

Flora of Nepal

नेपालका वनस्पति

Cruciferae

Cruciferae: Webedition 1 (2012)

<http://data.rbge.org.uk/publications/FloraofNepal/library/Cruciferae/1>

Editors

Mark F. Watson, Shinobu Akiyama, Hiroshi Ikeda, Colin A. Pendry,
Keshab R. Rajbhandari, Krishna K. Shrestha

Authors

Ihsan A. Al-Shehbaz & Mark F. Watson

Genera in this account

Alliaria (p.68)
Aphragmus (p.8)
Arabidopsis (p.31)
Arabis (p.12)
Arcyosperma (p.11)
Barbarea (p.37)
Brassica (p.26)
Braya (p.49)
Capsella (p.32)
Cardamine (p.37)
Christolea (p.51)
Crucihimalaya (p.33)
Descurainia (p.46)
Dilophia (p.52)
Diplotaxis (p.30)
Dontostemon (p.47)
Draba (p.14)
Erysimum (p.48)
Eutrema (p.57)
Lepidium (p.62)
Lepidostemon (p.52)
Megacarpaea (p.63)
Nasturtium (p.43)
Noccaea (p.64)
Pegaeophyton (p.60)
Pycnoplathopsis (p.54)
Raphanus (p.31)
Rorippa (p.44)
Sisymbrium (p.65)
Smelowskia (p.67)
Solms-laubachia (p.55)
Thlaspi (p.68)
Turritis (p.36)

Published on 05 July 2012 by Royal Botanic Garden Edinburgh, 20a Inverleith Row, Edinburgh, EH2 5LR, UK

This PDF Webedition will be permanently available and citable using the URL specified at the top of this page. Family accounts have numbered pages so individual pages can be cited. Previous and future editions can also be accessed via the project website (www.floraofnepal.org.uk/PDFLibrary).

© text and images, except where individually credited,
Nepal Academy of Science and Technology, Khumaltar, Lalitpur, Kathmandu, Nepal
Royal Botanic Garden Edinburgh, 20a Inverleith Row, Edinburgh, EH3 5LR, UK
The Society of Himalayan Botany, University Museum, University of Tokyo, Hongo 7-3-1, Tokyo 113-0033, Japan

2011

All rights reserved.

Every effort has been made to trace holders of copyright in text and illustrations. Should there be any inadvertent omissions or errors the publishers will be pleased to correct them for future editions.

Appendices

1: Illustration plates

2: Format, abbreviations and categories used in Flora of Nepal

See printed volumes of the Flora of Nepal (www.rbge.org.uk/publications/floraofnepal) and the project website (www.floraofnepal.org) for further information on the Flora of Nepal and acknowledgement of the institutes and people involved with this international collaborative project.



Royal
Botanic Garden
Edinburgh



Cruciferae

Ihsan A. Al-Shehbaz & Mark F. Watson

Annual herbs, biennial, or perennial, with a pungent watery juice. Eglandular trichomes simple, 2-many forked, stellate, dendritic, or malpighiaceus (medifixed, bifid, appressed); glandular trichomes multicellular, with uniseriate or multiseriate stalk. Leaves exstipulate, simple, entire or variously pinnately dissected, rarely trifoliolate or pinnately, palmately, or bipinnately compound, almost always alternate, rarely opposite or whorled, petiolate or sessile, sometimes only basal. Racemes bracteate or ebracteate, sometimes corymbs or panicles, or flowers solitary on long pedicels originating from axils of rosette leaves. Flowers mostly actinomorphic. Sepals 4, in 2 decussate pairs, free or sometimes united, not saccate or lateral (inner) pair saccate. Petals 4, alternate with sepals, arranged in the form of a cross, sometimes rudimentary or absent, persistent or caducous. Stamens 6, in 2 whorls, tetradynamous (outer, lateral pair shorter than inner, median 2 pairs), rarely equal or in 3 pairs of unequal length, sometimes stamens 2 or 4, very rarely to 24; filaments slender, winged, or appendaged, inner pairs free or rarely united; anthers dehiscent by longitudinal slits. Nectar glands receptacular, opposite bases of lateral filaments, median glands present or absent. Ovary superior, mostly 2-locular and with a false septum (replum) connecting 2 placentas; placentation parietal, rarely apical. Fruit typically a 2-valved capsule, generally termed silique (siliqua) when length more than 3× width, or silicle (silicula) when length less than 3× width, dehiscent or indehiscent, sometimes schizocarpic, nutlet-like, lomentaceous, or samaroid, segmented or not, terete, angled, or flattened parallel to septum (latiseptate) or at a right angle to septum (angustiseptate); replum (persistent placenta) rounded, rarely flattened or winged; septum complete, perforate, or lacking. Style 1 or absent. Stigma entire or 2-lobed, sometimes lobes decurrent and free or connate. Seeds uniseriately or biseriately arranged in each locule, winged or wingless. Cotyledons incumbent (radicle lying along back of 1 cotyledon), accumbent (radicle applied to margins of both cotyledons) or conduplicate (cotyledons folded longitudinally around radicle).

Worldwide about 330 genera and 3780 species in 44 tribes. Found in all continents except Antarctica, mainly in temperate areas, with highest diversity in Irano-Turanian, Mediterranean, and western N American regions. 33 genera and 101 species (nine endemic) in Nepal.

The sequence of genera follows their assignment to the alphabetical system of tribes as currently delimited in the new phylogenetic system proposed by Al-Shehbaz *et al.* (Pl. Syst. Evol. 259: 89–120. 2006) and its subsequent updating following Warwick *et al.* (Plant Syst. Evol. 285: 209–232. 2010).

Although fruit characters are essential in Cruciferae taxonomy and needed for the identification of some genera, many flowering specimens may be accurately identified. To facilitate identification a key emphasizing fruiting material and another emphasizing flowering material are given. The most reliable determination of genera can be achieved when the material has fruits and flowers and when both keys are used to reach the same genus. In the key to flowering material (*) indicates that fruits are necessary to proceed further in the key. The Cruciferae are rather poorly collected in Nepal, and perhaps more than most families in the Flora, the distribution maps do not necessarily accurately represent the true range of the species.

Fig. 1a-k

Key to Genera

1a	Stamens (8–)12–16(–24)	28. <i>Megacarpaea</i>
b	Stamens 2–6	2
2a	Stamens 2 or 4	27. <i>Lepidium</i>
b	Stamens 6	3
3a	Plants with multicellular glands	17. <i>Dontostemon</i>
b	Plants eglandular	4
4a	At least some of the trichomes branched	5
b	Trichomes absent or exclusively simple	26
5a	At least some cauline leaves 1–3-pinnatisect	6
b	Cauline leaves entire, dentate, lobed, or absent	7
6a	Petals yellow. Raceme ebracteate	16. <i>Descurainia</i>
b	Petals white. Raceme bracteate	31. <i>Smelowskia</i>
7a	Cauline leaves absent	8
b	Cauline leaves present	13

Cruciferae

8a	Flowers on solitary pedicels from basal rosette.....	23. <i>Pycnoplinthopsis</i>
b	Flowers in racemes	9
9a	Sepals, petals, and stamens persistent.....	22. <i>Lepidostemon</i>
b	Sepals, petals, and stamens deciduous shortly after anthesis	10
10a	Filaments flattened, subapically toothed. Ovary retrorsely pilose.....	24. <i>Solms-laubachia</i>
b	Filaments slender, toothless. Ovary glabrous or not retrorsely hairy.....	11
11a	Filaments and petal bases purple. Leaves 1–2.5 cm wide	24. <i>Solms-laubachia</i>
b	Filaments and petal bases white or yellow. Leaves much narrower (*).....	12
12a	Fruit flattened. Seeds biseriate. Cotyledons accumbent	4. <i>Draba</i>
b	Fruit terete. Seeds uniseriate. Cotyledons incumbent.....	19. <i>Braya</i>
13a	Flowers orange or yellow	14
b	Flowers white, pink, or purple.....	16
14a	Trichomes exclusively sessile, medifixed, 2–4-rayed.....	18. <i>Erysimum</i>
b	Trichomes stalked, forked or stellate mixed with simple.....	15
15a	Plants pubescent throughout. Ovary ovate or oblong	4. <i>Draba</i>
b	Plants glabrous and glaucous above middle. Ovary linear.....	11. <i>Turritis</i>
16a	Cauline leaves auriculate or sagittate at base	17
b	Cauline leaves obtuse, cuneate, or attenuate at base	19
17a	Ovary obtriangular or obcordate. Cauline leaves with sessile, stellate trichomes	9. <i>Capsella</i>
b	Ovary linear. Cauline leaves with stalked branched trichomes (*).....	18
18a	Fruit flattened. Seeds winged at least apically. Cotyledons accumbent	3. <i>Arabis</i>
b	Fruit terete. Seeds wingless. Cotyledons incumbent.....	10. <i>Crucihimalaya</i>
19a	Plants annual or biennial	20
b	Plants perennial	23
20a	Filaments of median stamens winged. Anthers reniform.....	22. <i>Lepidostemon</i>
b	Filaments of median stamens wingless. Anthers ovate or oblong.....	21
21a	Ovaries and young fruits oblong or suborbicular	4. <i>Draba</i>
b	Ovaries and young fruits linear.....	22
22a	Raceme ebracteate. Trichomes simple and forked	8. <i>Arabidopsis</i>
b	Raceme bracteate at least basally, if not then cauline leaves lobed. At least some trichomes stellate or dendritic	10. <i>Crucihimalaya</i>
23a	Plants minutely puberulent distally	1. <i>Aphragmus</i>
b	Plants with distinct trichomes distally	24
24a	Basal rosette absent. Anthers reniform	22. <i>Lepidostemon</i>
b	Basal rosette well developed. Anthers oblong or ovate (*)	25
25a	Fruit flattened. Seeds biseriate. Cotyledons accumbent	4. <i>Draba</i>
b	Fruit terete. Seeds uniseriate. Cotyledons incumbent.....	19. <i>Braya</i>
26a	Cauline leaves absent. Flowers solitary from basal rosette.....	27
b	Cauline leaves present. Flowers in distinct racemes or corymbs	28
27a	Sepals united. Petals purplish	24. <i>Solms-laubachia</i>
b	Sepals free. Petals white	26. <i>Pegaeophyton</i>

28a	Raceme bracteate throughout, rarely only basally	29
b	Raceme ebracteate	33
29a	Flowers in corymbs. Anthers apiculate. Ovaries and fruit cristate	21. <i>Dilophia</i>
b	Flowers in racemes. Anthers not apiculate. Ovaries and fruit not cristate	30
30a	Cauline leaves palmately veined and lobed	1. <i>Aphragmus</i>
b	Cauline leaves pinnately veined, not lobed	31
31a	Ovary and fruit oblong or ovate. Roots fleshy	25. <i>Eutrema</i>
b	Ovary and fruit linear. Roots not fleshy	32
32a	Plants annual. Petals white	15. <i>Rorippa</i>
b	Plants perennial. Petals purple or lavender	24. <i>Solms-laubachia</i>
33a	Petals yellow (to creamy-yellow or white in <i>Brassica</i>), rarely absent	34
b	Petals white, pink, or purple, always present	39
34a	Plants perennial, with well-developed caudex	35
b	Plants annual or biennial	36
35a	Basal rosette present. Ovaries and fruits stipitate	6. <i>Diploxys</i>
b	Basal rosette absent. Ovaries and fruits sessile	20. <i>Christolea</i>
36a	Uppermost cauline leaves pinnatisect or pinnatifid. Stems angular	12. <i>Barbarea</i>
b	Uppermost cauline leaves usually undivided. Stems often terete	37
37a	Stigma 2-lobed. Fruit valves 3-veined	30. <i>Sisymbrium</i>
b	Stigma entire. Fruit valves 1-veined	38
38a	Petals (6–)7–30 mm. Seeds globose. Cotyledons conduplicate	5. <i>Brassica</i>
b	Petals absent or 1.5–4.5 mm. Seeds oblong or ovate. Cotyledons accumbent	15. <i>Rorippa</i>
39a	Plants annual or biennial	40
b	Plants perennial, with rhizomes, tubers, or distinct caudex	44
40a	Cauline leaves auriculate	33. <i>Thlaspi</i>
b	Cauline leaves petiolate	41
41a	Cauline leaves pinnatisect or compound	42
b	Cauline leaves toothed, simple	43
42a	Ovary linear. Ovules 10–40	13. <i>Cardamine</i>
b	Ovary oblong-ovate or elliptic. Ovules 2	27. <i>Lepidium</i>
43a	Petals white, pink or purple with darker veins, 1.2–2.2 cm. Sepals 6–10 mm	7. <i>Raphanus</i>
b	Petals white, without dark veins, (2.5–)4–8(–9) mm. Sepals (2–)2.5–3.5(–4.5) mm	32. <i>Alliaria</i>
44a	Plants aquatic, rooting from lower nodes	14. <i>Nasturtium</i>
b	Plants neither aquatic nor rooting from lower nodes	45
45a	Plants with tubers or rhizomes. Leaves compound, if simple then petals purple and 1–1.7 cm	13. <i>Cardamine</i>
b	Plants with a caudex. Leaves simple	46
46a	Cauline leaves auriculate. Fruit strongly flattened. Cotyledons accumbent	29. <i>Noccaea</i>
b	Cauline leaves not auriculate. Fruit terete. Cotyledons incumbent	47
47a	Ovules 30–50 per ovary. Raceme elongated in fruits. Seeds biseriate	2. <i>Arcyosperma</i>
b	Ovules 4–10 per ovary. Raceme not elongated in fruit. Seeds uniseriate	25. <i>Eutrema</i>

Cruciferae

Key to Genera (fruiting material)

