stud. Fl. Egypt ed. 2: 422 (1974).

Type: Egypt and Syria (Hb. Linn. 1219/8, photo).

Icon: Flora Palestina 3, t. 427 (1979). (Figures 1 and 2)

Annual herbs, 7-18 cm, glabrous, branched from the base. Stem erect to ascending, bearing long terminal spikes nearly from the base. Leaves in whorls of 4, ovate

to oblong or cordate, 1-1.8 × 0.8-1.2 cm, base tapering, sub-petiolate, apex obtuse or acute, margin entire. Inflorescence axillary, cymes, 5-7 flowered. Peduncle 1-2 mm, glabrous to sparsely hairy, strongly deflexed downwards. Pedicels 0.5-1.5 mm, slender, glabrous. Flowers 4-merous, terminal flower of each cyme hermaphrodite, lateral flowers staminate. Calyx absent. Corolla yellow, rotate, 1.2-2 mm in diameter, ovate, glabrous, acuminate apex, entire margin. Stamens 4, filaments 0.5-0.7 mm; anther 0.4-0.5 mm, minute. Style 0.5 mm long, divided almost to base; stigma capitate. Fruit usually of 1 mericarp, reniform, 2-3 mm, papillate-hairy when young, glabrous when ripe. Seed kidney-shaped, 1.5-2 × 1.2-1.5 mm, brown, glabrous. $2n = 10$.

Fl. & Fr.: April-May.

Habitat: saline soil.

Distribution: The genus includes 6 species in Europe, the Mediterranean region, and western Asia. *C. articulata* is found in Egypt, Palestine, Iraq, Iran, and Turkey.

Material examined: Egypt, Abu Sir, in salty place, Muschler s.n. April 1906 (BR); El Kantarah, Muschler April 1903 (BR) (Figure 3)

Discussion

Molecular analysis, based on chloroplast encoded gene matK sequencing (Bakker et al., unpublished),

demonstrated that *Rorippa integrifolia* Boulos is most closely related to *Nasturtiopsis coronopifolia* (Desf.) Boiss. and both are readily separated from *Rorippa* lineage.

Both *Nasturtiopsis coronopifolia* (Desf.) Boiss. and *Rorippa integrifolia* Boulos are found in dry sandy soils, they have densely spreading trichomes, leaf margin entire or dentate to crenate or pinnatifid, petals orbicular, radicle incumbent, seed epidermal cell shape 4-5 polygonal to elongate in one direction and periclinal cell wall flat to convex, striate to folded.

Concerning *Cruciata articulata* (L.) Ehrend., the specimens were first identified as *Galium articulatum* according to Boissier's revision (Boissier, 1875) and Täckholm (1974), in which the synonyms are given as *Valantia articulata* L. and *Cruciata articulata* (L.) Ehrend. We then identified the specimens as *Cruciata articulata*

(L.) Ehrend. using Flora of Palestina (1979) in which *Galium articulatum* (L.) Lam. is given as the synonym of the species. According to Täckholm (1974), the genus *Galium* has 12 species in Egypt. Now that number has decreased to 11 species. *Cruciata articulata* (L.) Ehrend. has a wide range of distribution including Egypt, which borders Palestine, and it is also found in the Mediterranean region and western Asia.

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References

- Abdel Khalik K, van der Maesen LJG, Koopman WJM & den Berg RG (2002). Numerical taxonomic study of some tribes of Brassicaceae from Egypt. *Plant Syst Evol* 233: 207-221.
- Al-Shehbaz IA (1984). The tribes of Cruciferae (Brassicaceae) in the southeastern United States. *J Arnold Arbor* 65: 343-373.
- Al-Shehbaz IA, O'Kane ST & Price RA (1999). Generic placement of species excluded from *Arabidopsis* (Brassicaceae). *Novon* 9: 296-307.
- Al-Shehbaz IA, Beilstein MA & Kellogg EA (2006). Systematics and phylogeny of the Brassicaceae (Cruciferae): an overview. *Plant Syst Evol* 259: 89-120.
- Bakker FT, Abdel Khalik K, Copini P, Wieringa & Maummenhoff K (2007). A matK-based phylogeny of the Brassicaceae. *J Mol Evol* (under review).
- Boissier PE (1875). *Flora orientalis* 3, Geneva.
- Boulos L (1964). Plantae Novae aegyptiacae. *Candollea* 19: 209-213.
- Boulos L (1995). *Flora of Egypt (Checklist)*. Al Hadara publishing, Cairo.
- Boulos L (2000). *Flora of Egypt* vol. 2: 229-242. Al Hadara publishing, Cairo.
- Ehrendorfer F (1958). Critical notes on Turkish Rubiaceae. *Notes Roy Bot Gard Edinburgh* 22: 323-401.
- Feinbrun-Dothan N. (1979). *Flora Palaestina*, vol. 3. Israel Academy of Science and Humanities. Jerusalem.
- Franzke A, Pollmann K, Bleeker W, Kohrt R & Hurka H (1998). Molecular systematics of Cardamine and allied genera (Brassicaceae): ITS and non coding chloroplast DNA. *Folia Geobotanica* 33: 225-240.
- Muschler R (1912). *A Manual of the Flora of Egypt*, Vol. II: 914, Berlin, R. Fredlaender & Sohan.
- Ramis AI (1929). *Bestimmungstabellen Flora von Aegypten*, Jena.
- Täckholm V (1956). *Students' Flora of Egypt* ed 1. Cairo University Press, Cairo, Egypt.
- Täckholm V (1974). *Students' Flora of Egypt*, ed. 2. p 423, Cairo University Press, Cairo, Egypt.