

**ARABIDOPSIS** (de Candolle) Heynhold in Holl & Heynhold, Fl. Sachsen 1: 538. 1842;  
nom. cons.

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Tribe: Camelinae de Candolle, Mém. Mus. Hist. Nat. 7(1): 239. 1821.

Name derivation: From *Arabis*, a genus of Brassicaceae, and Greek *opsis*, aspect, in reference to resemblance to *Arabis*.

Type species: *Arabidopsis thaliana* (Linnaeus) Heynhold (based on *Arabis thaliana* Linnaeus);  
typ. Cons.

*Cardaminopsis* (C. A. Meyer) Hayek, Fl. Steiermark 1: 477. 1908. Type species: not designated.

*Hylandra* Å. Löve, Svensk Bot. Tidskr. 55: 211. 1961. Type species: *H. suecica* (E. M. Fries) A. Löve (based on *Arabis suecica* E. M. Fries).

**Herbs** annual, biennial, or perennial with stolons or woody caudex. **Trichomes** simple mixed with stalked 1–3(or 4)-forked. **Multicellular glands** absent. **Stems** erect to ascending or decumbent, most frequently several from base, few branched above. **Basal leaves** petiolate, rosulate, simple, entire or toothed, sometimes lyrate to pinnately lobed, cauline leaves petiolate to sessile and cuneate to attenuate at base, never auriculate or sagittate, entire, dentate, or rarely lyrate. **Racemes** few to several flowered, dense or lax, ebracteate, corymbose, elongated considerably in fruit; rachis straight; fruiting pedicels ascending to divaricate or slightly reflexed, persistent. **Sepals** oblong, free, erect to ascending, equal, base of inner pair slightly saccate or not. **Petals** white, pink, or purple, erect at base with flaring blade, longer than sepals; blade obovate to spatulate or oblanceolate, apex obtuse to emarginate; claw obscurely differentiated from blade or distinct, glabrous, entire. **Stamens** 6, exserted, erect, tetradynamous; filaments filiform, wingless, unappendaged, glabrous; anthers oblong, obtuse apex. **Nectar glands** confluent and subtending bases of all stamens; median nectaries sometimes distinct and not confluent. **Ovules** 15–80 per ovary; placentation parietal. **Fruit** dehiscent, capsular siliques, linear, terete or latisepate, not inflated, unsegmented; valves papery, veinless or with a distinct midvein, glabrous, not keeled, smooth or somewhat torulose, wingless, unappendaged; gynophore to 1 mm; replum rounded, visible; septum complete, membranous, not veined; style obsolete to 1 mm, cylindrical, persistent; stigma capitate, entire, unappendaged. **Seeds** uniseriate, wingless or margined, oblong to ellipsoid, plump or flattened; seed coat minutely reticulate, mucilaginous or not mucilaginous when wetted; cotyledons accumbent or rarely incumbent.  $2n = 10, 16$ .

Ten to 15 species according to the taxonomic concept applied: primarily in Europe, few extending into northern Asia and northern North America. *Arabidopsis thaliana*, a Eurasian weed naturalized worldwide, is the model organism in plant biology. For more information on the systematics and phylogeny of the species, see the references below. Further information on other aspects of its biology is accessible via TAIR at <http://arabidopsis.org>.

References: Al-Shehbaz & O’Kane (2002), Al-Shehbaz et al. (1999), Beck et al. (2007, 2008), Clauss and Koch (2006), Kadota (2007), Koch et al. (1999, 2000, 2008), Kolník & Marhold (2006), Löve (1961), Meyerowitz (1989), Meyerowitz & Pruitt (1985), Mummenhoff & Hurka (1994, 1995), O’Kane & Al-Shehbaz (1997, 2003), O’Kane et al. (1997), Price et al. (1994), Warwick et al. (2006).

The most actual status of taxonomic treatment is summarized with the following Table:

<b>Arabidopsis arenosa species aggregate</b>		
<i>Arabidopsis arenosa</i> (L.) Lawalrée		
subsp. <i>arenosa</i>	(2n = 32)	Central and Western Europe, Scandinavia (lower altitudes)
subsp. <i>arenosa</i> var. <i>intermedia</i> (Kovats) Hayek	(2n = 32)	Southeastern Austrian Alps (similar to <i>A. neglecta</i> )
subsp. <i>borbasii</i> (Zapalowicz) O'Kane & Al-Shehbaz	(2n = 32)	Central and Western Europe (mountain ranges, higher altitudes)
<i>Arabidopsis arenosa</i> , unclear taxonomic treatment	(2n = 16)	Romania, Croatia, maybe Hungary and Bulgaria and other countries
<i>Arabidopsis carpathica</i> , nom. prov.	(2n = 16)	Carpathians (limestone)
<i>Arabidopsis neglecta</i> (Schultes) O'Kane & Al-Shehbaz		
subsp. <i>neglecta</i>	(2n = 16)	Carpathians (alpine ranges)
subsp. <i>robusta</i> , nom. prov.	(2n = 32)	Carpathians (alpine ranges, only occasionally in lower altitudes)
<i>Arabidopsis nitida</i> , nom. prov.	(2n = 16)	Carpathians (mountain ranges, middle to subalpine altitudes)
<i>Arabidopsis petrogena</i> (A. Kern) V.I. Dorof.		
subsp. <i>petrogena</i>	(2n = 16)	Carpathians (maybe two varieties: var. <i>petrogena</i> and var. <i>kernerii</i> )
subsp. <i>exoleta</i> , nom. prov.	(2n = 32)	Carpathians
<b>Arabidopsis lyrata lineage</b>		
<i>Arabidopsis lyrata</i> subsp. <i>lyrata</i> (L.) O'Kane & Al-Shehbaz	(2n = 16)	Alaska, Canada, United States
<i>Arabidopsis lyrata</i> subsp. <i>petraea</i> (L.) O'Kane & Al-Shehbaz	(2n = 16/32)	Europe
= <i>A. petraea</i> (L.) V.I. Dorof.		
<i>Arabidopsis petraea</i> subsp. <i>umbrosa</i> (Turcz. Ex Steud.) Elven & D.F. Murray	(2n = 16)	arctic NE Asia, Siberia, Alaska, Canada
<i>Arabidopsis petraea</i> subsp. <i>septentrionalis</i> (N. Busch) Elven & D.F. Murray	(2n = 32)	arctic NE Europe, European Russia to Siberia
<i>Arabidopsis arenicola</i> (Richardson ex Hook.) Al-Shehbaz et al.	(2n = 16)	arctic Canada and Greenland
<b>Arabidopsis halleri lineage</b>		
<i>Arabidopsis halleri</i> subsp. <i>halleri</i> (L.) O'Kane & Al-Shehbaz	(2n = 16)	Europe
<i>Arabidopsis halleri</i> subsp. <i>daciae</i> (Heuff.) Kolnik	(2n = 16)	Carpathians, Romania
<i>Arabidopsis halleri</i> subsp. <i>gemmafera</i> (Matsum.) O'Kane & Al-Shehbaz	(2n = 16)	Russia Far East, NE China, Korea, Japan, and Taiwan
<i>Arabidopsis halleri</i> subsp. <i>ovirensis</i> (Wulfen) A. P. Iljinsk.	(2n = 16)	Austria only (all accessions from the Balkans belong to subsp. <i>halleri</i> )
<i>Arabidopsis halleri</i> subsp. <i>patrica</i> (Pawl.) Kolnik	(2n = 16)	Tatra mountains, Slovakia
<i>Arabidopsis umezawana</i> Kadota	(2n = ??)	Japan, Hokkaido (alpine zone of Mt. Rishirizin), annual to biennial
<b>Other (mostly) diploid taxa</b>		
<i>Arabidopsis pedemontana</i> (Boiss.) O'Kane & Al-Shehbaz	(2n = 16)	NW Italy
<i>Arabidopsis cebennensis</i> (DC.) O'Kane & Al-Shehbaz	(2n = 16)	SE France, Massif Central
<i>Arabidopsis croatica</i> (Schott) O'Kane & Al-Shehbaz	(2n = 16/32)	Bosnia, Croatia (maybe affiliated with <i>A. arenosa</i> species aggregate)
<b>Allopolyploid taxa</b>		
<i>Arabidopsis kamchatica</i> (Fisch. Ex DC.) O'Kane & Al-Shehbaz	(2n = 32)	Boreal Alaska, Canada, E Siberia, Russian Far East, Korea, Japan, Taiwan
<i>Arabidopsis kamchatica</i> subsp. <i>kawasakiana</i> (Makino) Shimizu & Kudoh	(2n = 32)	Japan, winterannual (coastal, lowland)
<i>Arabidopsis suecica</i> (Fr.) Norrt.	(2n = 28)	Fennoscandinavia and the Baltic region

With this table and including *A. thaliana* 16 species have been recognized. However, for various taxa it remains unclear if they should be treated as species, subspecies or better treated within broader defined species (as indicated with the following 10 species descriptions).