1a	Fruit on solitary pedicels originating from basal rosette.....	2
b	Fruit in racemes	4
2a	Plants with at least some branched trichomes. Fruit geocarpic, maturing underground	23. <i>Pycnolinthopsis</i>
b	Plants glabrous or with simple trichomes only. Fruit not geocarpic	3
3a	Stigma 2-lobed. Replum rounded. Sepals united or rarely free (<i>S. harenensis</i>), often persistent at fruit	24. <i>Solms-laubachia</i>
b	Stigma entire. Replum flattened. Sepals free, caducous in fruit	26. <i>Pegaeophyton</i>
4a	Fruit strongly flattened at a right angle to septum (angustiseptate)	5
b	Fruit flattened parallel to septum (latiseptate), terete, or angled	11
5a	At least some of the trichomes branched	6
b	Trichomes absent or exclusively simple	7
6a	Cauline leaves sessile, auriculate or sagittate at base, entire or toothed. Raceme ebracteate. Fruit obdeltoid to obdeltoid-obcordate.....	9. <i>Capsella</i>
b	Cauline leaves petiolate, not auriculate or sagittate, 1- or 2-pinnatisect. Raceme bracteate. Fruit oblong, elliptic, or suborbicular.....	31. <i>Smelowskia</i>
7a	Seeds (or ovules) 1 or 2 per fruit	8
b	Seeds (or ovules) 4–24 per fruit	9
8a	Annuals. Fruit not didymous, 1.8–6(–7) mm.....	27. <i>Lepidium</i>
b	Perennials. Fruit didymous, 30–40 cm	28. <i>Megacarpaea</i>
9a	Cauline leaves not auriculate. Roots fleshy, fusiform. Fruit cristate apically	21. <i>Dilophia</i>
b	Cauline leaves auriculate. Roots not fleshy, cylindric. Fruit not cristate	10
10a	Perennials. Seeds smooth	29. <i>Noccaea</i>
b	Annuals. Seeds concentrically striate.....	33. <i>Thlaspi</i>
11a	Plants with branched trichomes at least basally	12
b	Plants glabrous or exclusively with simple trichomes	29
12a	Basal and lower cauline leaves 2- or 3-pinnatisect	16. <i>Descurainia</i>
b	Basal and lower cauline leaves entire, dentate, or rarely pinnatifid.....	13
13a	Fruit a silicle (less than 3× longer than broad).....	14
b	Fruit a silique (more than 3× longer than broad)	16
14a	Leaves glabrous. Pedicels minutely papillate.....	1. <i>Aphragmus</i>
b	Leaves pubescent. Pedicels glabrous or pubescent	15
15a	Cotyledons accumbent. Seeds often biseriate. Fruits flattened or rarely terete	4. <i>Draba</i>
b	Cotyledons incumbent. Seeds uniseriate. Fruits terete	19. <i>Braya</i>
16a	Trichomes exclusively sessile, medifixed	18. <i>Erysimum</i>
b	At least some branched trichomes stalked.....	17
17a	Cotyledons accumbent.....	18
b	Cotyledons incumbent.....	21
18a	Fruit rarely to 10× longer than broad	19
b	Fruit often much longer, rarely 15× longer than broad	20
19a	Seeds biseriate. Valves readily separated	4. <i>Draba</i>

b	Seeds uniseriate. Valves united with replum at fruit apex	24. <i>Solms-laubachia</i>
20a	Fruit flattened. Seeds winged at least distally. Plants not glaucous or glabrous above base	3. <i>Arabis</i>
b	Fruit subterete-quadrangular. Seeds wingless. Plants glaucous and glabrous often just above base	11. <i>Turritis</i>
21a	Stems leafless	22
b	Stems leafy	23
22a	Fruit terete, 0.4–1.1 cm. Trichomes primarily dendritic.....	22. <i>Lepidostemon</i>
b	Fruit flattened, (0.9–)1.5–2.5(–3.5) cm. Trichomes simple and forked	24. <i>Solms-laubachia</i>
23a	Raceme ebracteate. Plants annual or biennial.....	24
b	Raceme bracteate at least basally. Plants perennial, sometimes annual or biennial	26
24a	Fruit (2.5–)3.5–7.5(–9.5) cm. Plants tomentose with finely branched stellate trichomes.....	10. <i>Crucihimalaya</i>
b	Fruit 0.4–1.5(–1.5) cm. Plants pubescent with simple and forked trichomes.....	25
25a	Fruit linear, glabrous. Submalpighiaceae trichomes absent	8. <i>Arabidopsis</i>
b	Fruit oblong, pubescent. Submalpighiaceae trichomes present	22. <i>Lepidostemon</i>
26a	Fruit flattened. Plants minutely puberulent along rachis and pedicels	1. <i>Aphragmus</i>
b	Fruit terete. Plants glabrous or pubescent with long trichomes on rachis and pedicels	27
27a	Plants annual or biennial. Seeds and ovules 50–160 per fruit.....	10. <i>Crucihimalaya</i>
b	Plants perennial. Seeds and ovules rarely to 40 per fruit	28
28a	Basal leaves rosulate, persistent. Fruit torulose	19. <i>Braya</i>
b	Basal leaves not rosulate, soon withered. Fruit not torulose	22. <i>Lepidostemon</i>
29a	Plants with multicellular glands	17. <i>Dontostemon</i>
b	Plants eglandular	30
30a	Raceme bracteate.....	31
b	Raceme ebracteate.....	34
31a	Cauline leaves absent, if present palmately veined and lobed.....	1. <i>Aphragmus</i>
b	Cauline leaves pinnately veined, entire or dentate.....	32
32a	Fruit a silicle (rarely to 3x longer than broad). Replum expanded.....	25. <i>Eutrema</i>
b	Fruit a silique (more than 3x longer than broad). Replum not expanded	33
33a	Fruit terete, valves readily separated from replum	15. <i>Rorippa</i>
b	Fruit flattened, valves united with replum apically	24. <i>Solms-laubachia</i>
34a	Fruit a silicle (rarely to 3x longer than broad).....	35
b	Fruit a silique (more than 3x longer than broad)	36
35a	Cauline leaves auriculate. Seeds more than 20 per fruit.....	15. <i>Rorippa</i>
b	Cauline leaves not auriculate. Seeds 4–10 per fruit	25. <i>Eutrema</i>
36a	Fruit indehiscent, corky	7. <i>Raphanus</i>
b	Fruit dehiscent, not corky	37
37a	Fruit valves without midvein, coiled at dehiscence. Replum flattened.....	13. <i>Cardamine</i>
b	Fruit valves with midvein, not coiled at dehiscence. Replum terete	38
38a	Leaves compound. Stems rooting from lower nodes.....	14. <i>Nasturtium</i>
b	Leaves simple. Stems not rooting from lower nodes.....	39
39a	Plants perennial. Fruits flattened.....	40

Cruciferae

b	Plants annual or biennial. Fruits terete or angled.....	42
40a	Fruit on a gynophore 1–4 mm. Cotyledons conduplicate	6. <i>Diploxaxis</i>
b	Fruit sessile. Cotyledons incumbent.....	41
41a	Seeds biseriate, 30–50 per fruit. Basal rosette present.....	2. <i>Arcyosperma</i>
b	Seeds uniseriate, 10–20 per fruit. Basal rosette absent.....	20. <i>Christolea</i>
42a	Leaves palmately veined. Seeds longitudinally striate	32. <i>Alliaria</i>
b	Leaves pinnately veined. Seeds reticulate or foveolate.....	43
43a	Seeds globose. Cotyledons conduplicate.....	5. <i>Brassica</i>
b	Seeds oblong. Cotyledons accumbent or incumbent	44
44a	Cauline leaves auriculate. Stems angled throughout	12. <i>Barbarea</i>
b	Cauline leaves not auriculate. Stems not angled	45
45a	Stigma entire. Valves 1-veined. Cotyledons accumbent	15. <i>Rorippa</i>
b	Stigma 2-lobed. Valves 3-veined. Cotyledons incumbent	30. <i>Sisymbrium</i>

1. *Aphragmus* Andr. ex DC., Prodr. 1: 209 (1824).

Lignariella Baehni; *Staintoniella* H.Hara.

Annual herbs, biennial or perennial. Caudex absent or thick, covered with petiolar remains of previous years, sometimes with slender rhizomes. Trichomes simple or forked, sometimes papillate, less than 0.1 mm. Stems erect, ascending, prostrate or decumbent, branched basally, often minutely puberulent. Basal leaves petiolate, rosulate, simple, entire. Cauline leaves, sometimes absent, petiolate or sessile, base cuneate or attenuate, not auriculate, margin entire, repand, or palmately 3(–5)-lobed or -toothed. Racemes few- to several-flowered, bracteate throughout, elongated or not in fruit. Sepals oblong, erect or ascending, caducous or persistent, bases saccate or not. Petals white, pink, lavender, blue, purple, orbicular to obovate or spatulate, apex obtuse or rounded; claw subequalling or shorter than sepals, sometimes absent; stamens 6, equal or slightly tetradynamous; filaments dilated or not at base; anthers obtuse or apiculate at apex; nectar glands confluent and subtending bases of stamens. Ovules 2–16 per ovary. Fruiting pedicels slender, erect, ascending, divaricate, sometimes recurved or reflexed, puberulent above. Fruit dehiscent siliques or silicles, ovate, ovoid, elliptic, oblong, lanceolate, or linear, latiseptate or terete; valves with an obscure or distinct midvein, smooth; replum flattened basally; septum absent or complete and membranous. Style 0.5–4 mm; stigma capitate, entire. Seeds uniseriate, biseriate or 1 per fruit, wingless, oblong or ovoid, plump, on filiform funicles often longer than seeds; seed coat minutely reticulate or colliculate, not mucilaginous when wetted; cotyledons incumbent.

Worldwide eleven species in the Himalayas, north-western N America, Siberia. Six species in Nepal.

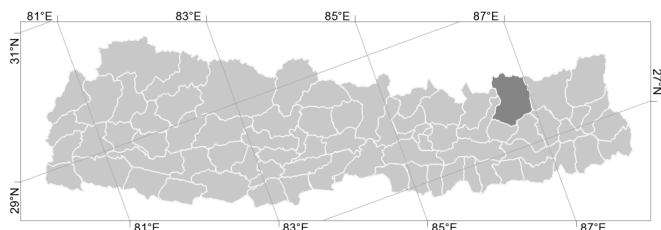
Key to Species

1a	Caudex many-branched, rhizome-like. Cauline leaves absent.....	3 <i>A. nepalensis</i>
b	Caudex absent or present and simple or few-branched, not rhizome-like. Cauline leaves present	2
2a	All leaves entire. Plants with forked trichomes	5 <i>A. oxycarpus</i>
b	At least some leaves 3(–5)-lobed or -toothed. Plants with simple, papillate trichomes	3
3a	Fruit 1-seeded. Gynophore 0.5–1 mm in flower, 20–100 mm in fruit. Seed 3.7–4.7 mm long.....	1 <i>A. hinkuensis</i>
b	Fruit 2–8(–12)-seeded. Gynophore obsolete in flower and fruit, rarely to 2 mm in fruit. Seed to 2.6 mm.....	4
4a	Petals orbicular or orbicular-obovate, (5.5–)6–8(–9) mm. Anthers 0.6–1.2 mm long	2 <i>A. hobsonii</i>
b	Petals narrowly to broadly obovate, 1.5–4(–4.5) mm. Anthers 0.25–0.4 mm	5
5a	Fruit narrowly oblong to linear, 6–12 seeded. Fruiting pedicels usually straight. Petals pale lavender, 1.5–2 × 0.5–1 mm. Lower cauline leaves simple	4 <i>A. ohbana</i>
b	Fruit oblong-ovoid to broadly oblong, 2–4-seeded. Fruiting pedicels often recurved. Petals purple, (2.7–)3–4(–4.5) × 1.7–2.5 mm. All cauline leaves 3- or 5(or 7)-lobed.....	6 <i>A. serpens</i>

1. *Aphragmus hinkuensis* (Kats.Arai, H.Ohba & Al-Shehbaz) Al-Shehbaz & S.I.Warwick, *Canad. J. Bot.* 84: 279 (2006).
Lignariella hinkuensis Kats.Arai, H.Ohba & Al-Shehbaz, *Harvard Pap. Bot.* 5(1): 117 (2000).

Annual herbs, glabrous throughout. Stems few-branched from base, ascending to decumbent, 8.5–25 cm. Cauline leaves petiolate 1.5–3.7 cm, broadly ovate to suborbicular in outline, 3–5-lobed; lobes of larger leaves ovate to oblong, 6–15 × 4–11 mm, apex acute to obtuse, entire or 1- or 2-toothed. Pedicel 1–2 cm in flower, 2–7.5 cm in fruit, strongly recurved, papillate above, glabrous below. Sepals caducous, oblong, 2.3–3 × 1.2–1.7 mm, ascending, glabrous, somewhat saccate at base, scarious at margin. Petals bluish purple, broadly obovate, 5–7 × 2.7–5.8 mm, apex rounded to somewhat retuse, base narrowed into a claw ca. 1 mm. Filaments purplish above, pale to yellowish below, 2.5–3 mm; anthers purple, oblong, cordate at base, 0.4–0.6 mm. Ovary ellipsoid, glabrous, 1–1.5 mm; ovules (2–)4 per ovary. Fruit geocarpic, curved, ovoid to ellipsoid, 2.5–7 × 2–5.5 mm; gynophore 2–10 cm, very slender; valves obscurely 1–3-veined; style 2–3 mm. Seeds 1 per fruit, ovoid-oblong, 3.7–4.7 × 1–1.2 mm.

Distribution: Endemic to Nepal.



Altitudinal range: ca. 3600 m.

Ecology: Wet rocks.

Flowering: August. **Fruiting:** August.

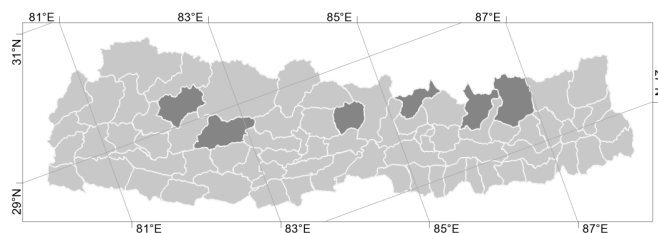
The species is known only from the type collection, *Miyamoto et al.* 9592484 (MO, TI), from Thasing Dingma, Solu Khumbu District.

