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Arabidopsis gamosepala and *A. tuemurnica* Belong to *Neotorularia* (Brassicaceae)

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ABSTRACT. The new combination *Neotorularia gamosepala* is proposed. *Arabidopsis tuemurnica* is reduced to synonymy of *N. humilis*. The limits of *Arabidopsis* and *Neotorularia* are discussed.

Although *Arabidopsis thaliana* has become the plant of choice in molecular, developmental, physiological, genetic, and related studies, little is known about its immediate relatives, and the limits of *Arabidopsis* remain controversial (Al-Shehbaz, 1988; Price et al., 1994). For the past few years, the present authors have been working on the elucidation of the generic boundaries of *Arabidopsis*, and some of the species previously assigned to this genus have already been transferred to other genera (Al-Shehbaz, 1994; Al-Shehbaz & O'Kane, 1995). The present paper deals with two such controversial species.

On the basis of molecular studies (O'Kane et al., 1997), *Arabidopsis gamosepala* Hedge (endemic to Afghanistan) and *A. tuemurnica* Kuan & An (endemic to China) form with the widespread *Neotorularia torulosa* (Desfontaines) Hedge & Léonard (China west into western Russia, the Middle East, and North Africa) a well-defined clade distinctly unrelated to that including *Arabidopsis*. The evidence from morphology (see below) fully supports the molecular data to include these two species in *Neotorularia*.

Schulz (1924) separated *Arabidopsis* from *Torularia* (now *Neotorularia*) primarily on the basis of having mucilaginous instead of non-mucilaginous seeds. However, this feature is unreliable, and many genera of the Brassicaceae include species with or without seed mucilage (Vaughan & Whitehouse, 1971). The most reliable characters for the separation of these genera are the trichome and fruit types. *Neotorularia* has distinctly torulose fruits with pubescent valves, and the trichomes are primarily few to several branched. In contrast, *Arabidopsis* has non-torulose glabrous fruits, and the trichomes are simple mixed primarily with 2-forked ones. Both *Arabidopsis gamosepala* and *A. tuemurnica* have the typical features of *Neotorularia* mentioned above.

A synopsis of *Neotorularia* is being carried out by the authors, and it is estimated that the genus includes 25–30 species. Because the completion of the revision will take some time, the following nomenclatural adjustments are proposed to make them available for some of the checklists and floras in progress, especially the forthcoming treatment of the Brassicaceae for the *Flora of China*.

Neotorularia gamosepala (Hedge) Al-Shehbaz & O'Kane, comb. nov. Basionym: *Arabidopsis gamosepala* Hedge, Fl. Iran. 57: 334. 1968. TYPE: Afghanistan. Munjan: above Anjuman valley, near Anjuman, 3100 m, 14 Aug. 1965, *Podlech 12379* (holotype, M; isotype, W).

Hedge (1968) indicated that *Arabidopsis gamosepala* has no clear ally in *Arabidopsis* and that it

is anomalous in the genus for lacking the median nectar glands, a feature characteristic of *Neotorularia*. The species appears to be most closely related to *N. torulosa*, from which it is readily distinguished in being a perennial with a gamosepalous calyx. *Neotorularia torulosa* is an annual with free sepals.

Neotorularia humilis (C. A. Meyer) Hedge & Léonard, Bull. Jard. Bot. Belg. 56: 394. 1986. *Sisymbrium humile* C. A. Meyer, in Ledebour, Icon. Pl. Ross. 2: 16. 1830. TYPE: Altai, *C. A. Meyer s.n.* (holotype, LE).

Arabidopsis tuemurnica Kuan & An, Bull. Bot. Lab. North-East. Forest. Inst. 8: 44. 1980. Syn. nov. TYPE: China. Xinjiang: Wen-su Xian, Tuo-mu-er-feng, 2400 m, 24 June 1977, *Tuo-mu-er-feng Expedition 770084* (holotype, PE, listed as HP; isotype, BJM, listed as HM).

In their original description of *Arabidopsis tuemurnica*, Kuan and An (1980) compared the species with *A. thaliana* and indicated that it is an annual differing primarily in the basal leaves. However, an examination of the holotype of the former reveals that it is a short-lived perennial clearly unrelated to *A. thaliana*, especially in fruit and trichome characters. In fact, the plant is indistinguishable from the highly variable *Neotorularia humilis*, a species widespread in northern North America (Alaska and Canadian Arctic south to Colorado and east to Vermont) and northern Asia (Russia and China south to the Himalayas and west to Afghanistan, Pakistan, and Central Asia). North American authors (e.g., Abbe, 1948; Harris, 1985; Rollins, 1993) treated *N. humilis* in *Braya*. However, the molecular evidence (O'Kane et al., 1997; O'Kane, unpublished), as well as the critical morphological comparison of the species with its Asian representatives and other *Neotorularia* species, clearly support the placement of this species in *Neotorularia*. Unfortunately, all studies of the North American *Braya* completely ignored the Asian members and gave no reference to *Neotorularia* or *Torularia*. In our opinion, the North American *Braya* needs a comprehensive study, and some of its species may well prove to be *Neotorularia*, a genus up to this study not yet recognized in North America.

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