This literature could be consulted highlighting these issues in some more detail:

- JORGENSEN M.H., EHRICH D., SCHMICKL R., KOCH M.A., BRYSTING A. (2011) Interspecific and interploidal gene flow in Central European *Arabidopsis* (Brassicaceae). BMC Evolutionary Biology 11: e346. doi:10.1186/1471-2148-11-346.
- KOCH M.A., GERMAN D. (2013) Taxonomy and systematics are key to biological information: *Arabidopsis*, *Eutrema* (*Thellungiella*), *Noccaea* and *Schrenkiella* (Brassicaceae) as examples. Frontiers in Pl. Science, DOI: 10.3389/fpls.2013.00267.
- KOCH MA, MATSCHINGER M (2007) Evolution and genetic differentiation among relatives of *Arabidopsis thaliana*. PNAS 104 (15): 6272-6277.
- KOCH M. A., WERNISCH M., SCHMICKL R. (2008) *Arabidopsis thaliana*'s wild relatives: an updated overview on systematics, taxonomy and evolution. Taxon 57 (3): 933-943.
- SCHMICKL R., KOCH M.A. (2011) Arabidopsis hybrid speciation processes. PNAS 108 (34): 14192-14197.
- SCHMICKL R, PAULE J, KLEIN J, MARHOLD K, KOCH M.A. (2012) The evolutionary history of the *Arabidopsis arenosa* species complex: Highly diverse tetraploids mask that the Western Carpathians are the center of species and genetic diversity. PLoS ONE 7(8): e42691.
- SCHMICKL R, JORGENSEN M, BRYSTING A, KOCH MA (2010) The evolutionary history of the *Arabidopsis lyrata* complex: A hybrid in the amphi-Beringian area closes a large distribution gap and builds up a genetic barrier. BMC Evol. Biol. 10: e98.

The detailed description includes 10 species, but most of the synonyms/names included in the Table from the above are also found in the following descriptions.

1. arenicola
2. arenosa

3. cebennensis
4. croatica
5. halleri
6. lyrata
7. neglecta
8. pedemontana
9. suecica
10. thaliana

**1. Arabidopsis arenicola** (Richardson ex W. J. Hooker) Al-Shehbaz, R. Elvin, D. Murray & S. I. Warwick, Can. J. Bot. 84: 279. 2006; *Eutrema arenicola* Richardson ex W. J. Hooker, Fl. Bor.-Amer. 1: 67, plate 24. 1833; *Arabis arenicola* (Richardson ex W. J. Hooker) Gelert, Bot. Tidsskr. 21: 289. 1898; *Parrya arenicola* (Richardson ex W. J. Hooker) J. D. Hooker, Trans. Linn. Soc. London 23: 285. 1861. TYPE: Canada, “deep sand upon shores of Arctic America between longitude 107° and 150°,” *Richardson s.n.* (holotype, not seen; isotype, CAN!). *Sisymbrium humifusum* Vahl, Fl. Dan. t. 2297. 1840; *Arabis humifusa* (Vahl) S. Watson, Proc. Amer. Acad. Arts 25: 124. 1890. TYPE: plate 2297 above. *Arabis humifusa* (Vahl) S. Watson var. *pubescens* S. Watson in Gray & Watson, Syn. Fl. N. Amer. 1: 160. 1895; *A. arenicola* var. *pubescens* (S. Watson) Gelert, Bot. Tidsskr. 21: 290. 1898. TYPE: Canada, Manitoba, York Factory, Hudson Bay, *Bell s.n.* (holotype, not seen; isotype, CAN).

**Herbs**, perennial with branched or rarely simple caudex covered with petiolar remains of previous years, glabrous throughout or sparsely to moderately pubescent with simple and short-stalked, forked trichomes to 0.5 mm. **Stems** 0.5–2(–3) dm, erect, ascending, or decumbent, simple or few branched above, often several caudex, glabrous or sparsely pubescent rarely above middle. **Basal leaves** rosulate, fleshy; petiole 0.5–2 cm, ciliate or glabrous; leaf blade oblanceolate to spatulate, 0.5–2 cm x 2–6 mm, pubescent or glabrous, margin entire or dentate, not ciliate, apex obtuse or acute; cauline leaves (1–)2–4(–6), sessile, oblong to oblanceolate, 0.7–1.8(–2.5) cm x 2–5 mm, glabrous or sparsely pubescent, base not auriculate, margin entire or rarely dentate, apex obtuse or acute. **Racemes** simple, dense; fruiting pedicels ascending to divaricate, 5–10(–12) mm, slender, glabrous. **Sepals** oblong or ovate, 1.7–3 x 1–1.5 mm, the lateral pair not saccate; petals white, oblanceolate or rarely spatulate, 4–5 x 1–2 mm, apex rounded; claw entire; filaments slender, 1.7–3 mm; anthers ovate, 0.4–0.5 mm; ovules 30–54 per ovary. **Fruit** linear, (0.8–)1–2(–2.8) cm x 1.5–2.2(–2.5) mm, suberect to divaricate, terete or only slightly flattened, straight; valves glabrous, smooth, with an obscure midvein; style 0.4–0.8 mm. **Seeds** reddish brown, narrowly oblong, 0.9–1.1 x 0.5–0.6 mm, uniseriate or sub-biseriate, pointed distally; cotyledons incumbent. **2n** = 32.

Flowering: Jun–Aug.

Habitat: sandy beaches, gravel, flats of riverbeds.

Elevation: 0–1500 m.

Distribution: Canada (Newfoundland, Labrador, Manitoba, Nunavut, Ontario, Quebec, Saskatchewan), Greenland.

**2. Arabidopsis arenosa** (Linnaeus) Lawalrée, Bull. Soc. Roy. Bot. Belg. 42: 242. 1969.

**Herbs**, biennial or short-lived perennial with a caudex. **Stems** (5–)8–80(–100) cm, erect, simple or with few to many branches from the base, usually branched above, basally pilose to subhirsute with simple trichomes to 1 mm, apically glabrous. **Basal leaves** rosulate; petiole (0.3–)0.7–2(–3) cm, pilose; leaf blade obovate to oblanceolate, 1–4.5(–6.5) x 0.5–1.3(–1.7) cm,

sparsely to densely pubescent with simple and short-stalked forked trichomes, margin pinnatifid to lyrate-pinnatifid and with 3–11 lateral lobes on each side, rarely dentate, apex obtuse to subacute; terminal lobe considerably larger or nearly as large as adjacent lateral lobes; cauline leaves 3–10, short petiolate or uppermost sessile; blade lanceolate to narrowly oblong, middle ones 1–4 (–5) x 0.3–1.5 cm, margin pinnatifid to dentate on lower leaves, dentate or entire on uppermost ones, apex acute to obtuse. **Fruiting pedicels** slender, divaricate, straight, 4–10(–15) mm. **Sepals** 2.2–3 mm, glabrous or distally sparsely pilose with simple trichomes, lateral pair saccate; petals white to lavender, obovate, 5–8 x 2.5–4 mm, apex obtuse or truncate; claw often apically with a pair of minute teeth; filaments white, 3–4 mm; ovules 28–74 per ovary. **Fruits** linear, distinctly compressed, smooth to slightly torulose, (1–)2–4(–5) cm x (0.8–)1–1.5 mm; valves with a distinct midvein; style to 0.5 mm; gynophore to 0.5 mm. **Seeds** oblong, compressed, light to reddish brown, (0.6–)0.8–1.2 mm, obscurely to prominently winged distally; cotyledons accumbent.  $2n = 16, 32$ .

Flowering: Apr–Jul(–Aug).

Habitats: forest margins, roadsides, railroad tracks, river or stream banks, trails, disturbed areas, slopes, fields, grassy areas.

Elevation: 0–2100 m.

Distribution: Europe: native in Austria, Belarus, E Belgium Bosnia Herzegovina, Bulgaria, Croatia, Czech Republic, NE France, Germany, Hungary, N Italy, Latvia, Lithuania, Macedonia, Poland, Romania, Slovakia, Slovenia, Switzerland, Ukraine, and Yugoslavia; naturalized in Belgium, Denmark, Estonia, Finland, Greenland, Holland, Norway, Russia and W Siberia, and Sweden.

Two subspecies.