2. *Aphragmus hobsonii* (H.Pearson) Al-Shehbaz & S.I.Warwick, *Canad. J. Bot.* 84: 279 (2006).
Cochlearia hobsonii H.Pearson, *Hooker's Icon. Pl.* 27: pl. 2643 (1900); *Lignariella hobsonii* (H.Pearson) Baehni.

Short-lived perennial herbs, puberulent on stem and/or pedicels. Stems coarse, few to many from base, decumbent or rarely ascending, (6–)11–20(–30) cm, glabrous or puberulent along 1 line or throughout. Leaves with somewhat flattened petiole 4–10(–18) mm, simple or rarely deeply 3(or 5)-lobed apically, blade broadly ovate to suborbicular and often wider than long, rarely oblong, (3–)6–10(–15) × (1.5–)4–10(–15) mm, glabrous, obscurely to prominently 3- or 5-toothed, teeth sometimes restricted to subtruncate apex, when lobed central lobe broadly to narrowly oblong, slightly broader than lateral lobes. Flowers often protogynous. Sepals oblong, glabrous, 2.5–3.5(–4) × 1–1.5 mm, margin membranous and to 0.5 mm wide, spreading, slightly saccate at base. Petals blue to deep

purple, orbicular to orbicular-obovate, (5.5–)6–8(–9) × 4–6(–7) mm, apex rounded, base abruptly narrowed into a claw 0.5–1.5 mm. Filaments purple above, whitish below, 4–5.5 mm; anthers narrowly oblong, 0.6–1.2 mm, often strongly curved after dehiscence. Ovules 4–6(–11) per ovary. Fruiting pedicels slender, strongly recurved to sigmoid, (0.7–)1.5–3(–4) cm, puberulent above with papillae to 0.1 mm. Fruit not geocarpic, linear to narrowly oblong, rarely ovoid, straight or curved, (5–)10–20 × 1.5–2 mm; gynophore ca. 0.5 mm; valves torulose; style 3–4 mm, stout. Seeds uniseriate, oblong, 2.2–2.8 × 1.2–1.4 mm.

Distribution: Nepal, E Himalaya and Tibetan Plateau.



Altitudinal range: 2800–4100 m.

Ecology: River or stream banks on small stones and coarse sand, wet grass, stream-sides, mossy areas in running water, wet cliffs, scree, damp banks, wet stony slopes.

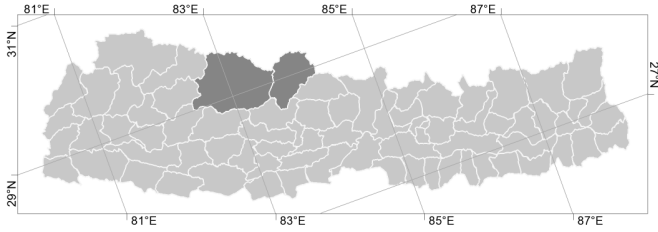
Flowering: May–July. **Fruiting:** June–September.

3. *Aphragmus nepalensis* (H.Hara) Al-Shehbaz, *Harvard Pap. Bot.* 5(1): 112 (2000).
Staintoniella nepalensis H.Hara, *J. Jap. Bot.* 49: 196 (1974).

Perennial herbs, (2–)4–10 cm. Caudex many-branched, rhizome-like, with distinct internodes separating whorls of petiolar remains of successive growing seasons. Stems erect, simple, minutely papillate puberulent. Basal leaves rosulate, somewhat fleshy; petioles persistent, (0.8–)1.5–4(–6) cm, base broadly expanded to 4 mm wide; leaf blade ovate to broadly so, 4–12(–17) × 2.5–9 mm, base obtuse, apex obtuse, margin entire, glabrous. Cauline leaves absent. Fruiting racemes, elongated; bracts similar to basal leaves but very short petiolate to sessile. Sepals often purplish, 2–3.5 × 1.2–1.5 mm, glabrous. Petals purple with darker veins, obovate, (6–)7–9 × 3–5 mm, apex rounded; claw to 2.5 mm. Filaments 3–4 mm; anthers 0.7–0.9 mm. Ovules 8–10 per ovary. Fruiting pedicels divaricate, 5–12 mm, puberulent above, glabrous below. Immature fruit ovate to elliptic, compressed; valves obscurely veined, glabrous; septum absent; style 1.5–2 mm. Mature seeds not seen.

Distribution: Endemic to Nepal.

Cruciferae



Altitudinal range: 4800–5800 m.

Ecology: Loose scree.

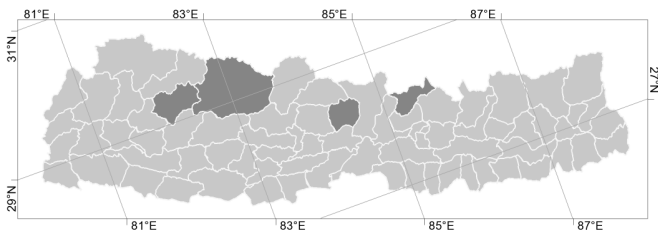
Flowering: June–July.

4. *Aphragmus ohbana* (Al-Shehbaz & Kats.Arai) Al-Shehbaz & S.I.Warwick, *Canad. J. Bot.* 84: 279 (2006).
Lignariella ohbana Al-Shehbaz & Kats.Arai, *Harvard Pap. Bot.* 5(1): 120 (2000).

Biennial or short-lived perennial herbs, glabrous throughout except for pedicels. Stems slender, few or rarely 1 from base, decumbent, 2–12(–15) cm. Lowermost cauline leaves simple, becoming 3-lobed in the middle and terminal portions of plant; petiole glabrous, (2–)4–8(–12) mm; blade of lowermost leaves ovate, subacute, 3–5 × 2–3 mm wide; middle lobe of bracts narrowly oblong to broadly ovate, entire, (2–)3–6(–8) × 1.3–4(–7) mm, obtuse; lateral lobes smaller and narrower, entire or rarely obscurely 1-toothed. Sepals oblong, 0.7–1.5 × 0.5–0.7 mm, not saccate at base, scarious at margin. Petals lavender, narrowly obovate, 1.5–2 × 0.5–1 mm, apex rounded, base cuneate and not clawed. Filaments white or rarely lavender, 0.8–1.2 mm; anthers purple, ovate, 0.2–0.3 mm. Ovules 6–12 per ovary. Fruiting pedicels 5–8(–13) mm, puberulent above with papillae to 0.1 mm. Fruit not geocarpic, linear to narrowly oblong, straight or slightly curved at middle, 5–10 × 0.7–1 mm; gynophore obsolete; valves torulose; style 0.5–0.8 mm, stout. Seeds uniseriate, oblong, 1–1.4 × 0.5–1 mm.

Fig. 2a & Fig. 3a

Distribution: Nepal and E Asia.



Altitudinal range: 3000–4600 m.

Ecology: Among rocks, sandy flats by stream-sides.

Flowering: July–August. **Fruiting:** July–October.

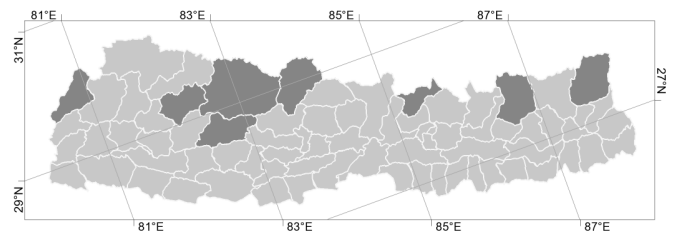
Hara (Enum. Fl. Pl. Nepal 2: 44. 1979) cited *Stainton*, *Sykes & Williams* 6075 (BM) and *Polunin*, *Sykes & Williams* 2369 (BM) as *Lignariella hobsonii* subsp. *serpens* (W.W.Sm.) H.Hara. However, these collections are now identified as *Aphragmus*

ohbana.

5. *Aphragmus oxycarpus* (Hook.f. & Thomson) Jafri, *Notes Roy. Bot. Gard. Edinburgh* 22: 96 (1956).
Braya oxycarpa Hook.f. & Thomson, *J. Proc. Linn. Soc., Bot.* 5: 169 (1861); *Aphragmus oxycarpus* var. *glaber* (Vassilcz.) Z.X.An; *A. oxycarpus* var. *microcarpus* Z.X.An; *A. oxycarpus* var. *stenocarpus* (O.E.Schulz) G.C.Das; *A. przewalskii* (Maxim.) A.L.Ebel; *A. stewartii* O.E.Schulz; *A. tibeticus* O.E.Schulz; *Braya foliosa* Pamp.; *B. oxycarpa* forma *glaber* Vassilcz.; *B. oxycarpa* var. *stenocarpa* O.E.Schulz; *B. rubicunda* Franch.; *Eutrema przewalskii* Maxim.; *Lignariella duthiei* Naqshi.

Perennial herbs, (1–)2–11(–18) cm. Caudex covered with petiolar bases of previous years. Stems erect to ascending, branched from base, minutely puberulent with simple or short-stalked trichomes less than 0.1 mm, rarely glabrous. Basal leaves rosulate, somewhat fleshy; petioles persistent, 0.2–2(–5) cm, base broadly expanded and to 3 mm wide; leaf blade spatulate, oblanceolate, linear, oblong, or elliptic, rarely ovate, (0.2–)0.5–2(–3) cm × 0.5–3(–5) mm, glabrous, base cuneate to attenuate, apex obtuse to acute, margin entire. Cauline leaves and bracts similar to basal leaves but narrower and sessile to short petiolate, reduced in size upward. Sepals often purplish, 1.5–2.5 × 1.2–1.5 mm, glabrous. Petals deep purple to white, broadly obovate to spatulate, 3.5–5(–6) × 1.5–3(–4) mm, apex rounded; claw 1–2.5 mm. Filaments 1.5–2.5 mm; anthers 0.3–0.6 mm. Ovules 10–16 per ovary. Fruiting raceme somewhat elongated. Fruiting pedicels erect to ascending, (1.5–)2–10(–20) mm, puberulent above, glabrous below. Fruit lanceolate to elliptic, 5–10 × 1.5–2 mm, compressed; valves obscurely veined, glabrous or rarely sparsely puberulent; gynophore to 0.7 mm; septum complete, hyaline; style 0.5–1(–2) mm. Seeds light brown, oblong, biseriate, 0.9–1.3 × 0.6–1 mm.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, C Asia and SW Asia.



Altitudinal range: 3300–5800 m.

Ecology: Glacial moraine, among gravel, limestone rubble and cliffs, open stony slopes, alpine pastures, scree, dolomite cliffs, stream banks, peaty ground and turf.

Flowering: May–August. **Fruiting:** July–September.

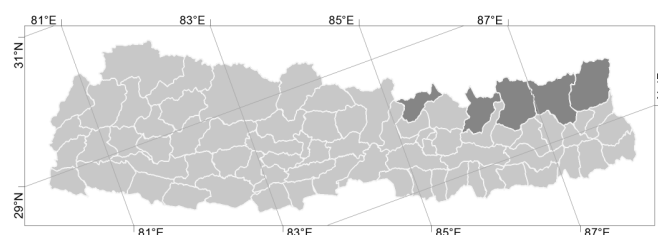
Hooker & Anderson (Fl. Brit. Ind. 1: 155. 1872) misapplied the name *Braya alpina* Sternb. & Hoppe to this species.

6. *Aphragmus serpens* (W.W.Sm.) Al-Shehbaz & S.I.Warwick, *Canad. J. Bot.* 84: 279 (2006).

Cochlearia serpens W.W.Sm., Rec. Bot. Surv. India 4: 175 (1911); *Lignariella hobsonii* subsp. *serpens* (W.W.Sm.) H.Hara; *L. obscura* Jafri; *L. serpens* (W.W.Sm.) Al-Shehbaz, Kats.Arai & H.Ohba.

Short-lived perennial herbs, glabrous throughout except for pedicels and sometimes fruit. Stems slender, few to many from base, decumbent, (1.5–)5–15(–30) cm. Leaves deeply 3(or 5)-lobed throughout, simple leaves absent; petiole glabrous, (2–)5–15(–40) mm; blade of central lobe oblong to ovate, rarely linear, (1.5–)3–8(–15) × (0.5–)1–3(–7) mm, apex obtuse to subacute, entire or rarely 1-toothed on each side; lateral lobes smaller, entire, 1- or 2-lobed or toothed, rarely leaves subternate. Sepals oblong, 1.5–5 × 0.7–1 mm, not saccate at base, scarious margin ca. 0.2 mm wide. Petals purple, broadly obovate, (2–)3–4(–4.5) × (1–)1.5–2.5(–3) mm, apex rounded, cuneate into a claw to 0.1 mm. Filaments purplish, 1.5–2.5 mm; anthers purple, ovate, 0.3–0.4 mm. Ovules 3–6 per ovary. Fruiting pedicels (10–)15–30(–40) mm, strongly recurved to sigmoid, often filiform, puberulent above with papillae to 0.1 mm. Fruit not geocarpic, ovoid to oblong, rarely oblong-linear, often curved at middle, 2.5–8(–12) × 1–2(–2.5) mm; gynophore 0.5–3 mm; valves slightly torulose or not, glabrous or puberulent; style 1–1.5(–2) mm, stout. Seeds uniseriate, oblong, (1–)1.5–2.5 × (0.5–)0.8–1.2(–1.5) mm.

Distribution: Nepal, E Himalaya and Tibetan Plateau.



Altitudinal range: 1700–4300 m.

Ecology: Alpine peaty soil, scree, gravelly stream edges, turf among rocks and small shrubs.

Flowering: June–August. **Fruiting:** July–October.

Hara (Fl. E. Himalaya: 109. 1966) and Photo. Fl. E. Himalaya: 25, f. 224 (1968) partially misapplied the name *Lignariella hobsonii* (Pers.) Baehni to this species.

2. *Arcyosperma* O.E.Schulz, in Engl., Pflanzenr. IV. 105(Heft 86): 182 (1924).

