Two New Infraspecific Taxa of *Orychophragmus violaceus* (Brassicaceae) in Northeast China

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ABSTRACT. Two new varieties of *Orychophragmus violaceus* (L.) O. E. Schultz (Brassicaceae) are described from Heilongjiang Province in northeastern China. The new variety, *O. violaceus* var. *odontopetalus* Ling Wang & Chuan P. Yang, differs from the typical variety of the species in that the petal has five or more obtuse teeth (vs. smooth petals) in the upper third of the expanded petal. The clawed petals have an expanded apical section that is 10–13 mm long (vs. 7–13 mm), and the stems and pedicels are puberulent (vs. glabrous). A second new variety is *O. violaceus* var. *variegatus* Ling Wang & Chuan P. Yang, which differs from the typical variety by the marked petal variegation of white and purple (vs. no petal variegation). The uppermost leaves are often undivided, with sharply serrate margins (vs. irregularly toothed leaves). These distinctions have persisted and been stable after eight years of cultivation in field experiments in Heilongjiang. A key to the infraspecific taxa of *O. violaceus* is included. Both new varieties are cataloged as of Least Concern (LC), based on IUCN Red List categories and criteria.

Key words: Brassicaceae, China, Cruciferae, Heilongjiang, IUCN Red List, *Orychophragmus*.

The genus *Orychophragmus* Bunge (Brassicaceae) was established in 1833 (Fu, 1980), based on the one species *O. sonchifolia* Bunge. A second species, *O. violaceus* (L.) O. E. Schulz, was added in 1916 and it was long accepted that only two species were known in East and Central Asia, with the one species in China as *O. violaceus* [≡ *Brassica violacea* L.]. This species is widely distributed in Heilongjiang, Jilin, Liaoning, Hebei, Shanxi, Henan, Shandong, Anhui, Jiangsu, Zhejiang, Jiangxi, Shaanxi, Gansu, and Sichuan provinces as wild and cultivated populations. From such broad geographic distribution and wide ranges of variation in leaf structure, shape, size, and indumentum, at least five additional varieties of *O. violaceus* have been described, including variety *homaeophyllus* (Hance) O. E. Schulz, variety *hupehensis* (Pamp.) O. E. Schulz (1923), variety *intermedius* (Pamp.) O. E. Schulz (1923), variety *subintegrifolius* (Pamp.) O. E. Schulz, and variety *lasiocarpus* Migo. New species considered to be closely related to *O. violaceus* were also described from China and include *O. taibaiensis* Z. M. Tan & B. X. Zhao (from Shanxi Province), *O. diffusus* Z. M. Tan & J. M. Xu, *O. limprichtianus* (Pax) Al-Shehbaz & G. Yang (both from Zhejiang), and *O. ziguiensis* Z. E. Zhao & J. Q. Wu.

Recent fieldwork and herbarium research by the authors support the discovery of two additional varieties of the species *Orychophragmus violaceus*. Both belong to this species because they share the same height, flowering time, and number of flowers per stem. The new variety *O. violaceus* var. *odontopetalus* Ling Wang & Chuan P. Yang differs from the typical variety in that the petals have five or more obtuse teeth (vs. ovate petals) on the upper third of the expanded blade. The clawed petals have an expanded apical section that is 10–13 mm long (vs. 7–13 mm), and the stems and pedicels are puberulent (vs. glabrous). The second new variety, *O. violaceus* var. *variegatus* Ling Wang & Chuan P. Yang, differs from the typical variety in that the petals are strikingly white and purple variegated (vs. no variegation). Its uppermost leaves are often undivided, with sharply serrate margins (vs. irregularly toothed). The two new taxa are described, particularly regarding the variable characters of the petals, which are taxonomically significant. These petal features remained stable after eight years of cultivation in field plots at the Northeast Forestry University campus at Harbin in Heilongjiang Province.