#### KEY TO THE SUBSPECIES OF *ARABIDOPSIS ARENOSA*

1. Basal leaves with terminal lobe larger than the 1–6 lateral lobes on each side; seeds very narrowly winged distally or rarely wingless; ovules 36–74 per ovary 2a. subsp. *arenosa*
1. Basal leaves with terminal lobe subequal to or scarcely larger than the 4–11 lateral lobes on each side; seeds conspicuously winged distally; ovules 28–38 per ovary 2b. subsp. *borbasii*

**2a. *Arabidopsis arenosa* subsp. *arenosa*; *Sisymbrium arenosum* Linnaeus, Sp. Pl. 2: 658. 1753; *Arabis arenosa* (Linnaeus) Scopli, Fl. Carniol., ed. 2, 2: 32. 1772; *Arabis petraea* (Linnaeus) Lamarck var. *arenosa* (Linnaeus) Neilreich, Nachtr. Fl. Wein. 262. 1851; *Cardamine arenosa* (Linnaeus) Roth, Man. Bot. 291. 1830; *Cardaminopsis arenosa* (Linnaeus) Hayek, Fl. Steiermark 1: 478. 1908. TYPE: “In Germania, Helvetica” (lectotype designated by O’Kane & Al-Shehbaz (1997: 325), LINN 836.22).**

*Arabis petrogena* A. Kerner, Oesterr. Bot. Z. 13: 141. 1863; *Arabis arenosa* var. *petrogena* (A. Kerner) Borbás; *Cardaminopsis arenosa* subsp. *petrogena* (A. Kerner) Soó, Acta Bot. Acad. Sci. Hung. 16: 371. 1971; *C. petrogena* (A. Kerner) Mesicek, Preslia 42: 246. 1970; *Arabidopsis petrogena* (A. Kerner) V. I. Dorofeyev, Turczaninowia 5(3): 36. 2002; *Arabidopsis petrogena* (A. Kerner) Kotník & Marhold, Willdenowia 33: 70. 2003, comb. superfl. TYPE: “in locis petrosis mintium circa Budam; communissima in monte Adlersberg et in rupibus dolmaticis vallis Auwinkel” (syntypes, WU).

*Arabis segetalis* Schur, Enum. Pl. Transsilv. 45. 1866; *Cardaminopsis arenosa* var. *segetalis* (Schur) E.I. Nyárády in Savulescu, Fl. Reipubl. Popularis Roman. 3: 291. 1955. TYPE: “Auf Aeckern unter Saaten, an der Strasse nach Schellenberg bei Hermannstadt.” (holotype, not located).

*Arabis arenosa* var. *simplex* Neilreich, Fl. N.-Öster. 715. 1859; *Cardaminopsis arenosa* var. *simplex* (Neilreich) Hayek, Fl. Steiermark 1: 479. 1908. TYPE: “in ihrer typischen Gestalt am schönsten auf den Inseln und in den Auen dr Donau” (syntypes, W).

*Cardaminopsis arenosa* var. *peregrina* Lawalrée, Bull. Jard. Bot. État Bruxelles 26: 350. 1956; *Arabidopsis arenosa* var. *runcinata* (Godron) Lawalrée f. *peregrina* (Lawalrée) Lawalrée, Bull. Soc. Roy. Bot. Belgique 9: 243. 1960. TYPE: Belgium, Etterbeek, Etterbeek-Cinquantenaire, May 1924, *E. Michel s.n.* (holotype, BR).

Plants annual or biennial, rarely perennial. Basal leaves pinnatisect, with 1-6 lateral lobes on each side, rarely dentate; terminal lobe considerably larger than adjacent lateral lobes. Petals white to lilac. Ovules 36–74 per locule. Seeds very narrowly winged at least distally or rarely wingless.  $2n=16, 32$ .

Flowering: Apr–Jul(–Aug).

Habitats: forest margins, roadsides, railroad tracks, river banks, disturbed areas, slopes, fields, grassy areas.

Elevation: 0–2000 m.

Distribution: Europe: native in Austria, Belarus, Bosnia Herzegovina, Bulgaria, Croatia, Czech Republic, NE France, Germany, Hungary, N Italy, Latvia, Lithuania, Macedonia, Poland, Romania, Slovakia, Slovenia, Switzerland, Ukraine, and Yugoslavia; naturalized in Belgium, Denmark, Estonia, Finland, Greenland, Holland, Norway, Russia and W Siberia, and Sweden.

**2b. *Arabidopsis arenosa* (Linnaeus) Lawalrée subsp. *borbasii* (Zapalowicz O’Kane & Al-Shehbaz, Novon 7: 325. 1997; *Arabis arenosa* (Linnaeus) Scopli subsp. *borbasii* Zapalowicz, Rozpr. Wydz. Mat.-Przyr. Acad. Umiejtn., Dzial B, Nauki Biol. 52: 31. 1912; *Cardaminopsis arenosa* (Linnaeus) Hayek subsp. *borbasii* (Zapalowicz) Pawlowski ex H. Scholz, Willdenowia 3: 139. 1962; *C. arenosa* var. *borbasii* (Zapalowicz) E.I. Nyárády in Savulescu, Fl. Reipubl. Popularis Roman. 3: 288. 1955; *C. borbasii* (Zapalowicz) H. Hess, Landolt & Hirzel, Fl. Schweiz, Fl. Schweiz. 3: 778. 1972. TYPE: Poland. Carpathians, Babia Góra monte, 1285–1725 m, *Zapalowicz s. n.* (lectotype, designated by O’Kane & Al-Shehbaz (1997), KRAM).**

*Arabis arenosa* var. *dependens* Borbás, Math. Term. Közl. 15: 156. 1878; *Cardaminopsis arenosa* var. *dependens* (Borbás) Jávorka, Magyar Fl. 436. 1924; *C. arenosa* subsp. *borbasii* var. *dependens* (Borbás) Soó, Acta Bot. Acad. Sci. Hungar. 13: 304. 1967; *C. dependens* (Borbás) Kotov, comb. invalid. TYPE:

*Arabis arenosa* var. *multiceps* Neilreich, Fl. N. Öster. 715. 1859; *Arabis multiceps* (Neilreich) Favarger & Rech., Abh. Zool. Bot. Ges. Wien 3: 31. 1905, not *A. multiceps* Greene, Leaflets Bot. Obs. 2: 76. 1910. TYPE: “Flussgebieten der Peisting, Schwarza, Traisen” (syntypes, W).

*Arabis arenosa* var. *runcinata* Godron, Fl. de Lorraine, ed. 2, 1: 60. 1857; *Arabidopsis arenosa* var. *runcinata* (Godron) Lawalrée, Bull. Soc. Roy. Bot. Belgique 92: 242. 1960. TYPE: “Nancy, aux Fonds Saint Barthelémy et à Liverdun (Soyer-Willemet); Pont-à-Mousson (Léré); Rosières-aux Salines; Lunéville” (syntypes, NCY).

*Arabis arenosa* var. *sarmentosa* Schur, Enum. Pl. Transsilv. 44. 1866. Type: “Auf dem Königstein bei Kronstadt, kalk., Aug, 6000” (holotype, not located).

*Arabis hispida* Mygind var. *intermedia* Freyn, Österr. Bot. Z. 39: 133. 1889; *A. freynii* Brügger, Österr. Bot. Z. 39: 231. 1889. TYPE: Salzburg, *J. Freyn s.n.* (holotype, BRNM?).

*Arabis multijuga* Borbás, Linnaea, 41: 604. 1877; *Arabisarenosa* subsp. *multijuga* (Borbás) Kulczynski in Szafer, Fl. Polska 3: 162. 1927; *A. arenosa* var. *multijuga* (Borbás) Zapalowicz, Rozpr. Wydz. Mat.-Przyr. Acad. Umiejtn., Dzial B, Nauki Biol. 52: 35. 1912; *Cardaminopsis multijuga* (Borbás) Czerepanov, Plantae Vasculares URSS 127. 1981; *C. arenosa* var.

*multijuga* (Borbás) Kotov in Klukov & E. D. Wissjulina, Fl. RSS Ucr. 5: 290. 1953. TYPE: Gutin, *Borbás s.n.* (holotype, BP or BPU).

*Arabis petraea* (Linnaeus) Lamarck var. *intermedia* Neilreich, Nachtr. Fl. Wien. 262. 1851; *Cardaminopsis arenosa* var. *intermedia* (Neilreich) Hayek, Fl. Steiermark 1: 479. 1908. TYPE: “Gemein auf Felsen der kalkgebirge und in Sand subalpiner Bäche in der höhern Berg-un Voralpen region besonders im Flossgebiete des kaltenganges und der Schwarza steight night über 3000” (syntypes, W).

Plants usually perennial. Basal leaves pinnatisect, with 4-11 lateral lobes on each side; terminal lobe about as large as adjacent lateral lobes. Petals bright lilac. Ovules 28–38 per locule. Seeds broadly winged at least distally.  $2n=16, 32$ .

Habitats: forest margins, slopes, stream banks, trails.

Elevation: 400–2100 m.

Distribution: E Belgium, Czech Republic, NE France, Germany, Hungary, Poland, Romania, Slovakia, Switzerland, Ukraine. Doubtfully occurring in Denmark.

**3. *Arabidopsis cebennensis*** (de Candolle) O’Kane & Al-Shehbaz, *Novon* 7: 325. 1997; *Arabis cebennensis* de Candolle, *Syst. Nat.* 2: 234. 1821; *Cardaminopsis cebennensis* (de Candolle) Burdet in Greuter & Raus, *Willdenowia* 13: 86. 1983. TYPE: France, “in locis asperis subumbrosis montium Cebennorum in horto Dei et Bramabiou” (holotype, G-DC).