Perennial herbs with caudex. Trichomes eglandular, simple. Stems erect to ascending, leafy. Basal leaves petiolate, rosulate, simple, entire or dentate. Cauline leaves sessile, cuneate at base, not auriculate, entire or rarely denticulate. Racemes several- to many-flowered, ebracteate, corymbose, slightly elongated in fruit; rachis straight. Sepals oblong, free, tardily deciduous to persistent, suberect to ascending, equal, base of inner pair not saccate, margin membranous. Petals white to pinkish, erect at base with flaring blade, longer than sepals; blade obovate-oblong, apex subemarginate; claw not differentiated from blade, glabrous. Stamens 6, 4 included, erect, slightly tetradynamous; filaments wingless, unappendaged, glabrous, free, not dilated at base; anthers oblong-ovate, not apiculate at apex. Nectar glands confluent and subtending bases of all stamens; median nectaries present; lateral nectaries horseshoe-shaped. Ovules 30–50 per ovary; placentation parietal. Fruiting pedicels slender, divaricate. Fruit dehiscent, capsular siliques, broadly linear to linear-oblong, subterete, not inflated, sessile, unsegmented; valves papery, with a distinct midvein, glabrous, not keeled, torulose, wingless, unappendaged; gynophore absent; replum rounded, visible; septum complete, membranous, veinless; style obsolete or to 1 mm, stout; stigma capitate, entire, unappendaged. Seeds biseriate, wingless, ovate, slightly flattened; seed coat coarsely reticulate, not mucilaginous when wetted; cotyledons obliquely incumbent.

Worldwide one species in Nepal, India and Pakistan.

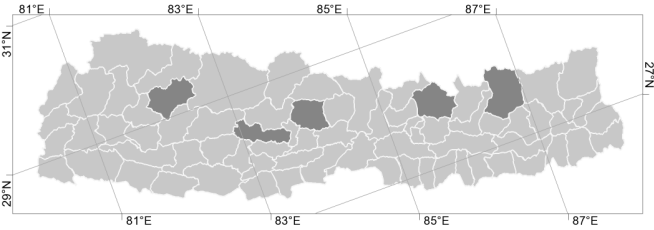
1. *Arcyosperma primulifolium* (Thomson) O.E.Schulz, in Engl., Pflanzenr. IV. 105(Heft 86): 182 (1924). *Sisymbrium primulifolium* Thomson, Hooker's J. Bot. Kew Gard. Misc. 5: 18 (1853); *Eutrema primulifolium* (Thomson) Hook.f. & Thomson.

Herbs 4–20 cm. Caudex simple, to 1.3 cm in diameter, with petiolar remains of previous years. Stems glabrous or pilose with simple trichomes to 1 mm. Basal leaves rosulate; petiole 1.5–10 cm, ciliate; leaf blade obovate to oblong, 2.5–10 × 1–4.5 cm, base attenuate to cuneate, apex obtuse to subacute, margin subentire to dentate, ciliate, glabrous on both surfaces or pilose below. Cauline leaves 3–6, sessile, oblong to oblong-ovate or oblanceolate, 1–4 cm × 3–12 mm, entire or rarely

denticulate, ciliate. Sepals oblong, 2.5–3 × 1–1.5 mm, glabrous. Petals white or pinkish, obovate-oblong, 4–6 × 1.5–2 mm. Median filaments 3–4 mm; lateral filaments 2.5–3 mm; anthers oblong-ovate, 0.4–0.5 mm. Fruiting pedicels divaricate, slender, 3–8 mm, glabrous or pilose. Fruits broadly linear to linear-oblong, 15–24 × 1.5–2.5 mm, slightly curved upward or straight; valves glabrous. Seeds dark brown, ovate, 0.9–1.2 × 0.6–0.8 mm.

Distribution: Nepal, W Himalaya and E Himalaya.

Cruciferae



Altitudinal range: 2700–4600 m.

Ecology: Shade of rocks, damp ledges, stream-sides.

Flowering: May–June. **Fruiting:** June–July.

3. Arabis L., Sp. Pl. 2: 664 (1753).

Biennial, or perennial herbs. Trichomes stellate, dendritic, or stalked forked, sometimes mixed with simple ones. Stems simple or branched. Basal leaves petiolate or not, rosulate, simple, often entire, sometimes dentate, rarely lyrate-pinnatifid. Cauline leaves sessile and auriculate, sagittate, or amplexicaul, very rarely petiolate, entire or dentate. Racemes ebracteate, elongated in fruit. Sepals ovate, oblong or sub lanceolate, base of lateral pair saccate or not, margin membranous. Petals white, pink, or purple, spatulate, oblong, or oblanceolate, rarely obovate, apex obtuse or emarginate; claw shorter than sepals. Stamens 6, tetradynamous; anthers oblong, or linear, obtuse at apex. Nectar glands confluent, subtending bases of all stamens; median glands sometimes tooth-like and free, rarely absent. Ovules 36–80 per ovary. Fruiting pedicels erect, ascending, divaricate, or reflexed. Fruit dehiscent siliques, linear, latiseptate, sessile or rarely shortly stipitate; valves papery, with an obscure or prominent midvein, smooth or torulose; replum rounded; septum complete; style obsolete or distinct; stigma capitate, entire or slightly 2-lobed. Seeds uniseriate, winged or margined, oblong or orbicular, flattened; seed coat smooth or minutely reticulate, not mucilaginous when wetted; cotyledons accumbent.

Worldwide about 70 species in temperate Asia, Europe, N America. Four species in Nepal.

The limits of *Arabis* are highly artificial, and the genus is defined primarily on the basis of having flattened, linear fruits, accumbent cotyledons, and branched trichomes. However, this combination of characters has evolved independently several times in the family.

Key to Species

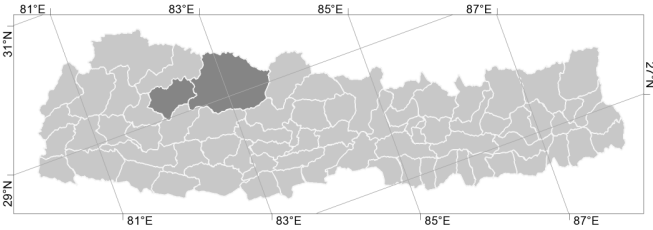
- 1a Fruits and often fruiting pedicels erect, appressed to rachis **4 A. pterosperma**
- b Fruits and fruiting pedicels divaricate to reflexed or ascending, fruits sometimes erect on divaricate or ascending pedicels never appressed to rachis.....2
- 2a Petals 3–6(–6.5) mm. Lateral sepals not saccate. Style in fruit 0.2–0.8 mm **3 A. paniculata**
- b Petals 7–15 mm. Lateral sepals saccate. Style in fruit 1–2.5 mm3
- 3a Plants hirsute or hispid with primarily simple, subsetose trichomes **1 A. amplexicaulis**
- b Plants tomentose or pilose with almost exclusively branched trichomes..... **2 A. bijuga**

1. Arabis amplexicaulis Edgew., Trans. Linn. Soc. London 20: 31 (1851).

Biennial or short-lived perennial herbs, (20–)30–60(–70) cm, densely to sparsely hispid or hirsute with primarily simple subsetose trichomes to 1.7 mm, these mixed with much fewer, smaller, 2–4-forked ones. Stems erect, often single from base. Basal leaves rosulate; petiole 0.5–5 cm; leaf blade lanceolate-obovate, oblong, or oblanceolate, 3–9(–11) × 1–2(–3) cm, base attenuate, apex obtuse to rounded, margin dentate or entire, ciliate. Middle cauline leaves sessile, oblong to ovate, (1–)1.5–5(–8) × 0.6–2.5(–4) cm, base cordate or amplexicaul, margin dentate to entire. Sepals oblong, 4–6 × 1.2–1.5 mm, glabrous, lateral pair saccate. Petals white, oblong to narrowly oblanceolate, (0.7–)0.9–1.2 cm × 2–3.5 mm, apex obtuse. Filaments 3.5–6 mm; anthers oblong, 0.8–1 mm. Ovules 50–70 per ovary. Fruiting pedicels, divaricate, 0.6–1.5 cm, slender, straight, glabrous. Fruit (2.5–)3.5–6.5(–7) cm × 1–1.5 mm, erect to divaricate or rarely reflexed, not appressed to rachis;

valves with distinct midvein, torulose, glabrous; style 1–1.5 mm. Seeds brown, oblong, 1.2–1.5 × 0.8–1 mm, narrowly winged apically.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau and SW Asia.



Altitudinal range: 1800–3200 m.

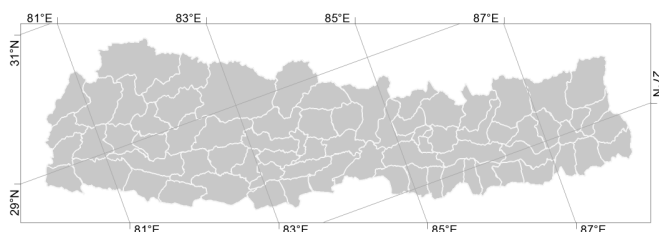
Ecology: Forest margins, shady places.

Flowering: April–June. **Fruiting:** May–July.

2. *Arabis bijuga* Watt, J. Linn. Soc., Bot. 18: 378 (1881).
Arabis macrantha C.C.Yuan & T.Y.Cheo; *A. pangiensis* Watt.

Perennial herbs, 15–40 cm, often densely tomentose or pilose, with primarily short-stalked, stellate trichomes, these sometimes mixed much fewer, simple or forked ones, rarely plants glabrescent and trichomes restricted primarily to leaf margin. Stems erect, often branched at base. Basal leaves rosulate; petiole 0.5–5 cm; leaf blade obovate-spatulate, oblong, elliptic, or oblanceolate, 1.5–5 × 0.5–1.5 cm, base attenuate, apex obtuse or rounded, margin dentate or entire. Middle cauline leaves sessile, oblong-linear, narrowly elliptic, or narrowly lanceolate, 1–4(–5.5) cm × 2–8 mm, base obtuse or auriculate, margin dentate or entire. Sepals oblong, 3.5–5 × 1.2–1.8 mm, glabrous, lateral pair saccate. Petals white or pinkish, oblong or narrowly oblanceolate, 0.9–1.4 cm × 2–4 mm, apex obtuse. Filaments 5–8 mm; anthers oblong, 1–1.5 mm. Ovules 40–70 per ovary. Fruiting pedicels divaricate or ascending, (0.8–)1.2–2.4(–3) cm, slender, straight, glabrous. Fruit 3–6 cm × 1–1.2 mm, not appressed to rachis; valves with a prominent midvein extending full length, slightly torulose, glabrous; style 1–1.5 mm. Seeds brown, oblong, ca. 1.2 × 0.5 mm, narrowly winged apically.

Distribution: Nepal, W Himalaya and E Asia.



Altitudinal range: 2400–3000 m.

Ecology: Grassy slopes, rock crevices, dry cliffs, stony pastures.

Flowering: April–June. **Fruiting:** May–July.

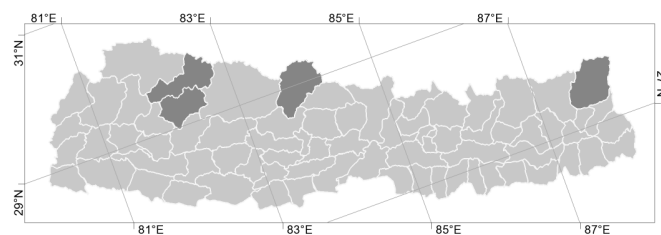
Reported for Nepal by Hara (Enum. Fl. Pl. Nepal: 39. 1979) under the name *Arabis pangiensis* on the basis of a collection now identified as *A. paniculata* Franch. (see note under this species).

Although no collections are now known from Nepal this species is expected to occur and so is included as a full entry without a distribution map. Except for being glabrescent, instead of moderately to densely tomentose, the type collection of *A. bijuga* is basically indistinguishable from those of *A. macrantha* and *A. pangiensis*.

3. *Arabis paniculata* Franch., Pl. Delavay. 1: 57 (1889).
Arabidopsis mollissima var. *yunnanensis* O.E.Schulz; *Arabis alpina* var. *parviflora* Franch.; *A. alpina* var. *rigida* Franch.; *A. alpina* var. *rubrocalyx* Franch.; *A. paniculata* var. *parviflora* (Franch.) W.T.Wang.

Biennial or short-lived perennial herbs, (10–)20–75(–110) cm, densely to sparsely hirsute with stalked, forked or 3- or 4-rayed stellate trichomes mixed at least basally with simple ones. Stems erect, simple or few from base, often branched at middle. Basal leaves rosulate, present at anthesis; petiole absent, rarely to 2.5 cm; leaf blade oblanceolate, narrowly obovate, oblong, or lanceolate, (1–)2–6(–8) × (0.5–)1–2(–2.5) cm, base attenuate, apex obtuse to acute, margin dentate, serrate, or rarely entire. Middle cauline leaves sessile, oblong, ovate, or elliptic, rarely suboblanceolate, (0.7–)1.5–4(–6) cm × (2–)4–14(–25) mm, stellate on both surfaces or above with simple trichomes, base cordate or auriculate, rarely amplexicaul, apex obtuse to acute, margin dentate to entire. Sepals oblong to suboblanceolate, 2.5–3.5(–4) × 1–1.5 mm, glabrous or sparsely pubescent, not saccate. Petals white or rarely pale pink, oblong to narrowly oblanceolate, 4–6(–6.5) × 1–2 mm, apex obtuse. Filaments 3.5–5 mm; anthers oblong, 0.8–1 mm. Ovules 36–80 per ovary. Fruiting pedicels divaricate, rarely ascending or slightly reflexed, (0.4–)0.6–1.8(–2.5) cm, slender, straight or rarely slightly curved. Fruit (1.5–)2.5–5.5(–6.5) cm × 1–1.5 mm, erect, divaricate, or rarely reflexed, not appressed to rachis; valves with distinct midvein, torulose, glabrous; style 0.4–0.8 mm. Seeds brown, oblong to ovate, 1–1.3 × 0.7–0.9 mm, narrowly winged terminally.