1. Orychophragmus violaceus (L.) O. E. Schulz, Bot. Jahrb. Syst. 54(3, Beibl. 119): 56. 1916. Basionym: *Brassica violacea* L., Sp. Pl. 2: 667. 1753. TYPE: China. Henan: Neixang Xian, Baotianman Nature Reserve Yinghu Gou, 20 May 1994, *D. Boufford, Liu, Ying, Zhang & Zhu 26131* (neotype, designated by Al-Shehbaz in Cafferty & Jarvis [Taxon 51: 532. 2002], A not seen; isoneotypes, E not seen, MO not seen).

doi: 10.3417/2009133 NOVON 22: 109–113. PUBLISHED ON 10 JULY 2012.

1a. Orychophragmus violaceus (L.) O. E. Schulz var. **violaceus**.

1b. Orychophragmus violaceus var. **odontopetalus** Ling Wang & Chuan P. Yang, var. nov. TYPE: China. Heilongjiang: Harbin, cultivated on campus of Northeast Forestry University (NEFU), 20 May 2009, *X. J. Ma, L. Wang & C. P. Yang 09009* (holotype, NEFI). Figure 1.

Haec varietas ab *Orychophragmo violaceo* (L.) O. E. Schulz var. *violaceo* petalis ad vel supra medium dentibus obtusis 5 vel plus praeditis, petalorum unguibus longioribus (10–13 mm longis) atque caulibus et pedicellis puberulis differt.

Herbs, annual or biennial, 10–50 cm tall; stems puberulent. Basal and lower leaves lyrate; petiole 2–4 cm; uppermost leaves often undivided, elliptic, 5–7 × 3–4 cm; apex acute, base auriculate, semi-amplexicaule, margin regularly serrate or rarely pinnatifid, lobes with few teeth. Flowers purple, 2–4 cm diam., pedicels 10–15 mm, puberulent; calyx tube purplish; petals 4, broadly obovate, with 5 or more obtuse teeth on expanded apical blade, expanded petal 10–13 mm long. Silique linear, 8–10 cm, quadrangular; seeds ovoid to oblong, 2 mm, black-brown.

Habitat and distribution. The plants were derived from naturally growing specimens from the Beijing Botanical Garden. The plants are common in Hebei, Liaoning, Shandong, Shanxi, Shaanxi, and Jiangsu provinces but do not grow in the wild in the Harbin area, Heilongjiang Province (Fu, 2003). However, the plants have been established as ornamental species throughout the Harbin metropolitan area.

IUCN Red List category. Because this is a widespread taxon in the above named provinces, the new variety is determined as of Least Concern (LC), according to IUCN Red List categories and criteria (IUCN, 2001).

Paratypes. CHINA. **Beijing:** Xiangshan, Beijing Botanical Garden, under trees, 22 Apr. 2006, *L. Wang 21012* (NEFI). **Heilongjiang:** Harbin, cult., residential area of NEFU, 20 May 2009, *L. Wang, X. J. Ma & Y. J. Bao 9014* (NEFI); Harbin Forest Farm of NEFU, forest edge, 18 May 2008, *L. Wang & X. Z. Zhang 8012* (NEFI). **Liaoning:** near town of Beizhen, roadsides, 6 May 2005, *L. Wang & C. P. Yang 4083* (NEFI).

1c. Orychophragmus violaceus var. **variegatus** Ling Wang & Chuan P. Yang, var. nov. TYPE: China. Heilongjiang: Harbin, cultivated on campus of NEFU, 18 May 2008, *L. Wang & X. J. Ma 8015* (holotype, NEFI). Figure 2.

Haec varietas ab *Oryochophragmo violaceo* (L.) O. E. Schulz var. *violaco* petalis albis purpureo-variegatis atque foliis summis 2 vel 3 saepe indivisis margine argute serratis recedit.

Herbs annual or biennial, 10–15 cm tall; stems glabrous. Basal and lower leaves lyrate, apex often undivided; petiole 2–4 cm; uppermost leaves often undivided, elliptic or oval, 4–7 × 2.5–4 cm; apex acute, base auriculate, semi-amplexicaule, margins sharply serrate. Flowers white and purple variegated, 2 cm diam., pedicels 8–15 mm, glabrous; calyx tube purplish; petals 4, broadly obovate, margins not toothed, expanded petal 7–13 mm long. Fruit a linear silique, length 7–10 cm, quadrangular; seeds ovoid to oblong, 1.5–2 mm, black-brown.