**Herbs**, perennial. **Stems** (25–)40–80 cm, erect, simple at base, branched above, pilose with simple trichomes mixed with stalked forked ones. **Basal leaves** rosulate; petiole (1–)1.5–4 cm; leaf blade ovate to ovate-lanceolate, 2–7 x 1.5–4.5 cm, sparsely to densely pubescent with stalked, forked or 3-rayed trichomes, base cuneate, margin coarsely and irregularly few toothed, apex acute; cauline leaves 7–15, similar to basal leaves, becoming smaller, short petiolate, and basally attenuate upward. **Fruiting pedicels** divaricate, slender, 6–12(–15) mm. **Sepals** oblong, 2.5–3.5 mm, lateral pair saccate; petals deep purple, lavender, or very rarely white, obovate, 7–10 x 2.5–4 mm, slightly spreading; claw entire; filaments usually lavender, 3–4.5 mm; ovules 30–44 per ovary. **Fruit** linear, (2–)2.5–4.5(–5) cm x 1–1.5 mm, strongly compressed, torulose; valves with a distinct midvein; gynophore to 1 mm; styles slender, 0.8–1.2 mm. **Seeds** reddish brown, compressed, 1.2–1.6 mm, narrowly winged distally; cotyledons accumbent.

Flowering: Jun-Aug.

Habitats: slopes, forest margins.

Elevation: 600–2300 m.

Distribution: SE France.

**4. *Arabidopsis croatica*** (Schott) O’Kane & Al-Shehbaz, *Novon* 7: 325. 1997; *Arabis croatica* Schott, in Schott, Nyman, & Kotschy, *Analect. Bot.* 44. 1854; *Cardaminopsis croatica* (Schott) Jávorka, *Magyar Fl.* 435. 1924. Type: Croatia, *F. Maly s. n.* (holotype, BP?).

**Herbs**, perennial, with a distinct caudex. **Stems** 8–18(–20) cm, erect, divaricately branched, flexuous, glabrous. **Basal leaves** rosulate; petiole to 3 cm; leaf blade obovate, 0.5–2 x 0.4–1.5 cm, glaucous, fleshy, glabrous or sparsely pubescent with simple and fewer, short-stalked forked trichomes, margin entire to denticulate, rarely lyrate-pinnatifid; cauline leaves similar to basal ones, sometimes larger. **Fruiting pedicels** slender, horizontal or reflexed, 7–10 mm. **Sepals** 2.5–3.5 mm long, glabrous or distally sparsely pilose with simple trichomes, lateral pair saccate; petals lavender to purplish, 4–6 x 2–2.5 mm, apex obtuse; claw, short, entire; filaments lavender, 2.5–3.5 mm; ovules ca. 50 per ovary. **Fruits** linear, compressed, smooth to slightly torulose, 1.8–5 cm x 0.9–1.1 mm; valves obscurely veined; style to 1 mm, slender. **Seeds** oblong, compressed, light brown, ca. 1 mm, wingless; cotyledons accumbent.

Flowering: May–July.  
Habitats: Rocky areas, crevices.  
Distribution: Bosnia, Croatia.

**5. *Arabidopsis halleri*** (Linnaeus) O’Kane & Al-Shehbaz, *Novon* 7: 325. 1997.

**Herbs**, perennial, stoloniferous. **Stems** (7–)20–65(–80) cm, decumbent, few from base, simple or branched above, basally with simple and 2- or 3-rayed forked trichomes, apically glabrous. **Basal leaves** rosulate; petiole (5–)1–2.5(–5) cm; leaf blade orbicular to broadly ovate, (1–)2–4.5(–9) x (0.5–)1–1.5(–2.5) cm, adaxially with a mixture of simple and stalked, 1- or 2-forked trichomes, margin pinnatifid to lyrate-pinnatifid and with (1 or)2–4(–7) suborbicular lateral lobes on each side; terminal lobe suborbicular, much larger than lateral ones, sometimes coarsely dentate, rarely entire or repand, apex obtuse; cauline leaves shortly petiolate, (3–)5–20(–24); blade of middle and lower ones ovate to oblong or lanceolate, (0.5–)1–2.5(–8) x (0.2–)0.5–1.5(–3) cm, coarsely toothed or rarely lobed, gradually reduced in size upward.

**Fruiting pedicels** divaricate or slightly reflexed, straight, (0.5–)0.8–1.3(–2) cm. **Sepals** 1.5–3(–3.5) mm, glabrous or apically with few simple trichomes, lateral pair saccate; petals white, lilac, or purplish, obovate, 4–7(–8) x 2–3.5(–4) mm; claw entire; filaments white, 2–2.5 mm; ovules 14–18 per ovary. **Fruits** linear, flattened, torulose, (0.9–)1–2.5(–3) cm x 0.6–1 mm; replum constricted between seeds; valves not veined or with an obscure midvein; gynophore slender, to 0.7 mm; style slender, to 1 mm. **Seeds** oblong, flattened, light brown, 0.8–1.2 mm, wingless; cotyledons accumbent.  $2n=16$ .

Flowering: May–Aug.

Habitats: slopes, forest margins, rocky crevices, gravelly or grassy slopes, forests, shaded and most areas.

Elevation: 0–2600 m.

Distribution: Albania, Austria, Belgium, Bosnia and Herzegovina, Croatia, Czech Republic, N France, Germany, N and C Italy, Moldova, Poland, Romania, Serbia, Slovakia, Slovenia, Switzerland, and S Ukraine; NE China, Korea, Japan, Russian Far East, Taiwan.

Three subspecies.

KEY TO THE SUBSPECIES OF *ARABIDOPSIS HALLERI*

1. Basal leaves entire or with weakly developed lateral lobes; lower stem leaves orbicular to ovate, entire or crenate; flowering stems few, sparsely branched above; petals light purple to pale lavender .....5b. subsp. *ovirensis*
1. Basal leaves pinnatifid or lyrate; lower stem leaves oblong and dentate; flowering stems numerous, branched at base and often also above; petals white or pale lavender.
  2. Basal leaves pinnatifid, with 1–7 lateral lobes; petals white or lavender; plants 20–45 cm; Europe .....5a. subsp. *halleri*
  2. Basal leaves lyrate; petals white; plants 40–80 cm; Russian Far East, NE China, Korea, Japan, and Taiwan .....5c. subsp. *gemmifera*

**5a. *Arabidopsis halleri* subsp. *halleri*.** *Arabis halleri* Linnaeus, *Sp. Pl.* ed. 2, 2: 929. 1763; *Cardamine halleri* (Linnaeus) Prantl, *Exkurs. Fl. Bayern*, ed. 2, 229. 1884; *Cardaminopsis halleri* (Linnaeus) Hayek, *Fl. Steiermark* 1: 479. 1908. Lectotype designated by Al-Shehbaz in Cafferty and Jarvis (2002): “*Sisymbrium [palustre album] foliis imis Barbareae reliquis*” in Haller (*Opusc. Bot.*: [t. I, f. 1], 1749. Epitype: Herb. Linn. No. 842.11 (LINN!).

*Arabis besseri* Zapalowicz subsp. *prosecarpatica* Zapalowicz, *Rozpr. Wydz. Mat.-Przyr. Acad. Umiejetn., Dzial B, Nauki Biol.* 52: 31. 1912. TYPE: “in rupibus calcareis Carpatorum

orientalium locis siccioribus: Budyowska Wielka, 1555 m,” *Zapalowicz s.n.* (lectotype, KRAM).

*Arabis halleri* var. *carstica* Dostál, Čas. Nar. Mus., Odd. Přír. 60: 61, 1936. TYPE: “ad declivia aprica graminosa in regione Slovensky Kras dicta et in convallibus rivi Hornad inter oppida Obyšovce et Košice,” ca. 450 m, 16 May 1933, *Dostál s.n.* (lectotype designated by Kolník & Marhold (2006: 45): PR).

*Arabis halleri* var. *devestita* Zapalowicz, Rozpr. Wydz. Mat.-Przyr. Akad. Umiejetn., Dzial B, Nauki Biol. 52, Ser. B.: 45, 1912. TYPE: “Na zachod od Babiej gory. . . w Tatrach. . . w krainie kosodrzewu Czarnej Hory.” 28 Apr 1906, *Zapalowicz 221.39* (lectotype designated by Kolník & Marhold (2006: 45): KRAM 114338).

*Arabis halleri* Linnaeus var. *pilifera* Beck, Fl. Nieder-Österreich 2: 458. 1892; *Cardaminopsis halleri* var. *pilifera* (Beck) E. Schmid in Hegi, Ill. Fl. Mittel-Eur., ed. 1, 424. 1919. TYPE: Austria, *Beck s.n.* (holotype, PRC or W).

*Arabis halleri* var. *prelukiensis* Zapalowicz, Rozpr. Wydz. Mat.-Przyr. Akad. Umiejetn., Dzial B, Nauki Biol. 52, Ser. B.: 45, 1912. TYPE: “Miedzi obu Czeremoszami blizko ich Zrodlowisk: Preluki na skalach wapiennych kolo 1550 m,” 1886, *Woloszczak 70.276* (Lectotype designated by Kolník & Marhold (2006: 44): KRAM 114348).

*Arabis halleri* var. *sudetica* Dostál, Čas. Nar. Mus., Odd. Přír. 60: 61, 1936. TYPE: “Montes Krkonoše.” (holotype not known).