Distribution: Nepal, W Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: 1300–4300 m.

Ecology: Waste areas, roadsides, grassy slopes, along ditches.

Flowering: April–August. **Fruiting:** April–August.

Hara (Enum. Fl. Pl. Nepal 2: 39. 1979) listed *Stainton, Sykes & Williams 1933* (BM) as *Arabis pterosperma* Edgew., but that collection is *A. paniculata*, a species first reported for Nepal in Fl. China 8: 115. 2001. Likewise Hara listed *Stainton, Sykes & Williams 762* (BM) as *Arabis pangiensis* Watt, but his collection is also *A. paniculata*.

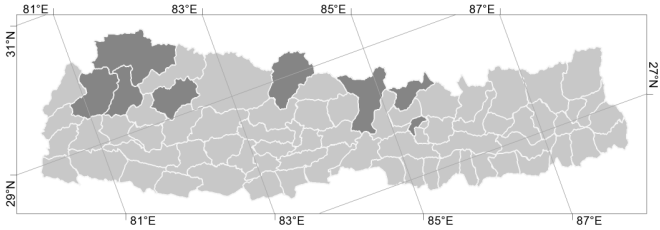
4. *Arabis pterosperma* Edgew., Trans. Linn. Soc. London 20: 33 (1851).
Arabidopsis yadungensis K.C.Kuan & Z.X.An; *Arabis alpina* var. *purpurea* W.W.Sm.; *A. latialata* Y.Z.Lan & T.Y.Cheo.

Biennial or short-lived perennial herbs, (10–)20–60(–80) cm, densely or rarely sparsely hirsute primarily with simple trichomes, these often mixed at least distally with long-stalked forked or rarely stellate ones. Stems erect, simple from base, simple or branched above. Basal leaves rosulate; petiole absent, rarely to 4 cm; leaf blade spatulate, oblanceolate,

Cruciferae

narrowly obovate, or oblong, (1–)2–7(–9) × (0.5–)1–2(–3) cm, base attenuate, apex obtuse to acute, margin dentate, serrate, or rarely entire, often ciliate. Middle cauline leaves sessile, oblong, elliptic, or ovate-lanceolate, (1–)2–4(–5) cm × (2–)4–10(–15) mm, hirsute with predominantly simple trichomes, base auriculate, cordate, or rarely amplexicaul, apex obtuse to acute, margin dentate to entire. Sepals oblong to sub lanceolate, 2.5–3.5 × 1–1.5 mm, often glabrous, not saccate. Petals purple, pink, or rarely white, oblong to narrowly oblanceolate, 6–9 × 2–3 mm, apex obtuse. Filaments 3.5–5 mm; anthers oblong, 0.6–1 mm. Ovules 40–80 per ovary. Fruiting pedicels, erect or rarely ascending, often subappressed to rachis, 4–10(–16) mm, slender, straight. Fruit (2.5–)3–5(–6) cm × 1.5–2 mm, erect, appressed to rachis; valves with a prominent midvein, torulose, glabrous; style 0.5–1 mm. Seeds brown, orbicular to ovate-orbicular, 1–1.6 mm in diameter, winged all around; wing (0.1–)0.2–0.4 mm wide. Fig. 2b & Fig. 3b–e

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: 2200–4400 m.

Ecology: Roadsides, woodlands, grassy slopes, alpine meadows.

Flowering: (March–)May–July. **Fruiting:** June–October.

Hooker & Thomson (J. Proc. Linn. Soc. Bot. 5: 141. 1861) and Hooker f. & Anderson (Fl. Brit. Ind. 1: 135. 1872) misapplied the name *Arabis alpina* L. to this species, to which Hara (Fl. E. Himalaya, Sec. Rep.: 42. 1971) misapplied the name *Arabidopsis mollissima* (C.A.Mey.) O.E.Schulz.

4. *Draba* L., Sp. Pl. 2: 642 (1753).

Perennial, sometimes annual herbs. Trichomes simple, forked, stellate, malpighiaceus, or dendritic, stalked or sessile, often mixed. Stems erect or ascending, sometimes prostrate, leafy or leafless and plants scapose. Basal leaves petiolate, often rosulate, simple, entire or toothed, rarely lobed. Cauline leaves petiolate or sessile, cuneate or auriculate at base, entire or dentate, sometimes absent. Racemes bracteate or ebracteate, elongated or not in fruit. Sepals ovate, oblong, or elliptic, base of lateral pair not saccate or subsaccate. Petals yellow, white, sometimes pink to purple, obovate, spatulate, oblong, oblanceolate, orbicular, or linear, apex obtuse, rounded, or rarely emarginate; claw obscurely to strongly differentiated from blade, or absent. Stamens 6, tetradynamous; filaments dilated or not at base; anthers ovate or oblong, obtuse at apex. Nectar glands 1, 2, or 4, distinct or confluent and subtending bases of all stamens; median glands present or absent. Ovules 4 to numerous per ovary. Fruiting pedicels slender, erect, ascending, or divaricate. Fruit dehiscent, silicles or rarely siliques, ovate, elliptic, oblong, orbicular, ovoid, globose, lanceolate, or linear, latiseptate or terete; valves distinctly or obscurely veined, glabrous or pubescent; replum rounded; septum complete; style distinct or obsolete; stigma capitate, entire or slightly 2-lobed. Seeds biseriate, wingless, oblong, ovate, or orbicular, flattened; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons accumbent.

Worldwide about 350 species, primarily in the N hemisphere, especially arctic, subarctic, alpine, and subalpine regions, with about 70 species in S America. 23 species in Nepal.

Draba is the largest and taxonomically most difficult genus in the family. More than 950 binomials and nearly a fourth as many infraspecific taxa have been proposed. Numerous taxa are based on trivial characters, especially the presence or absence of trichomes on the fruit valves. Schulz (Pflanzenr. 89(IV. 105): 1–396. 1927), who was the last to monograph *Draba* on a worldwide basis, accorded varietal names to forms with glabrous and pubescent fruits, but this variation often occurs within the same population (see discussion under *D. oreades* Schrenk). By contrast, petal colour is taxonomically important and should be recorded in the field rather than from dried specimens. Another taxonomically important character is the number of ovules (seeds) per ovary (fruit). This is easily obtained by counting the total number of seeds and aborted ovules within a fruit.

Key to Species

- 1a Annuals2
- b Perennials, with well-developed caudex often covered with leaf or petiolar remains of previous years4

- 2a Fruits linear. Seeds and aborted ovules (30–)36–60(–72) per fruit21 *D. stenocarpa*
- b Fruits ovate, oblong, or rarely suborbicular. Seeds and aborted ovules 10–24(–28) per fruit3

- 3a Fruit ovate, glabrous, acute at apex. Cauline leaves (5–)10–24(–30)22 *D. eriopoda*
- b Fruit oblong, oblong-elliptic, or rarely suborbicular, puberulent, obtuse at apex. Cauline leaves 3–1223 *D. ellipsoidea*

4a	Cauline leaves absent.....	5
b	Cauline leaves 1–numerous.....	10
5a	Petals white.....	6
b	Petals yellow.....	8
6a	Petals 1.5–2.5(–3) × 0.6–1.2 mm. Fruit not twisted, 2.5–5 mm. Style 0.1–0.4 mm.....	7 D. glomerata
b	Petals 4–7 × 1.5–4.5 mm. Fruit often twisted, (3–)5–12 mm. Style (0.5–)0.7–1.5 mm.....	7
7a	Rachis of fruiting raceme often flexuous. Fruit apex acute. Petals 1.5–2.5 mm wide. Stellate trichomes sessile or subsessile, with some branched rays.....	9 D. winterbottomii
b	Rachis of fruiting raceme straight. Fruit apex obtuse. Petals 2.5–4.5 mm wide. Stellate trichomes long-stalked, with unbranched rays.....	10 D. sikkimensis
8a	Upper leaf surface primarily with simple trichomes, rarely glabrous. Fruit flattened, slightly inflated basally.....	16 D. oreades
b	Upper leaf surface with short-stalked forked and stellate trichomes. Fruit distinctly inflated at least basally.....	9
9a	Fruit ovoid, apex acute. Seeds and ovules 8–10 per fruit.....	17 D. affghanica
b	Fruit oblong, apex obtuse. Seeds and ovules 16–24 per fruit.....	18 D. humillima
10a	Petals yellow.....	11
b	Petals white, purple, or pink.....	17
11a	Racemes bracteate throughout or only basally.....	12
b	Racemes ebracteate.....	13
12a	Racemes 20–60(–140)-flowered. Fruiting pedicels glabrous above, pubescent below.....	11 D. polyphylla
b	Racemes 3–10(–12)-flowered. Fruiting pedicels glabrous or pubescent throughout, if glabrous above then style 1.5–3 mm.....	20 D. gracillima
13a	Fruit ovate, suborbicular, or ovate-lanceolate, slightly inflated at base.....	16 D. oreades
b	Fruit linear, linear-lanceolate, linear-elliptic, or oblong, not inflated.....	14
14a	Petals 2.5–3.5 × 0.8–1.5 mm. Style 0.2–0.6 mm.....	15
b	Petals 6–9 × 3–4.5 mm. Style 1.5–4 mm.....	16
15a	Fruit oblong, twisted, 3–4 mm wide. Fruiting pedicels with axillary surface gland.....	19 D. macbeathiana
b	Fruit not twisted, narrowly oblong, linear or linear-lanceolate, 1–2 mm wide. Fruiting pedicels without axillary surface gland.....	20 D. gracillima
16a	Plants surculose, with rhizome-like suckers to 35 cm. Seeds winged. Raceme 12–25-flowered. Fruit 3–4 mm wide. Style 2–4 mm.....	12 D. radicans
b	Plants not surculose. Seeds wingless. Raceme 2–5(–12)-flowered. Fruit 1.5–2.5 mm wide. Style 1.5–2 mm.....	14 D. cholaensis
17a	Seeds and aborted ovules (24–)26–60 per fruit.....	18
b	Seeds and aborted ovules 6–20(–24) per fruit.....	20
18a	Petals 2.5–3.5 mm. Fruiting pedicels (1–)2–4.5(–6) mm.....	1 D. lanceolata
b	Petals 7–12 mm. Fruiting pedicels (6–)8–24 mm.....	19
19a	Petals white. Fruiting pedicels divaricate, recurved. Fruit 4–5 mm wide. Raceme 6–12-flowered.....	13 D. staintonii
b	Petals pink or purple. Fruiting pedicels ascending, straight. Fruit 2–3.5 mm wide. Raceme 20–40-flowered.....	15 D. amoena
20a	Petals broadly obovate, 2.5–4.5 mm wide. Sepals 2.5–3 mm. Fruit apex obtuse. Basal leaves subfloccose with slender trichomes.....	10 D. sikkimensis
b	Petals spatulate to narrowly obovate, 1–2(–3) mm wide. Sepals 1–2(–2.5) mm. Fruit apex acute to acuminate. Basal leaves pubescent, pilose, or tomentose with short trichomes.....	21
21a	Lower surface of basal leaves with predominantly simple trichomes. Stellate trichomes with unbranched rays.....	5 D. altaica

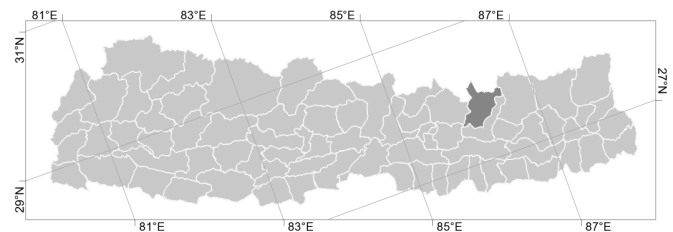
Cruciferae

- b Lower surface of basal leaves with predominantly stellate trichomes, 1 to all 4 rays of which laterally branched.....22
- 22a Fruit 2–4(–5) mm, ovate, elliptic, or rarely oblong-ovate. Seeds and aborted ovules 6–12(–14) per fruit23
- b Fruit (5–)6–11 mm, narrowly elliptic to lanceolate-linear. Seeds and aborted ovules 12–22(–24) per fruit25
- 23a Sepals, petals, and stamens persistent in fruit **8 *D. stenobotrys***
- b Sepals, petals, and stamens caducous before fruit maturity24
- 24a Fruiting pedicels divaricate. Racemes bracteate at least basally, slightly or not elongated in fruit..... **6 *D. lichiangensis***
- b Fruiting pedicels erect to ascending. Racemes ebracteate, distal half not elongated in fruit..... **7 *D. glomerata***
- 25a Petals 4–5.5 × 2–3 mm. Styles 1–1.5 mm..... **4 *D. poluniniana***
- b Petals 1.2–3.5 × 0.5–1.1 mm. Styles 0.1–0.5 mm.....26
- 26a Fruiting pedicels erect to ascending, forming a straight line with fruit. Petals 2–3.5 mm. Fruits lanceolate to lanceolate-linear, twisted, valves with branched trichomes. **2 *D. lasiophylla***
- b Fruiting pedicels horizontal, often recurved, forming a distinct angle with fruit. Petals 1.2–2 mm. Fruits narrowly elliptic, untwisted, valves with simple trichomes..... **3 *D. bagmatiensis***

1. *Draba lanceolata* Royle, Ill. Bot. Himal. Mts. [2]: 72 (1834).
Draba lanceolata var. *brachycarpa* Schult.; *D. lanceolata* var. *leiocarpa* O.E.Schulz; *D. lanceolata* var. *sonamargensis* O.E.Schulz; *D. nichanaica* O.E.Schulz; *D. stenobotrys* var. *leiocarpa* L.L.Lou & T.Y.Cheo; *D. stylaris* var. *leiocarpa* L.L.Lou & T.Y.Cheo.