Habitat and distribution. The new infraspecific taxon is usually mixed with *Orychophragmus violaceus* in populations from Hebei and Liaoning provinces. These plants are found on plains, mountains, roadsides, and the edges of deciduous broad-leaved forest. *Orychophragmus violaceus* var. *variegatus* has a relatively strong capacity to adapt to diverse environments. Full sun to partial shade was observed as the best conditions for growth. The plants prefer soils rich in organic matter, which are moist and well-drained, but are moderately tolerant of dry and barren sites.

IUCN Red List category. Because this is a widespread taxon in Heilongjiang Province, the new variety is determined as of Least Concern (LC), according to IUCN Red List categories and criteria (IUCN, 2001).

Phenology. The new variety was observed to flower in April through May, with fruits seen in late May–June.

Discussion. The new variety *variegatus* differs from other varieties in *Orychophragmus violaceus* by the white and purple variegation of the petals. Its uppermost leaves are often undivided, and the leaf blade margins are sharply serrate.

Paratypes. CHINA. **Beijing:** Xiangshan, Beijing Botanical Garden, under trees, 22 Apr. 2006, *C. P. Yang & L. Wang 21015* (NEFI). **Heilongjiang:** Harbin, residential area of NEFU, cult. 21 May 2009, *Y. J. Bao 9019* (NEFI); Harbin Forest Farm of NEFU, forest edge, 18 May 2008, *L. Wang & X. J. Ma 8015* (NEFI). **Liaoning:** near town of Beizhen, roadsides, 6 May 2005, *L. Wang & C. P. Yang 4085* (NEFI).

Figure 1. *Orychophragmus violaceus* var. *odontopetalus* Ling Wang & Chuan P. Yang. —A. Holotype specimen, *X. J. Ma, L. Wang & C. P. Yang 09009* (NEFU). —B. Close-up of flower, showing the obtuse teeth on petals; taken from specimen at NEFU by the authors.

Figure 2. *Orychophragmus violaceus* var. *variegatus* Ling Wang & Chuan P. Yang. —A. Holotype specimen, *L. Wang & X. J. Ma 8015* (NEFU). —B. Close-up of flower, showing the purple and white variegation of the petals, taken from specimen at NEFU by the authors.

KEY TO THE INFRASPECIES OF *ORYCHOPHRAGMUS VIOLACEUS*

1a. Petals either marginally toothed or variegated in color 2
2a. Petals with 5 or more obtuse teeth above the middle, lacking variegation .... *O. violaceus* var. *odontopetalus*
2b. Petals with entire margins, strikingly white and purple variegated ..... *O. violaceus* var. *variegatus*
1b. Petals either not marginally toothed or lacking white and purple variegation 3
3a. Siliques densely villose .... *O. violaceus* var. *lasiocarpus*
3b. Siliques glabrous 4
4a. Plants dwarfed in size, 8–22 cm tall; siliques only 2.5–5.5 cm long *O. violaceus* var. *homaeophyllus*
4b. Plants taller, 20–65 cm tall; siliques 7–13 cm long 5
5a. Leaves with the terminal lobe entire or dentate, ovate or triangularly ovate .... *O. violaceus* var. *violaceus*
5b. Leaves with the terminal lobe obtusely toothed or incised 6
6a. Leaves with the terminal lobe unequally sinuate and obtuse-toothed, lateral lobes obliquely ovate or ovate-cordate; without lobules; calyx lobes sometimes villose at apex .... *O. violaceus* var. *hupehensis*
6b. Leaves with the terminal lobe irregularly incised, lateral lobes obliquely ovate, with lobules; calyx lobes glabrous in apex .... *O. violaceus* var. *intermedius*

Acknowledgments. We thank Karl H. Hasenstein (University of Louisiana, Lafayette) for help with revision of the manuscript and text suggestions. We are also grateful to two anonymous reviewers for their comments, which significantly improved the quality of this manuscript. This work was supported by the National Natural Science Foundation of China, Grant No. 30872062, and by the Fundamental Research Funds for the Central Universities (DL09CA10).

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