*Arabis halleri* var. *tatrica* Pawlowski. Acta Soc. Bot. Poloniae 7: 129. 1930–1931; *Arabidopsis halleri* subsp. *tatarica* (Pawlowski) Kolník & Marhold, Biologia Bratislava 61: 45. 2006. TYPE: “. . . w postaci zupełnie typowej na całej przestrzeni od Krzesanicy po Kope Kondracka w wysokosci od 1950 po 2128 m,” 26 Jul 1928, *Pawlowski s.n.* (lectotype designated by Kolník & Marhold (2006: 45): KRAM 320705).

*Arabis halleri* var. *trachytica* Fritsch, Verh. Zool.-Bot. Ges. Wien 44: 311, 1895. TYPE: “Bosnia orientalis. In pratis montis Kvarac prope Srebrenica, solo trachytico et calcareo (?), 400–500 m, Julio mense (Wettstein). Styria inferior. In silvis prope Cilli, solo calcareo(?), ca. 600 m, 3 Jul (Rechinger, R.)” TYPE: not known.

*Arabis halleri* subsp. *transsilvanica* Klášterský, Preslia 8: 29. 1929, non Schur 1866, nom. illeg. Svidovec, travnaty svah od vrcholu Bližnice do kotle, 1800 m, 5 Jul 1926, *Klásterský 1601* (lectotype designated by Kolník & Marhold (2006: 44): PR).

*Arabis halleri* var. *valida* Zapalowicz, Rozpr. Wydz. Mat.-Przyr. Akad. Umiejetn., Dzial B, Nauki Biol. 52, Ser. B.: 46. 1912. TYPE: “Rospuntowa ko\_lo Chrzanowa” 24 Jul 1876, *Krupa 27.590* (holotype, KRAM 114327).

*Arabis tenella* Host, Fl. Austriac. 2: 273. 1831. TYPE: “in Styria superiore in humidis alpinum judenburgensium” (lectotype designated by Kolník & Marhold (2006: 43), W).

*Cardamine stolonifera* Scopoli, Fl. Carniol., ed. 2: 229. 1772; *Arabis stolonifera* (Scopoli) Horneman, Hort. Bot. Hafn. 2: 618, 1815. TYPE: “Habitat in Distictu Vipaccensi” (lectotype designated by Kolník & Marhold (2006: 43): Scopoli, Fl. Carnil. Ed. 2, tab. 39. fig. 818. 1772).

Plants with few stolons. Stems 20–45 cm, branched below and above. Basal leaves pinnatifid, with 1–7 lateral lobes on each side; lower stem leaves often oblong, dentate. Fruiting pedicels 5–10 mm. Petals white or rarely lavender.  $2n = 16$ .

Habitats: slopes, forest margins, rocky crevices.

Elevation: 600–2200 m.

Distribution: Austria, Belgium, Bosnia and Herzegovina, Croatia, Czech Republic, N France, Germany, N and C Italy, Moldova, Poland, Romania, Serbia, Slovakia, Slovenia, Switzerland, and S Ukraine.



**5b. *Arabidopsis halleri* subsp. *ovirensis*** (Wulfen) O’Kane & Al-Shehbaz, *Novon* 7: 325. 1997; *Arabis ovirensis* Wulfen in Jacquin, *Collectanea* 1: 196. 1787; *A. halleri* Linnaeus subsp. *ovirensis* (Wulfen) Kláštersky, *Preslia* 8: 30. 1929; *Cardaminopsis halleri* subsp. *ovirensis* (Wulfen) Hegi & E. Schmid in Hegi, *Ill. Fl. Mittel-Eur.* 4(1): 424. 1919; *C. ovirensis* (Wulfen) Thellung ex Jávorka, *Magyar Fl.* 436. 1924; *C. ovirensis* (Wulfen) O. Schwarz, *Mitt. Thuring. Bot. Ges.* 1(1): 101. 1949, comb. superfl. TYPE: Austria, *Ovirensis supra Ebriacum in Valle Junonia percurrerem alpes*, *Wulfen s.n.* (holotype, W).

*Arabis ovirensis* var. *dacica* Heuffel, *Verh. Zool.-Bot. Ges. Wien* 8: 52, 1858; *Arabidopsis halleri* subsp. *dacica* (Heuffel) Kolnik & Marhold, *Biologia Bratislava* 61: 45. 2006. TYPE: “In Banatu Temesiensii” (holotype, not found).

Plants with numerous stolons. Stems 10–20 cm, few branched above. Basal leaves entire or with weakly developed lateral lobes; lower stem leaves orbicular to ovate, often entire. Fruiting pedicels 10–14 mm. Petals lavender or purple.  $2n = 16$ .

Habitats: rocky slopes and crevices.

Elevation: 1200–2400m.

Distribution: Albania, Austria, NE Italy, Romania, Slovakia, Slovenia, SW Ukraine, former Yugoslavia.

**5c. *Arabidopsis halleri* subsp. *gemmifera*** (Matsumura) O’Kane & Al-Shehbaz, *Novon* 7: 325. 1997; *Cardamine gemmifera* Matsumura, *Bot. Mag. (Tokyo)* 13: 49. 1899; *Arabidopsis gemmifera* (Matsumura) Kadota, *J. Jap. Bot.*, 82: 236. 2007; *Arabis gemmifera* (Matsumura) Makino, *Bot. Mag. (Tokyo)* 24: 224. 1910; *Cardaminopsis gemmifera* (Matsumura) Berkutenko, *Novosti Sist. Vyssh. Rast.* 15: 154. 1978. TYPE: Japan, Prov. Shinano: monte Norikura, 1891, *K. Fuji s.n.* (holotype, TI!).

*Arabidopsis umezawana* Kadota, *J. Jap. Bot.* 82: 232. 2007. TYPE: Japan, Hoddaido, Sôya Subpref., Rishiri-gun, Rishiri-cho, Rishiri Island, Mt. Rishirizan, E ridge, ca. 1000 m, 7 Jul 2004, *S. Umezawa 04070701* (holotype, TNS).

*Arabis coronata* Nakai, *Bot. Mag. (Tokyo)* 28: 302. 1914. TYPE: Korea, “in silvis Laricis pedemontis Paiktusan, Aug 1913, *T. Mori s.n.* (holotype, TI!).

*Arabis gemmifera* var. *alpicola* H. Hara, *J. Jap. Bot.* 12: 901. 1936. TYPE: Japan, Honshu, Prov. Omi, Mt. Ibuki, May 1914, *G. Koidzumi s.n.* (holotype, TI!).

*Arabis halleri* Linnaeus var. *senanensis* Franchet & Savatier, *Enum. Pl. Jap.* 2: 279. 1879; *A. senanensis* (Franchet & Savatier) Makino, *Bot. Mag. (Tokyo)* 24: 224. 1910. TYPE: Prov. Senano, ubi Rein, *Savatier 2802* (holotype, P!).

*Arabis maximowiczii* N. Busch, *Bot. Mater. Gerb. Glav. Bot. Sada RSFSR* 3(3–4): 13. 1922; *Cardaminopsis maximowiczii* (N. Busch) O. E. Schulz in Engler & Prantl, *Nat. Pflanzenfam.*, ed. 2, 17B: 541. 1936. TYPE: Manchuria, “Ussuri et ejus confluentes, Vladivostok, insula Putjatin,” *Maximowicz s.n.* (holotype, LE!).

*Cardamine greatrexii* Miyabe & Kudo, *Trans. Sapporo Nat. Hist. Soc.* 6: 169. 1917; *Arabis greatrexii* (Miyabe & Kudo) Miyabe & Tatewaki, *Trans. Sapporo Nat. Hist. Soc.* 13: 379. 1934. TYPE: Japan, Hokkaido, Prov. Oshima, Hakodate, 10 Jun 1916, *Greatrex s.n.* (holotype, SAPA).

Plants with few to several stolons. Stems 40–65(–80) cm tall, branched below and above. Basal leaves often lyrate; lower stem leaves often ovate, dentate. Fruiting pedicels (8–)10–20 mm. Petals white.  $2n=16$ .

Habitats: gravelly or grassy slopes, forests, shaded and moist areas.

Elevation: 0–2600 m.

Distribution: Russian Far East, northeastern China, Korea, Japan, and Taiwan.