Perennial herbs, 10–30(–40) cm, caespitose. Caudex slender, few-branched, ultimate branches terminated in rosettes, covered with petiolar remains of previous years. Stems erect, simple, tomentose with subsessile stellate trichomes. Basal leaves rosulate, persistent; petiole to 1.5 cm, often undifferentiated; leaf blade elliptic, oblong, or lanceolate, (0.4–)1–2(–3) cm × (1–)2–6 mm, base attenuate to cuneate, apex acute, margin entire or denticulate, tomentose with sessile or short-stalked, 4-rayed, stellate trichomes 1 or 2 rays of which often branched. Cauline leaves 6–12(–16), sessile; leaf blade ovate, oblong, elliptic, or lanceolate, 0.7–2.6(–3.5) cm × 2–7(–10) mm, base cuneate to obtuse, apex acute, margin 2–5(–9)-toothed on each side, rarely entire, pubescent as basal leaves, often pilose above with predominantly simple trichomes. Racemes (7–)14–32(–47)-flowered, ebracteate or lowermost flowers bracteate, elongated in fruit. Sepals oblong or ovate, 1–2 × 0.5–0.8 mm, erect, pilose below, base of lateral pair not saccate, margin membranous. Petals white, spatulate, 2.5–3.5 × 1–2 mm, apex subemarginate or rounded; claw absent or to 1 mm. Filaments 1.5–2 mm; anthers ovate, 0.2–0.3 mm. Ovules (26–)30–48(–56) per ovary. Fruiting pedicels (1–)2–4.5(–6) mm, erect or ascending, often appressed to rachis, straight, tomentose all around with subsessile, stellate trichomes sometimes mixed with simple ones. Fruit lanceolate to lanceolate-linear, (6–)7–11(–12) × 1.5–2 mm, erect and often appressed to rachis, latiseptate, rarely slightly twisted; valves tomentose or very rarely glabrous, obscurely veined, apex acute; style 0.1–0.6 mm. Seeds brown, ovate, 0.8–1.1 × 0.5–0.6 mm.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, N Asia, C Asia and SW Asia.



Altitudinal range: ca. 4200 m.

Ecology: Mountain slopes, meadows, scrub, gravelly stream-sides, roadsides.

Flowering: June–August. **Fruiting:** June–August.

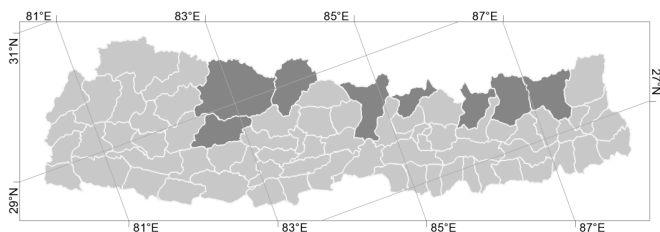
This is the first documented record of the species from Nepal, and is based on *Stainton, Sykes & Williams* 1256 (BM, E, UPS). Hara (Enum. Fl. Pl. Nepal 2: 42. 1979) listed this collection as *Draba lasiophylla* Royle var. *lasiophylla*.

2. *Draba lasiophylla* Royle, Ill. Bot. Himal. Mts. [2]: 71 (1834).
Draba glomerata var. *leiocarpa* Pamp.; *D. ladyginii* Pohle; *D. ladyginii* var. *trichocarpa* O.E.Schulz; *D. lasiophylla* var. *leiocarpa* (Pamp.) O.E.Schulz; *D. lasiophylla* var. *royleana* Pohle; *D. torticarpa* L.L.Lou & T.Y.Cheo.

Perennial herbs, (5–)10–20(–28) cm, caespitose. Caudex slender, few-branched, ultimate branches terminated in rosettes, covered with petiolar remains of previous years. Stems erect, simple, tomentose with subsessile stellate trichomes. Basal leaves rosulate; petiole to 6 mm, often undifferentiated; leaf blade lanceolate or elliptic-oblong, (3–)4–15(–18) × 1–4(–5) mm, base attenuate to cuneate, apex acute, margin entire or 1–3-toothed on each side, often ciliate at least near base, tomentose with sessile, 4-rayed stellate trichomes the rays of which having 1 or 2 lateral branches. Cauline leaves 1–4(or 5), sessile; leaf blade ovate, oblong, or elliptic, (4–)6–10(–20) × 1.5–4(–7) mm, base cuneate to obtuse, apex acute, margin entire or 1–5-toothed on each side, often

subsetose ciliate at base, pubescent as basal leaves. Racemes (5–)7–20(–25)-flowered, ebracteate or lowermost flowers bracteate, at least lowermost portion elongated in fruit. Sepals oblong, 1.2–1.8 × 0.5–0.9 mm, erect, caducous, pilose below, base of lateral pair not saccate, margin membranous. Petals white, spatulate, 2–3.5 × 0.8–1.1 mm, caducous, apex subemarginate or rounded; claw absent. Filaments 1–1.8 mm, caducous; anthers ovate, ca. 0.2 mm. Ovules (12–)14–20(–22) per ovary. Fruiting pedicels (1–)2–6(–10) mm, erect or ascending, straight, often subappressed to rachis, forming a straight line with fruit, tomentose all around with subsessile, stellate trichomes rarely mixed with fewer simple ones. Fruit narrowly lanceolate to lanceolate-linear, (5–)7–10(–11) × 1.5–2 mm, erect to ascending, often appressed to rachis, latiseptate, twisted 2 or sometimes 3 turns, rarely twisted 1 or 1/2 turn, apex acute to acuminate; valves tomentose with branched trichomes, or glabrous, obscurely veined, base obtuse, apex acute or acuminate; style 0.1–0.5 mm. Seeds brown, ovate, 0.8–1.1 × 0.4–0.5 mm.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia and C Asia.



Altitudinal range: 3000–5600 m.

Ecology: Mountain slopes, crevices, *Kobresia* turf.

Flowering: June–August. **Fruiting:** July–October.

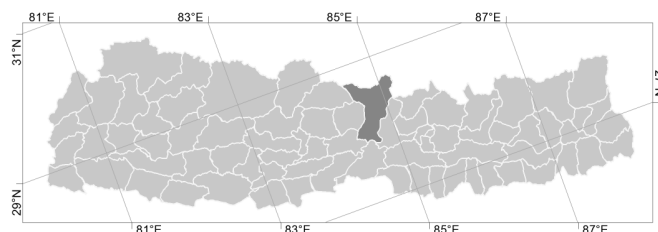
Hooker & Anderson (Fl. Brit. Ind. 1: 143. 1872) and Kitamura (Peoples Nepal Himalaya: 421. 1957) misapplied the name *Draba incana* L. to this species.

3. *Draba bagmatiensis* Al-Shehbaz, Novon 12: 317 (2002).

Perennial herbs, 1–6 cm, caespitose. Caudex slender, few- to many-branched, ultimate branches terminated in rosettes, covered with petiolar remains of previous years. Stems several to many, simple, ascending, tomentose with subsessile stellate trichomes. Basal leaves rosulate; petiole to 3 mm; leaf blade oblanceolate to oblong, 2–10 × 0.5–3 mm, base cuneate, apex obtuse, margin entire or 1-toothed on each side, often ciliate at least near base, tomentose with sessile, 4-rayed stellate trichomes the rays of which with 2 lateral branches. Cauline leaves 2–5, sessile; leaf blade ovate to oblong, 2–7 × 1–3 mm, obtuse, apex subacute, margin entire, not ciliate at base, pubescent as basal leaves. Racemes 5–13-flowered, lowermost flowers bracteate. Sepals oblong, 0.8–1 × 0.4–0.5 mm, erect, caducous, pilose below, base of lateral pair not saccate, margin membranous. Petals white, spatulate, 1.2–2 × 0.5–1 mm, caducous, apex subemarginate or rounded; claw absent. Filaments 0.8–1 mm, caducous; anthers ovate, 0.1–0.2 mm. Ovules 16 to 20 per ovary. Fruiting pedicels 1–5 mm,

horizontal, often recurved, forming a distinct angle with fruit, tomentose all around with subsessile, stellate trichomes. Fruit narrowly elliptic, 3–5 × 1.2–1.7 mm, not appressed to rachis, latiseptate, not twisted, acute; valves puberulent with simple trichomes; style 0.1–0.4 mm long. Seeds ovate, 0.5–0.7 × 0.3–0.5 mm.

Distribution: Nepal and E Himalaya.



Altitudinal range: 4100–4400 m.

Ecology: Sandy soil, fine scree.

Flowering: July–August. **Fruiting:** July–August.

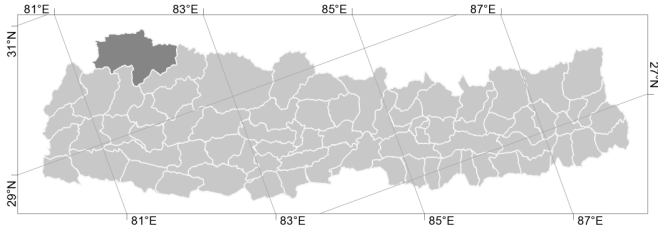
The type collection of the species, *F. Miyamoto et al.* 9400056 (MO, TI), was collected from Ganesh Himal.

4. *Draba poluniniana* Al-Shehbaz, Harvard Pap. Bot. 8(2): 171 (2004).

Perennial herbs, 7–15 cm, caespitose. Caudex slender, many-branched, ultimate branches terminated in rosettes, covered with petiolar remains of previous years. Stems erect, simple, tomentose with subsessile stellate trichomes. Basal leaves rosulate, subsessile; leaf blade oblanceolate, 5–15 × 2–4 mm, base attenuate to cuneate, apex obtuse, margin entire or 1–3-toothed on each side, not ciliate, tomentose with sessile, 4-rayed stellate trichomes all rays of which with 1 or 2 lateral branches. Cauline leaves 2–6, widely spaced, sessile; leaf blade ovate or oblong, 5–10 × 1.5–4 mm, base cuneate to obtuse, apex acute, margin entire or 1–3-toothed on each side, not ciliate at base, pubescent as basal leaves. Racemes 5–15-flowered, ebracteate or lowermost flower bracteate, elongated in fruit. Sepals oblong, 2–3 × 1–1.3 mm, erect, caducous, tomentose below with exclusively stellate trichomes, base of lateral pair not saccate, margin membranous. Petals white, obovate, 4–5.5 × 2–3 mm, caducous, apex subemarginate or rounded; claw absent. Filaments 2.5–3.5 mm, caducous; anthers ovate, ca. 0.6 mm. Ovules 20–24 per ovary. Fruiting pedicels 4–7 mm, divaricate, straight, forming a wide angle with fruit, tomentose all around with subsessile, stellate trichomes. Fruit lanceolate-linear, 6–8 × ca. 1 mm, not appressed to rachis, latiseptate, twisted 1 turn, apex acute to acuminate; valves glabrous, obscurely veined, base obtuse, apex acute or acuminate; style 1–1.5 mm. Seeds unknown.

Distribution: Endemic to Nepal.

Cruciferae



Altitudinal range: ca. 3800 m.

Ecology: Stony slopes and rock ledges.

Flowering: June.

The species is currently only known from the type collection, *Polunin, Sykes & Williams 4247* (holotype, TI; isotype, BM), a collection previously cited by Hara (Enum. Fl. Pl. Nepal 2: 43. 1979) as the only Nepalese record for *Draba tibetica* Hook.f. & Thomson var *duthiei* O.E.Schulz.

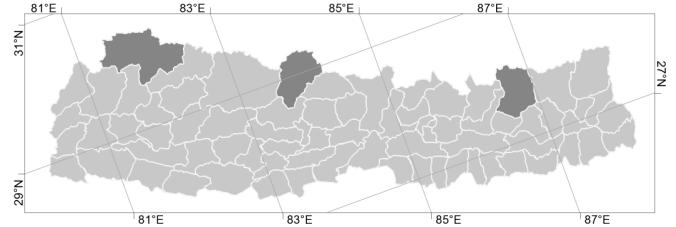
5. *Draba altaica* (C.A.Mey.) Bunge, Del. Sem. Hort. Dorpater: 8 (1841).

Draba rupestris var. *altaica* C.A.Mey., in Ledeb., Fl. Altaic. 3: 71 (1831); *Draba altaica* subsp. *modesta* (W.W.Sm.) O.E.Schulz; *D. altaica* var. *foliosa* O.E.Schulz; *D. altaica* var. *glabrescens* Lipsky; *D. altaica* var. *microcarpa* O.E.Schulz; *D. altaica* var. *modesta* (W.W.Sm.) W.T.Wang; *D. altaica* var. *racemosa* O.E.Schulz; *D. modesta* W.W.Sm.; *D. rupestris* var. *pusilla* Karelin & Kirilov.

Perennial herbs, (1–)2–10(–20) cm, caespitose. Caudex few-branched, ultimate branches terminated in rosettes and covered with petiolar remains of previous years. Stems erect, simple from caudex, rarely branched above, sparsely to densely hirsute with simple, straight or crisped trichomes to 0.7 mm, these sometimes mixed with forked and stellate ones, rarely glabrescent. Basal leaves rosulate, persistent; petiole (2–)5–12 mm, becoming straw-like; leaf blade linear-lanceolate or lanceolate, rarely oblanceolate or subspatulate, (0.3–)0.6–2(–3) cm × 1–4(–7) mm, base attenuate to cuneate, apex acute, margin entire or 1–3(–6)-toothed on each side, often ciliate, pubescent exclusively or predominantly with simple trichomes, stellate or forked trichomes mainly on midvein. Cauline leaves (1 or)2–6(–8), sessile; leaf blade ovate, oblong, elliptic, or lanceolate, (3–)4–13(–20) × 1–4.5(–6) mm, base cuneate or obtuse, apex acute, margin entire or 1–5(–7)-toothed on each side, pubescent as basal leaves. Racemes 5–15(–24)-flowered, bracteate basally, rarely ebracteate, not or only slightly elongated and subumbellate in fruit. Sepals oblong, 1–1.5 × 0.4–0.6 mm, erect, sparsely pubescent below with simple trichomes, base of lateral pair not saccate, margin not membranous. Petals white, spatulate, (1.2–)1.5–2.5 × (0.5–)0.7–1 mm, apex emarginate; claw to 0.7 mm. Filaments (0.6–)1–1.5 mm; anthers ovate, 0.1–0.2 mm. Nectar glands lateral, minute, 1 on each side of lateral stamen; median glands absent. Ovules 10–20 per ovary. Fruiting pedicels 1–4 mm, ascending to divaricate, straight, glabrous or sparsely to densely pubescent. Fruit ovate to oblong or lanceolate, (3–)4–7(–8) × 1.5–2 mm, latiseptate, not twisted apex acute to acuminate; valves glabrous, not veined, base obtuse, apex

acute; style 0.1–0.2 mm. Seeds brown, ovate, 0.7–0.9 × 0.5–0.6 mm.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, N Asia, C Asia and SW Asia.