**6. Arabidopsis lyrata** (Linnaeus) O’Kane & Al-Shehbaz, Novon 7: 325. 1997.

**Herbs**, biennial or perennial with a caudex and stolons. **Stems** (5–)10–30(–45) cm, erect or decumbent, 1 to numerous from base, usually branched and straight or flexuous above, basally pilose or subhirsute with simple and forked trichomes, apically glabrous. **Basal leaves** rosulate; petiole 0.4–2(–6) cm; leaf blade oblanceolate or ovate, (0.5–)1–3(–8) x (0.3–)0.5–1.5 cm, adaxially with a mixture of simple and stalked, 1-forked trichomes, rarely glabrous, margin entire, dentate, lyrate, or pinnatifid with 1–3 lateral lobes on each side, apex obtuse; cauline leaves shortly petiolate and uppermost often sessile; blade of middle ones oblanceolate, (0.5–)1–3.5(–5.5) x (0.1–)0.2–0.7(–1.3) cm, entire, repand, or obscurely toothed, rarely lower ones lobed, gradually reduced in size upward. **Fruiting pedicels** ascending to divaricate, straight, (0.4–)0.7–1.2(–1.5) cm. **Sepals** 2–3 mm, glabrous or densely pubescent, lateral pair saccate; petals white, rarely lavender or purplish, spatulate or obovate, 4–8(–9) x 1.5–3(–3.5) mm; claw not toothed; filaments white, 2–3 mm; ovules 20–36 per ovary. **Fruits** linear, flattened, torulose, (1–)2–4.5(–6) cm x 0.5–1.5 mm; valves with a distinct midvein extending full length; gynophore to 0.5 mm; style obsolete or to 1 mm. **Seeds** oblong, flattened, light brown, 0.8–1.2 mm, wingless, sometimes distally margined; cotyledons accumbent.  $2n = 16, 32$ .

Flowering: Mar–Oct.

Habitat: cliffs, calcareous ledges and bluffs, rock crevices, ledges, thickets, sandy areas in open woods, sand dunes, river banks, flooded areas, sandstone hills, serpentine rocks and barrens, shale, talus, tundra, roadsides, gravelly slopes, forests, volcanic ash.

Elevation: 0–3500 m.

Distribution: Austria, Canada (Alberta, British Columbia, Manitoba, Northwest Territories, Ontario, Saskatchewan, Yukon), Czech Republic, England, Germany, Hungary, Iceland, Ireland, N. Italy, Norway, NE European Russia, Scotland, Sweden, Ukraine, United States (Alaska, Connecticut, Delaware, District of Columbia, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin).

Three subspecies.

KEY TO THE SUBSPECIES OF *ARABIDOPSIS LYRATA*

1. Basal leaves entire or toothed; older plants with well-developed, often branched, somewhat thickened caudex 6b. subsp. *petraea*
1. Basal leaves lyrate or lyrate-pinnatifid; older plants often with a slender unbranched caudex or root crown.
  2. Basal leaves usually pubescent; petioles often hirsute; petals 6–8 mm; fruit 0.8–1 mm wide; style 0.5–1 mm 6a. subsp. *lyrata*
  2. Basal leaves glabrous or sometimes sparsely pubescent; petioles often glabrous; petals (4–)5–5.5(–6) mm; fruits 1.2–1.5(–1.8) mm wide; style obsolete or to 0.5 mm 6c. subsp. *kamchatica*

**6a. Arabidopsis lyrata** subsp. **lyrata**; *Arabis lyrata* Linnaeus, Sp. Pl. 2: 665. 1753;

*Cardaminopsis lyrata* (Linnaeus) Hiitonen, Mem. Soc. Faun. Fl. Fenn. 25: 75. 1950. Type: Canada, *D. Kalm s.n.* (lectotype designated by O’Kane & Al-Shehbaz (1997: 325), LINN 842.8).

Biennial or perennial herbs, with slender or rarely branched caudex. Basal leaves lyrate-pinnatifid; petioles pilose to subhirsute, often ciliate; lateral lobes 1–5 on each side, entire

of few toothed; terminal lobe considerably larger than lateral lobes. Petals 6-8 mm. Fruits 0.7–1 mm wide; styles slender, 0.5–1.1 mm, distinctly longer than broad.  $2n = 16, 32$ .

Flowering: Apr–Jul.

Habitat: cliffs, calcareous ledges and bluffs, rock crevices, ledges, thickets, sandy areas in open woods, sand dunes, river banks, sandstone hills, serpentine rocks and barrens, shale, talus.

Elevation: 0–2200 m.

Distribution: Canada (Alberta, British Columbia, Manitoba, Northwest Territories, Ontario, Saskatchewan), NE European Russia, United States (Alaska, Connecticut, Delaware, District of Columbia, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin).

- 6b. *Arabidopsis lyrata* subsp. *petraea*** (Linnaeus) O’Kane & Al-Shehbaz, *Novon* 7: 326. 1997; *Cardamine petraea* Linnaeus, *Sp. Pl.* 2: 654. 1753; *Arabidopsis petraea* (Linnaeus) V. I. Dorofeyev, *Turczaninowia* 5(3): 35. 2002; *Arabidopsis petraea* (Linnaeus) Kolník & Marhold, *Willdenowia* 33: 70. 2003, comb. superfl.; *Arabis arenosa* (Linnaeus) Scopli subsp. *petraea* (Linnaeus) Celakovsky, *Prodr. Fl. Böhm.* 455. 1875; *A. petraea* (Linnaeus) Lamarck, *Encycl.* 1: 221. 1783; *Cardaminopsis petraea* (Linnaeus) Hiitonen in Hylander, *Förteckn. Scand. Växt.* 1, Kärleväxt., ed. 3, 62. 1941. TYPE: “In Angliae, Arvoniae, Mervinae, Sueciae, rupibus excelsis” (lectotype designated by Marhold (see Jarvis 2007: 383), LINN 835.5).
- Arabis amurensis* N. Busch, *Bot. Mater. Gerb. Glav. Bot. Sada RSFSR* 3(3-4): 12. 1922; *Cardaminopsis amurensis* (N. Busch) O.E. Schulz in Engler & Prantl, *Nat. Pflanzenfam.* ed. 2, 17B: 541. 1936. TYPE: “Ad flumen Amur et ejus confluentis (Schilka Kur) et in Sachalin (contra ostium fl. Amur)” (syntypes, LE).
- Arabis crantziana* Ehrhart, *Beitr. Naturk.* 5: 177. 1796 (nomen. nud.), Ehrhart ex Willdenow, *Sp. Pl.* 3: 535. 1802; *A. petraea* var. *crantziana* (Ehrhart) de Candolle, *Syst. Nat.* 2: 229. 1821. TYPE: “in monte Katzenstein,” *Ehrhart* 78 (holotype, not located).
- Arabis hispida* Linnaeus, *Syst. Veg.*, ed. 13, 501. 1774, not *A. hispida* Moench, *Methodus* 258. 1794; *Cardaminopsis hispida* (Linnaeus) Hayek, *Fl. Steiermark* 1: 478. 1908. TYPE: Austria (lectotype here designated, LINN 842.9).
- Arabis media* N. Busch, *Bot. Mater. Gerb. Glav. Bot. Sada RSFSR* 3(3-4): 11. 1922; *Cardaminopsis media* (Busch) O.E. Schulz in Engler & Prantl, *Nat. Pflanzenfam.*, ed. 2, 17B: 541. 1936; *C. petraea* subsp. *media* (N. Busch) Hämet-Ahti, *Ann. Bot. Fenn.* 7: 293. 1970. TYPE: Russia, E Siberia, “Zona arctica et subarctica ab ostio Lenae usque ad Anadyr, montes Sajanenses orientales, montes ciset transbaicalenses atque Jacutenses” (holotype, LE).
- Arabis septentrionalis* N. Busch, *Bot. Mater. Gerb. Glav. Bot. Sada RSFSR* 3(3-4): 10. 1922; *A. petraea* subsp. *septentrionalis* (N. Busch) Tolmachev & Bloomintal, *TrudyBot. Muz.* 23: 204. 1931; *Cardaminopsis septentrionalis* (N. Busch) O. E. Schulz in Engler & Prantl, *Nat. Pflanzenfam.*, ed. 2, 17B: 541. 1936. TYPE: “Zona arctica a Novaja Zemlja usque ad ostia Lenae fluminis” (holotype, LE).
- Arabis umbrosa* Turczaninow in Ledebour, *Fl. Ross.* 1:120. 1842, not *A. umbrosa* Crantz, *Stirp. Austr. Fasc.* ed. 1,1: 43. 1762, ed. 2, 1: 41. 1769; *A. petraea* subsp. *umbrosa* (Turczaninow) Tolmachev, *Fl. Arctica URSS* 7: 97. 1975; *Cardaminopsis umbrosa* (Turczaninow) Czerepanov, *Plantae Vasculares URSS* 127. 1981; *C. petraea* subsp. *umbrosa* (Turczaninow) Peschkova, *Fl. Tsentral’noi Sibiri* 1: 396. 1979. TYPE: “in sabulosis ad fl. Irkut,” *Turczaninow s.n.* (holotype, KW).

Herbs, perennial, with stout, often several-branched caudex, rarely also stoloniferous. Basal leaves entire or dentate, rarely lyrate-dentate; petioles glabrous or pilose to subhirsute, often ciliate. Petals 4–7(–9) mm. Fruits 1–1.5(–2) mm wide; styles slender to stout, to 0.6 mm, slightly longer than broad.  $2n = 16, 32$ .

Habitats: Rocky and gravelly ground, sandy creek beds or banks, river terraces, sand dunes, tundra, volcanic ash.

Elevation: 0–2000 m.

Distribution: Austria, Canada (Yukon), Czech Republic, England, Germany, Hungary, Iceland, Ireland, N. Italy, Norway, Russia (NW Russia, Siberia and Far East), Scotland, Sweden, Ukraine, United States (Alaska).

**6c. *Arabidopsis lyrata* (Linnaeus) O’Kane & Al-Shehbaz subsp. *kamchatica*** (Fischer ex de Candolle) O’Kane & Al-Shehbaz, *Novon* 7: 326. 1997; *Arabidopsis kamchatica* (Fischer ex de Candolle) K. Shimizu & Kudoch, *Acta Phytotax. Geobot.* 56: 167. 2005; *Arabis lyrata* Linnaeus var. *kamchatica* Fischer ex de Candolle, *Syst. Nat.* 2: 231. 1821; *Arabis kamchatica* (Fischer ex de Candolle) Ledebour, *Fl. Ross.* 1: 121. 1842; *A. lyrata* subsp. *kamchatica* (Fischer ex de Candolle) Hultén, *Fl. Aleut. Isl.* 202. 1937; *Cardaminopsis kamchatica* (Fischer ex de Candolle) O. E. Schulz in Engler & Prantl, *Nat. Pflanzenfam.*, ed. 2, 17B: 541. 1936. TYPE: Russia, Kamchatka, *Fischer s.n.* (holotype, LE).

*Arabis ambigua* de Candolle var. *glabra* de Candolle, *Syst. Nat.* 2: 231. 1821; *A. kamchatica* var. *glabra* (de Candolle) N. Busch, *Fl. Sib. Orient. Est.* 4: 468. 1926; *A. lyrata* Linnaeus var. *glabra* (de Candolle) M. Hopkins, *Rhodora* 39: 93. 1937. TYPE: “in Kamchatka et insulis Kurilensis” (holotype, G-DC).

*Arabis ambigua* de Candolle var. *intermedia* de Candolle, *Syst. Nat.* 2: 231. 1821; *A. kamchatica* (Fischer ex de Candolle) Ledebour var. *intermedia* (de Candolle) N. Busch, *Fl. Sib. Orient. Est.* 4: 468. 1926; *A. lyrata* Linnaeus var. *intermedia* (de Candolle) Farwell, *Annual Rep. Michigan Acad. Sci.* 19: 256. 1917. Type: “insulis Kurilensibus,” (holotype, G-DC).

*Arabis kawasakiana* Makino, *Bot. Mag. (Tokyo)* 27: 24. 1913; *Arabidopsis kamchatica* (Fischer ex de Candolle) K. Shimizu & Kudoch subsp. *kawasakiana* (Makino) K. Shimizu & Kudoch, *Acta Phytotax. Geobot.* 56: 170. 2005. TYPE: Japan. Prov. Ise: Yokkaichi, *M. Kawasaki s. n.* (holotype, MAK).

*Arabis lyrata* var. *occidentalis* S. Watson in A. Gray, *Syn. Fl. N. Amer.* 1: 159. 1895; *A. occidentalis* (S. Watson) A. Nelson, *Univ. Wyoming Publ.* 3: 111. 1937. Type: not designated.

*Arabis morrisonensis* Hayata, *J. Coll. Sci. Imp. Univ. Tokyo* 30(1): 29. 1911. TYPE: Taiwan, monte Morrison, 13,094 ft., Nov 1905, *S. Nagasawa 680* (holotype, TI!).

*Sisymbrium tilesii* Ledebour, *Mem. Acad. Imp. Sci. St. Pétersbourg Hist. Acad.* 5: 548. 1815; *Arabis tilesii* (Ledebour) Karavaev ex V.N. Voroshilov, *Byull. Glavn. Bot. Sada (Moscow)* 134: 36. 1984. TYPE: Kamtschatka, 1806, *Tilesius s.n.* (holotype, LE?; isotype, MW).

Herbs, perennial, with slender or rarely branched caudex. Basal leaves lyrate-pinnatifid; petioles glabrous or rarely very sparsely pilose; lateral lobes 1–5 on each side, entire or few toothed; terminal lobe considerably larger than lateral lobes. Petals 4–5(–5.5) mm. Fruits (1–)1.2–1.5 mm wide; styles obsolete or distinct, stout, rarely to 0.5 mm long, distinctly wider than long.  $2n = 32$ .

Flowering: Jun–Jul.

Habitats: gravelly slopes, forests, alpine regions, roadsides, flooded areas, scree, talus.

Elevation: 0–3500 m.

Distribution: Canada (Alberta, British Columbia, Northwest Territories, Saskatchewan, Yukon), N China, Japan, Korea, Russia (E Siberia, Far East), Taiwan, United States (Alaska).

7. **Arabidopsis neglecta** (Schultes) O’Kane & Al-Shehbaz, *Novon* 7: 326. 1997; *Arabidopsis neglecta* Schultes, *Oestr. Fl.* 2: 248. 1814; *Arabidopsis arenosa* (Linnaeus) Scopli subsp. *neglecta* (Schultes) Zapalowicz, *Rozpr. Wydz. Mat.-Przyr. Acad. Umiejtn., Dzial B, Nauki Biol.* 52: 36. 1912; *Cardaminopsis neglecta* (Schultes) Hayek, *Fl. Steiermark* 1: 480. 1908. TYPE: Carpathians, ? Schultes s.n. (holotype, M).

*Arabidopsis floribunda* Schur, *Enum. Pl. Transsilv.* 44. 1866. TYPE: “Auf steinigem Abhängen der Rodnaer Alpen, 6,500’, in Gesellschaft von Lychn.” (holotype, not located).

*Arabidopsis glareosa* Schur, *Verh. Mitth. Siebenbürg. Vereins. Naturwiss. Hermannstadt* 1: 106. 1850; *Cardaminopsis neglecta* subsp. *glareosa* (Schur) Soó, *Acta Bot. Acad. Sci. Hung.* 16: 371. 1971. TYPE: “Auf den Rodnaer Alpen von Herrn Albert Bielz, auf den Arpáscher Alpen von mir 1847” (holotype, not located).

*Arabidopsis transsilvanica* Schur, *Enum. Pl. Transsilv.* 43. 1866. TYPE: “Auf feuchtem schlammigen Boden der Hochalpen, Glimmerschiefer, 6,000’, an Quellen und kleinen Bächen der Arpaser Alpen” (holotype, not located).

**Herbs**, perennial, with a distinct caudex. **Stems** 5–15(–20) cm, erect, simple or few branched, glabrous. **Basal leaves** rosulate; petiole to 2 cm; leaf blade obovate to oblanceolate, 0.5–2 x 0.3–1 cm, fleshy, glabrous or sparsely pubescent with simple and fewer, short-stalked forked trichomes, margin subentire to lyrate-pinnatifid with up to 4 teeth or small lateral lobes on each side; cauline leaves 3–6, attenuate to a short petiole; blade ovate to oblanceolate, usually glabrous, entire or basally minutely 2-toothed. **Fruiting pedicels** recurved or reflexed, 8–12 mm. **Sepals** 2.5–3.5 mm, glabrous or distally sparsely pilose with simple trichomes, lateral pair saccate; petals purple, 5–6 x 2–3 mm, apex obtuse; claw short, not toothed; filaments lavender, 3–4.5 mm; ovules ca. 30 per ovary. **Fruits** linear, distinctly compressed, smooth to slightly torulose, (1–)1.5–2.5(–3) cm x 1.2–1.8 mm; valves with a distinct midvein or obscurely veined; style to 1 mm, slender. **Seeds** oblong, compressed, light brown, 1–1.2 mm, wingless; cotyledons accumbent.  $2n = 16, 32$ .

Flowering: May–Jul.

Habitat: mountain slopes, forest margins.

Elevation: 1200–2660 m.

Distribution: Carpathian Mountains (Poland, Romania, Slovakia, and adjacent Ukraine).

8. **Arabidopsis pedemontana** (Boissier) O’Kane & Al-Shehbaz, *Novon* 7: 326. 1997; *Arabidopsis pedemontana* Boissier, *Diagn. Pl. Orient.* 1: 69. 1843; *Arabidopsis cebennensis* de Candolle subsp. *pedemontana* (Boissier) P. Fournier, *Quatre Fl. France* 421. 1936; *Cardaminopsis pedemontana* (Boissier) Burdet in Greuter & Raus, *Willdenowia* 13: 86. 1983. TYPE: [Switzerland], “In regione alpina montium Pedemontii, legi Aug. supra limitem arborum in collo inter Crissolo et Luzerna sitio” (holotype, G-BOIS).

**Herb**, perennial. **Stems** 10–30 cm, erect, simple or branched above, glabrous or subglabrous. **Basal leaves** rosulate; petiole (1.5–)2.5–6(–7) cm; leaf blade orbicular to broadly ovate-cordate, (1.5–)2–5 x (2–)2.5–5.5 cm, glabrous or very rarely sparsely pubescent with simple and stalked forked trichomes, base truncate to cordate, margin coarsely and irregularly few toothed or entire, apex obtuse to subacute; cauline leaves 3–6, smaller than basal ones, petiolate, broadly ovate or uppermost sessile and lanceolate, gradually reduced in size upward, base cuneate, margin coarsely dentate, apex acute. **Fruiting pedicels** divaricate to ascending, 7–12(–15) mm. **Sepals** oblong, 2.5–3.5 mm, lateral pair saccate; petals white, obovate, 6–7 x 2–3.5 mm; claw not toothed; filaments white, 2.5–4 mm; ovules 20–30 per ovary. **Fruit** linear, 1.5–3 cm x 1–1.5 mm, strongly compressed, slightly torulose; valves with a distinct midvein; gynophore to 0.5 mm;

styles slender, to mm. **Seeds** reddish brown, compressed, 0.9–1.4 mm, broadly winged at least distally; cotyledons accumbent.