Altitudinal range: 2000–5600 m.

Ecology: Rocky slopes, gravelly areas, moraine, stream-sides, *Kobresia* turf, *Juniperus* forests, grassy slopes.

Flowering: June–August. **Fruiting:** July–September.

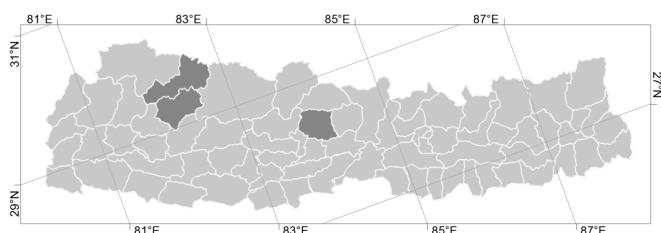
Hooker & Anderson (Fl. Brit. Ind. 1: 143. 1872) partially misapplied the name *Draba fladnitzensis* Wulfen to this species.

6. *Draba lichiangensis* W.W.Sm., Notes Roy. Bot. Gard. Edinburgh 11: 208 (1919).

Draba daochengensis W.T.Wang; *D. hicksii* Grierson; *D. lichiangensis* var. *microcarpa* O.E.Schulz; *D. lichiangensis* var. *trichocarpa* O.E.Schulz.

Perennial herbs, (1–)2–5(–8) cm, often densely caespitose, scapose. Caudex many-branched, ultimate branches terminated in rosettes and covered with petiolar remains of previous years. Stems erect, simple, sparsely to densely tomentose with stellate trichomes. Basal leaves rosulate, persistent; petiole to 4 mm, persistent, ciliate with simple trichomes or not ciliate; leaf blade spatulate, oblanceolate, or rarely oblong, (2–)4–8(–12) cm × (0.5–)1–2.5(–3) mm, base attenuate, apex obtuse to acute, margin entire or minutely 1–4-toothed, subglabrous above or with simple or stellate trichomes, tomentose below with stellate trichomes the rays of which with 1 or 2 lateral branches. Cauline leaves (1 or)2–8(–11), sessile; leaf blade ovate, oblong, or elliptic, similar in indumentum to basal leaves. Racemes (3–)5–10(–13)-flowered, bracteate basally or rarely throughout, slightly or not elongated in fruit. Sepals oblong, 1–1.8 × 0.6–0.8 mm, erect, sparsely pubescent below, base of lateral pair not saccate, margin not membranous, caducous before fruit maturity. Petals white, narrowly obovate to oblanceolate, 2–3 × 0.7–1.3 mm, apex subemarginate, caducous. Filaments 1–1.8 mm; anthers ovate, 0.2–0.3 mm. Ovules 8–12 per ovary. Fruiting pedicels (1–)2–8(–15) mm, divaricate, straight, sparsely to densely tomentose all around with stellate and forked trichomes. Fruit ovate to elliptic, 2–4(–5) × 1.5–2.5 mm, not inflated, latiseptate, not twisted apex acute to acuminate; valves glabrous or rarely pubescent, obscurely veined, base obtuse to acute, apex acute; style 0.1–0.4 mm. Seeds brown, ovate, (0.6–)0.9–1.3 × (0.4–)0.6–0.9 mm.

Distribution: Nepal, E Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: 3500–5000 m.

Ecology: Mountain slopes, gravelly areas, crevices of limestone cliffs, scree, grassy hillsides, stony moist meadows.

Flowering: May–July. **Fruiting:** June–August.

This species is recorded from Nepal based on *Polunin, Sykes & Williams 4565* (BM), a collection cited by Hara (Enum. Fl. Pl. Nepal 2: 42. 1979) as *Draba altaica* Bunge.

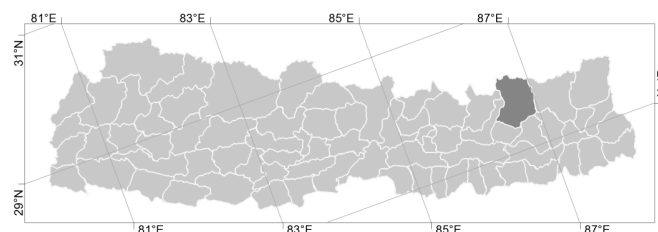
Draba altaica is easily distinguished from *D. lichiangensis* by the dominance of simple trichomes on leaf surfaces, whereas the latter has distinctly stellate trichomes with branched rays.

7. *Draba glomerata* Royle, Ill. Bot. Himal. Mts. [2]: 71 (1834). *Draba glomerata* var. *dasycarpa* O.E.Schulz.

Perennial herbs, (1–)2–8(–10) cm, densely caespitose, often scapose. Caudex slender, often many-branched, ultimate branches terminated in rosettes, covered with leaf remains of previous years. Stems erect, simple, tomentose with subsessile stellate trichomes. Basal leaves rosulate; petiole absent, rarely to 4 mm, rarely ciliate; leaf blade obovate, oblong, or lanceolate, 2–8 × (0.7–)1–2 mm, base attenuate to cuneate, apex obtuse, margin entire, not ciliate, densely tomentose with sessile or subsessile, very fine, 4-rayed stellate trichomes the rays of which with 1 or 2 lateral branches on each side. Cauline leaves 0–3(–5), sessile; leaf blade ovate, oblong, or elliptic, 2–5 × 0.5–2 mm, base cuneate to obtuse, apex subobtusely, margin entire or rarely with 1 or 2 minute teeth on each side, not ciliate, pubescent as basal leaves. Racemes (3–)5–10-flowered, ebracteate or rarely lowermost flower bracteate, basally slightly elongated, remainder often subumbellate in fruit; rachis straight. Sepals oblong, 1–2 × 0.6–0.8 mm, erect, sparsely tomentose below, base of lateral pair not saccate, margin narrowly membranous, caducous before fruit maturity. Petals white, spatulate, (1.8–)2–2.7(–3) × 0.8–1.2 mm, apex subemarginate, caducous. Filaments 1–1.5 mm; anthers ovate, ca. 0.2 mm. Ovules (6–)8–12 per ovary. Fruiting pedicels 1–3(–4) mm, ascending, straight, tomentose all around with subsessile, stellate trichomes. Fruit ovate, rarely oblong-ovate, (2.5–)3–4(–5) × 1.5–2.5 mm, not inflated, latiseptate, not twisted apex acute to acuminate; valves glabrous or rarely puberulent, obscurely veined, base obtuse, apex acute; style obsolete or 0.1–0.2(–0.4) mm. Seeds brown, ovate, 0.7–1 × 0.5–0.7 mm.

Fig. 3f-i

Distribution: Nepal, W Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: ca. 4400 m.

Ecology: Grassy areas, sandy river banks, gravelly slopes.

Flowering: June–August. **Fruiting:** July–October.

The record of *Draba glomerata* from Nepal by Hara (Enum. Fl. Pl. Nepal 2: 42. 1979) was based on misidentified specimens of *D. winterbottomii* (Hook.f. & Thomson) Pohle.

This is the first confirmed record of *D. glomerata* from Nepal, and it is based on *McCosh 317* (BM).

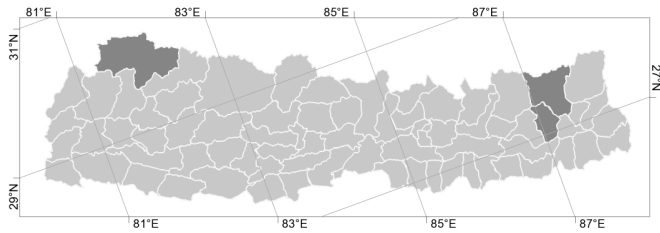
8. *Draba stenobotrys* Gilg & O.E.Schulz, in Engl., Pflanzenr. IV. 105(Heft 89): 291 (1927).

Draba ludlowiana Jafri; *D. oariocarpa* O.E.Schulz.

Perennial herbs, (4–)10–25 cm, caespitose. Caudex slender, few- to many-branched, ultimate branches terminated in rosettes, covered with petiolar remains of previous years. Stems often several from base, erect to ascending, simple, tomentose with subsessile stellate trichomes sometimes mixed with simple ones. Basal leaves rosulate; petiole to 7 mm; leaf blade oblanceolate to oblong, 6–15 × 1.5–3 mm, base attenuate to cuneate, apex obtuse, margin entire, often ciliate at least near base, tomentose on both surfaces with short-stalked to subsessile, 4-rayed stellate trichomes the rays of which having 1 or 2 lateral branches. Cauline leaves 2–10, sessile; leaf blade ovate to oblong, 3–10 × 1–4 mm, base cuneate to obtuse, apex subacute, margin entire, not ciliate at base, pubescent as basal leaves. Racemes 10–25-flowered, lowermost portion bracteate, elongated in fruit. Sepals oblong, 1.2–1.5 × 0.6–0.8 mm, erect, persistent, pilose below, base of lateral pair not saccate, margin membranous. Petals white, spatulate, 2–3 × 0.8–1.5 mm, persistent, apex subemarginate or rounded; claw absent. Stamens persistent; filaments 1–1.5 mm, caducous; anthers ovate, ca. 0.2 mm. Ovules 8–14 per ovary. Fruiting pedicels 1–6 mm, suberect to ascending, straight, forming a straight line with fruit, tomentose all around. Fruit ovate or narrowly so, 3–5 × 1.5–2 mm, erect to ascending, sometimes appressed to rachis, latiseptate, not twisted, or rarely twisted 1/2 turn apex acute to acuminate; valves puberulent with simple and forked trichomes, or glabrous, not veined, base obtuse, apex acute; style obsolete to 0.5 mm. Seeds brown, ovate, 0.7–0.8 × 0.4–0.5 mm.

Distribution: Nepal and Tibetan Plateau.

Cruciferae



Altitudinal range: 4200–5100 m.

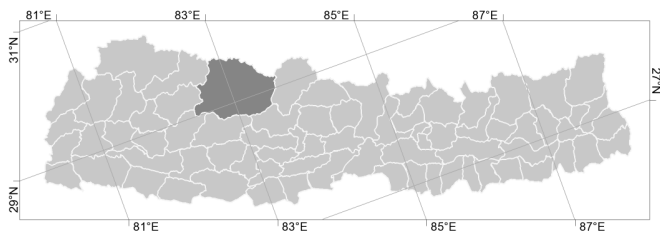
Ecology: Stony hillsides, open moraine scree, open turf and dwarf scrub, rock ledges.

Flowering: July. **Fruiting:** August–September.

9. *Draba winterbottomii* (Hook.f. & Thomson) Pohle, Repert. Spec. Nov. Regni Veg. Beih. 32: 138 (1925).
Draba tibetica var. *winterbottomii* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 152 (1861); *Draba dasyastra* Gilg & O.E.Schulz; *Ptilotrichum wageri* Jafri.

Perennial herbs, (1–)2–7(–12) cm, densely or laxly caespitose, scapose. Caudex slender, often many-branched, ultimate branches terminated in rosettes, covered with straw-like petiolar remains of previous years. Stems erect, simple, tomentose with subsessile stellate trichomes. Basal leaves rosulate; petiole absent, rarely to 6 mm, rarely ciliate; leaf blade obovate, oblong, spatulate, or lanceolate, 2–10 × 0.5–2 mm, base attenuate to cuneate, apex obtuse, margin entire, not ciliate, densely tomentose with sessile or subsessile, very fine, 4-rayed stellate trichomes the rays of which having 1 or 2 lateral branches on each side. Cauline leaves absent. Racemes 5–12-flowered, ebracteate, lax and elongated in fruit; rachis often flexuous, slender. Sepals oblong, 2–3 × 1–1.5 mm, erect, sparsely tomentose below, base of lateral pair not saccate, margin narrowly membranous. Petals white, spatulate, 4–5 × 1.5–2.5 mm, apex subemarginate or rounded. Filaments 2–3 mm; anthers ovate, 0.4–0.5 mm. Ovules (10–)12–20 per ovary. Fruiting pedicels (3–)5–12(–15) mm, divaricate or rarely ascending, straight, tomentose all around with subsessile, stellate trichomes. Fruit narrowly elliptic, lanceolate, or oblong, (3–)5–9 × 1.5–2.3(–2.8) mm, not inflated, latiseptate, often twisted; valves glabrous or rarely puberulent, obscurely veined, base obtuse, apex acute; style (0.5–)0.7–1.3(–1.5) mm. Seeds brown, ovate, 0.9–1 × 0.7–0.8 mm.

Distribution: Nepal, W Himalaya and Tibetan Plateau.



Altitudinal range: 5600–5900 m.

Ecology: Grassy slopes, gravelly areas, glacial terraces.

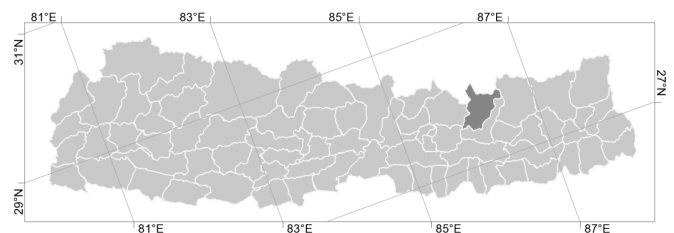
Flowering: June–August. **Fruiting:** July–September.

The collection *Polunin, Sykes & Williams 1186* (BM) represents the first record for Nepal. It was listed by Hara (1979) as *Draba glomerata* Royle.