Flowering: Jun–Aug.

Habitats: mountain slopes, forest margins.

Distribution: NW Italy, presumably extinct in adjacent SW Switzerland.

**9. *Arabidopsis suecica*** (Fries) Norrlin, Meddel. Soc. Fauna Fl. Fenn. 2: 12. 1878; *Arabis suecica* Fries, Summ. Veget. Scand. I, 30, 147. 1846; *A. arenosa* (Linnaeus) Scopoli subsp. *suecica* (Fries) Ahlfvengren in Neuman & Ahlfvengren, Sveriges Flora 453. 1901; *A. arenosa* var. *suecica* (Fries) Cajander in Mela, Suomenkasvio, ed. 5, 295. 1906; *Cardaminopsis suecica* (Fries) Hiitonen ex Hylander, Forteckn. Skand. Vaxt., 1. Karlvaxter, 62, 139. 1941; *Hylandra suecica* (Fries) Å. Löve, Svensk Bot. Tidskr. 55: 215. 1961; *Sisymbrium suecicum* (Fries) Nyman, Consp. Fl. Europ. 44. 1878; *Stenophragma suecicum* (Fries) Celakovsky ex Prantl in Engler & Prantl, Pflanzenfam. 3(2): 192. 1891. TYPE: Sweden. Pro v. Södermanland: Strängnäs, *Fries s.n.* (lectotype, UPS; see Löve, 1961).

**Herbs**, annual. **Stems** (5–)10–45(–60) cm, erect, 1–5(–8) from the base, usually branched above, basally pilose with simple trichomes to 1 mm, apically glabrous. **Basal leaves** rosulate; petiole (0.3–)0.6–2(–2.8) cm, ciliate; leaf blade obovate to oblanceolate, (0.3–)0.7–3(–4) x (0.1–)0.2–1.4(–1.7) cm, sparsely to densely pubescent with simple and short-stalked forked trichomes, rarely subglabrous, margin lyrate to pinnatifid on each side with 3–6 lateral lobes much smaller than terminal one, rarely dentate, apex obtuse to subacute; cauline leaves 3–8, short petiolate or uppermost sessile; blade lanceolate, oblong, or linear, middle ones (0.3–)1–2.5(–4) x 0.1–0.8(–1.3) cm, margin dentate on lower leaves, entire on upper ones, apex acute to obtuse.

**Fruiting pedicels** slender, divaricate, straight, 5–10(–15) mm. **Sepals** 1.5–2.2(–2.5) mm, glabrous or distally sparsely pilose with simple trichomes, lateral pair saccate; petals white to lavender, spatulate, 4–5(–6) x 1.5–2.5 mm, apex obtuse or truncate; claw short, not toothed; filaments white, 2.5–4 mm; ovules 40–70 per ovary. **Fruits** linear, subterete to slightly compressed, smooth to slightly torulose, (2–)2.5–3.5(–4.5) cm x 0.5–0.8 mm; valves with a distinct or obscure midvein; style to 0.5 mm; gynophore to 0.5 mm. **Seeds** oblong, slightly compressed, light to reddish brown, 0.5–0.8 mm; cotyledons obliquely incumbent.  $2n = 26$ . Flowering: May–Jul.

Habitats: fields, roadsides, slopes, moist forest margins, grassy areas.

Elevation: 0–600 m.

Distribution: Fennoscandinavia and the Baltic region but perhaps native only in Finland, adventive in adjacent NW Russia, Estonia, NE Denmark, Sweden, Norway, and N Germany (see Jalas & Suominen, 1994).

Note: *Arabidopsis suecica* is an amphidiploid produced since the last glacial maximum from the hybridization of *A. thaliana* and diploid *A. arenosa* (Mummenhoff and Hurka, 1994, 1995; O’Kane et al., 1997, and references therein).

**10. *Arabidopsis thaliana*** (Linnaeus) Heynhold in Holl & Heynhold, Fl. Sachsen 1: 538. 1842; *Arabis thaliana* Linnaeus, Sp. Pl. 2: 665. 1753; *Conringia thaliana* (Linnaeus) Reichenbach, Fl. Germ. Excurs. II. 686. 1826; *Crucifera thaliana* (Linnaeus) E. H. L. Krause in Sturm, Fl. Deutschland, ed. 2, 6: 86. 1902; *Erysimum thalianum* (Linnaeus) Kittel, Taschenb. Fl. Deutschl. ed. 2, 899. 1844; *Hesperis thaliana* (Linnaeus) Kuntze, Rev. Gen. Pl. 2: 935. 1891; *Pilosella thaliana* (Linnaeus) Kosteletzky, Ind. Pl. Hort. Prag. 104. 1844; *Sisymbrium thalianum* (Linnaeus) J. Gay & Monnard, Ann. Sci. Nat. Bot., ser. 1, 7: 399. 1826; *Stenophragma thalianum* (Linnaeus) Celakovsky, Kvet. Ok. Prazs. 75. 1870. TYPE: “Hab. in

Europae septentrionalis sabulosis.” Lectotype designated by anonymous [see Jarvis (2007: 308)], “*Pilosella siliquata*” in Thal, Sylv. Herc. 84, t. 7, f. D. 1588.

*Cardamine pusilla* A. Richard, Tent. Fl. Abyss. 1: 18. 1847; *Arabidopsis thaliana* var. *pusilla* (A. Richard) O. E. Schulz in Engler, Pflanzenr. IV. 105(Heft 86): 274. 1924; *Sisymbrium thalianum* (Linnaeus) Gay & Monnard var. *pusillum* (A. Richard) T. Durand & Schinz, Consp. Fl. Afr. 1(2): 99. 1898; *Stenophragma thaliana* (Linnaeus) Celakovsky var. *pusilla* (A. Richard) Engler, Hochgebirgsfl. Trop. Afr. 226. 1895. TYPE: Ethiopia, Begemdir, *SchimperII.1311* (holotype, P; isotype, K).

**Herbs**, annual. **Stems** (2–)5–30(–60) cm, erect, 1 to many from the base, simple or branched above, basally pilose with predominantly simple trichomes, apically glabrous. **Basal leaves** shortly petiolate, rosulate; leaf blade obovate, spatulate, ovate, or elliptic, 0.8–3.5(–4.5) x (0.1–)0.2–1(–1.5) cm, adaxially with predominantly simple and stalked 2- or 3(or 4)-forked trichomes, margin entire, repand, serrulate, or dentate, apex obtuse; cauline leaves subsessile or sessile, usually few; blade lanceolate, linear, oblong, or elliptic, middle ones (0.4–)0.6–1.8(–2.5) x 0.1–0.6(–1) cm, margin entire or rarely sparsely dentate, apex acute to obtuse. **Fruiting pedicels** slender, divaricate, straight, 3–10(–15) mm. **Sepals** 1–2(–2.5) mm, glabrous or distally sparsely pubescent with simple trichomes, lateral pair not saccate; petals white, spatulate, 2–3.5(–4) x 0.5–1.5 mm, apex obtuse; claw short, not toothed; filaments white, 1.5–2 mm; ovules 40–70 per ovary. **Fruits** linear, terete, smooth, (0.8–)1–1.5(–2) cm x 0.5–0.8 mm; valves with a distinct midvein; style to 0.5 mm. **Seeds** ellipsoid, plump, light to reddish brown, 0.3–0.5 mm; cotyledons incumbent.  $2n = 10$ .

Flowering: Jan–Jun(–Oct).

Habitat: sandy areas, roadsides, river banks, railroad tracks and embankments, open areas, disturbed habitats, pastures, grassy flats, fields, prairies, floodplains, woods, lawns, limestone ledges and crevices, bluffs, rocky slopes, cultivated ground, meadows, alkaline flats, shale and serpentine barrens, gravel, sandstone.

Elevation: 0–4250 m.

Distribution: Native range all Europe (excluding Iceland) to central

Asia; Africa (Algeria, Eritrea, Ethiopia, Kenya, Libya, Morocco, Tanzania, Tunisia, Uganda, Zaire), most of Asia (excluding Bahrain, Bangladesh, Bhutan, Cambodia, Iraq, Israel, Jordan, Kuwait, Kyrgyzstan, Laos, Malaysia, Myanmar, Nepal, New Guinea, Oman, Philippines, Qatar, Sri Lanka, Taiwan, Thailand, Turkmenistan, United Arab Emirates, Vietnam, Yemen).

**Introduced** into Argentina, Australia, Canada (British Columbia, Ontario, Quebec), Chile, New Zealand, South Africa, United States (Alabama, Arkansas, California, Connecticut, Delaware, District of Columbia, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia); Uruguay.