10. *Draba sikkimensis* (Hook.f. & Thomson) Pohle, Repert. Spec. Nov. Regni Veg. Beih.: 144.
Draba sikkimensis forma *thoroldii* O.E.Schulz; *D. tibetica* var. *sikkimensis* Hook.f. & Thomson.

Perennial herbs, (4–)7–20(–26) cm, densely caespitose, scapose. Caudex several branched, ultimate branches terminated in rosettes and covered with leaves or petiolar remains of previous years. Stems erect, simple, densely tomentose towards base, sparsely so towards apex. Basal leaves rosulate, persistent; petiole 2–10 mm, persistent; leaf blade spatulate, oblanceolate, oblong, or rarely obovate, (0.3–)0.5–1.5(–2) cm × (1–)2–4(–6) mm, base attenuate to cuneate, apex obtuse to subacute, margin entire, densely subfloccose with fine, stalked, stellate trichomes with simple or branched slender rays, sometimes a few, slender, simple trichomes also present. Cauline leaves absent or 1–4, sessile; leaf blade ovate to oblong, 4–15 × 2–4 mm, apex obtuse, margin entire, indumentum as basal leaves. Racemes (2–)5–16(–20)-flowered, ebracteate, often elongated considerably in fruit; rachis straight. Sepals oblong, 2.5–3 × 1–1.5 mm, erect, sparsely pubescent below, base of lateral pair not saccate, margin narrowly membranous. Petals white, broadly obovate, 5–7 × 2.5–4.5 mm, apex rounded; claw ca. 1 mm. Filaments 2.5–3; anthers ovate, 0.5–0.6 mm. Ovules 8–14 per ovary. Fruiting pedicels (0.2–)0.7–1.7(–2) cm, erect and subappressed to rachis, or ascending, straight, tomentose all around. Fruit oblong to elliptic, 6–12 × 2.5–3 mm, not inflated, latiseptate, twisted to 2 turns, very rarely not twisted, apex obtuse; valves tomentose, not veined, base and apex obtuse; style (0.6–)1–1.5 mm. Seeds brown, ovate, 1–1.5 × 0.7–1 mm. Fig. 2c & Fig. 3j-k

Distribution: Nepal, E Himalaya and Tibetan Plateau.



Altitudinal range: 4800–5500 m.

Ecology: Shady grassy slopes, stony slopes.

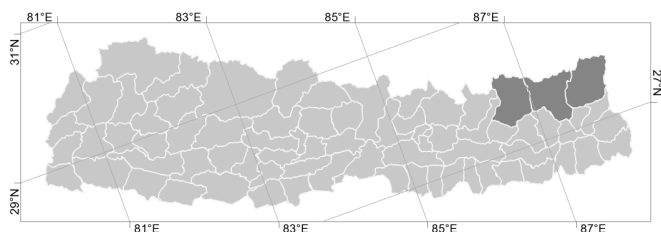
Flowering: June–July. **Fruiting:** August–September.

This is the first record of the species from Nepal, based on *Miyamoto et al. 9592300* (MO, TI), from Panch Pokhari, Dolakha District.

11. *Draba polyphylla* O.E.Schulz, in Engl., Pflanzenr. IV. 105(Heft 89): 180 (1927).

Perennial herbs, (20–)30–65(–90) cm. Caudex simple or branched. Stems erect, simple, sparsely or rarely densely pubescent with a mixture of simple and sessile stellate trichomes, apically tomentose with appressed stellate ones. Basal leaves rosulate, persistent, sessile or rarely on petiole to 4 cm; leaf blade oblanceolate to spatulate, 1.5–5 cm × 5–11 mm, base cuneate, apex obtuse, margin dentate or entire, sparsely pubescent below with stalked, 3- or 4-rayed stellate trichomes, sometimes glabrescent except for margin and midvein, with a mixture of primarily simple trichomes and fewer stellate ones above, rarely exclusively simple. Cauline leaves 5–20(–40), sessile; leaf blade oblong, lanceolate, or ovate, 1.2–3.5(–5) cm × 4–11 mm, base often auriculate or amplexicaul, apex obtuse or acute, margin dentate or subentire, pubescent as basal leaves. Racemes 20–60(–140)-flowered, bracteate basally to throughout, elongated considerably in fruit. Sepals oblong or ovate, 2–3(–3.5) × 1–2 mm, ascending, sparsely pilose below with primarily simple trichomes, base of lateral pair subsaccate, margin membranous. Petals yellow, obovate, 5–7(–8) × 2–3.5 mm, apex emarginate; claw 1–2 mm. Filaments 2.5–3.5(–4) mm; anthers oblong, 0.6–0.9 mm. Ovules (12–)16–22(–24) per ovary. Fruiting pedicels (0.3–)0.7–2(–2.5) cm, divaricate, straight, glabrous above, pubescent below with appressed stellate trichomes. Fruit oblong, elliptic, or ovate, (0.7–)1–1.5 cm × 3–5(–6) mm, latiseptate, rarely slightly twisted; valves glabrous, with a distinct midvein extending to middle or full length; style 0.5–1.5 mm. Seeds brown, ovate, 1.5–1.9 × 1–1.3 mm.

Distribution: Nepal, E Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: 2900–5000 m.

Ecology: Grassy slopes, scree, stream-sides, among shrubs, forests, peaty meadows.

Flowering: June–August. **Fruiting:** June–August.

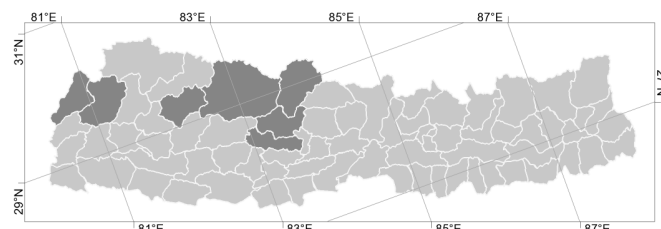
Hara (Enum. Fl. Pl. Nepal 2: 42. 1979) listed *Draba polyphylla* in the synonymy of and cited *Stainton 658* (BM) as *D. elata* Hook.f. & Thomson. However the latter species does not occur in Nepal and is known thus far only from Sikkim and adjacent Tibet. *Draba polyphylla* is easily distinguished by having at least some auriculate or amplexicaul cauline leaves, divaricate fruiting pedicels glabrous above, glabrous and slightly twisted fruits, petals 5–7(–8) mm long, and at least basally bracteate racemes 20–60(–140)-flowered. By contrast, *D. elata* has basally cuneate cauline leaves, ascending fruiting pedicels pubescent all around, pilose untwisted fruits, petals 3–4.5 mm

long, and ebracteate racemes 10–25-flowered.

12. *Draba radicans* Royle, Ill. Bot. Himal. Mts. [2]: 71 (1834). *Draba radicans* var. *leiocarpa* O.E.Schulz.

Perennial herbs, 5–30 cm, surculose. Rhizome-like suckers to 35 cm, simple or branched, without leaf remains. Stems erect to ascending, simple, sparsely to densely hirsute with stout, forked and/or subsetose, simple trichomes. Basal leaves rosulate; petiole 1–10 mm; leaf blade obovate, oblanceolate, or lanceolate, 0.6–2 cm × 2–9 mm, base cuneate, apex acute, margin serrate or entire, ciliate with simple trichomes to 1 mm, sparsely to densely pubescent below with sessile or short-stalked, forked or 3- or 4-rayed stellate trichomes sometimes mixed with simple ones, hirsute above with primarily subsetose simple trichomes occasionally mixed with forked and stellate ones. Cauline leaves 4–12, sessile; leaf blade ovate to obovate, 0.7–3 × 0.3–1.4 cm, pubescent as basal leaves, margin serrate to serrulate, rarely entire. Racemes 10–25-flowered, ebracteate, elongated considerably in fruit. Sepals oblong to ovate, (2.5–)3–4 × 1.5–2 mm, erect, sparsely pilose below with simple trichomes, base of lateral pair subsaccate, margin narrowly membranous. Petals bright yellow, broadly obovate to oblong-obovate, 7–9 × 3–4.5 mm, apex subemarginate; claw absent. Filaments 4–5 mm; anthers oblong, 0.9–1.1 mm. Ovules 18–24 per ovary. Fruiting pedicels (0.6–)1–2.5 cm, slender, divaricate to horizontal, recurved or rarely straight, often subreflexed, pubescent all around, rarely subglabrous. Fruit narrowly oblong, 0.9–1.8 cm × 3–4 mm, latiseptate, not twisted; valves densely or sparsely pilose with simple or forked trichomes, base and apex subobtusate; style slender, 2–4 mm. Seeds brown, oblong, ca. 1.2 × 1 mm, winged all around; wing 0.1–0.2 mm wide.

Distribution: Nepal, W Himalaya and E Himalaya.



Altitudinal range: 3000–3900 m.

Ecology: Alpine meadows, forests, rocky ledges, open places, moist fields along streams.

Flowering: April–June. **Fruiting:** May–July.

Hooker & Anderson (Fl. Brit. Ind. 1: 142. 1872) partially misapplied the name *Draba alpina* L. to this species.

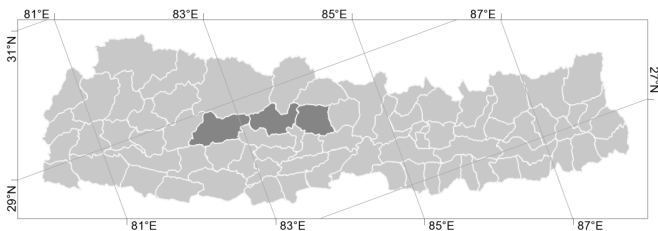
13. *Draba staintonii* Jafri ex H.Hara, in H.Hara & L.H.J.Williams, Enum. Fl. Pl. Nepal 2: 42 (1979).

Perennial herbs, 5–12 cm, laxly caespitose. Caudex with several long branches, ultimate ones terminated in rosettes and covered with remains of previous years. Stems erect to ascending, simple, densely pilose with subsessile stellate

Cruciferae

trichomes. Basal leaves rosulate, subsessile or with a petiole to 5 mm; leaf blade obovate to spatulate, 7–3 × 4–11 mm, base cuneate, apex obtuse to acute, margin entire, toothed, often ciliate with simple trichomes, thin, subglabrous above or distally pilose with primarily simple trichomes, pilose below with short-stalked to subsessile, 4-rayed stellate trichomes the rays of which simple or 1 or 2 of them branched at or near base and trichome appears up to 7-rayed. Cauline leaves 3–10, distal ones sessile, obovate to ovate or uppermost lanceolate, 7–17 × 3–10 mm, base subobtusate to cuneate, apex obtuse to acute, margin 2–5-toothed on each side, pubescent as basal leaves. Racemes 6–12-flowered, bracteate at least basally, soon elongated. Sepals oblong to ovate, 2.5–4 × 1.5–2.5 mm, ascending, sparsely pilose below with simple and fewer forked trichomes, base of lateral pair subsaccate, margin narrowly membranous. Petals white, broadly obovate to spatulate, 7–12 × 3–5 mm, apex rounded; claw absent. Filaments white, 3–4 mm; anthers oblong, 0.7–0.8 mm. Ovules 28–32 per ovary. Fruiting pedicels divaricate, 8–20 mm, initially straight but becoming recurved at maturity, densely stellate or pilose all around. Fruits oblong, 8–10 × 4–5 mm latiseptate, not twisted; valves pilose with simple and fewer forked trichomes, with a distinct midvein at least along lower half, base and apex obtuse to rounded; style 0.7–1.5 mm; stigma distinctly wider than style. Seeds brown, ovate, compressed, biseriate, 0.9–1 × 0.6–0.8 mm.

Distribution: Endemic to Nepal.



Altitudinal range: 3900–4600 m.

Ecology: Crevices in steep shale cliffs, rock ledges.

Flowering: June–July. **Fruiting:** August.

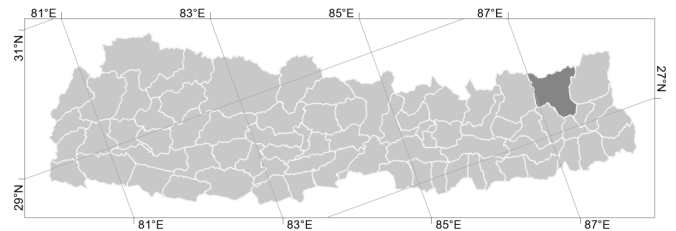
14. *Draba cholaensis* W.W.Sm., Rec. Bot. Surv. India 4: 352 (1913).

Draba cholaensis var. *leiocarpa* H.Hara.

Perennial herbs, 5–20 cm. Caudex branches slender, few to numerous, without petiolar remains of previous years. Stems erect to ascending, simple, slender, sparsely to densely pilose towards base with simple trichomes to 0.7 mm, these rarely mixed with fewer forked ones. Basal leaves subrosulate; petiole rarely to 1 cm, ciliate with simple trichomes; leaf blade narrowly obovate or oblanceolate, sometime oblong-obovate, 0.4–2 cm × 2–8 mm, base cuneate to attenuate, apex obtuse to acute, margin entire or minutely 1- or 2-toothed on each side, ciliate with simple trichomes to 1 mm, often sparsely pilose with simple trichomes to 0.6 mm, often also with stalked forked trichomes below rarely also some stellate ones. Cauline leaves 2–6, sessile, often well spaced; leaf blade oblong to subelliptic, 4–12 × 2–4 mm, with apex, leaf margin and

indumentum similar to basal leaves. Racemes 2–5(–12)-flowered, ebracteate, elongated considerably and lax, subflexuous in fruit. Sepals oblong, 2.5–3 × 1.5–1.8 mm, erect, sparsely pilose below with simple trichomes, base of lateral pair subsaccate, margin narrowly membranous. Petals yellow, broadly obovate, 6–8 × 3–4 mm, apex subemarginate; claw to 1 mm. Filaments 3–4.5 mm; anthers oblong, 0.7–0.8 mm. Nectar glands confluent, subtending bases of all stamens though more developed laterally than medianly. Ovules 18–22 per ovary. Fruiting pedicels 0.6–2 cm, filiform, ascending to divaricate, slightly reflexed, straight or curved, glabrous. Fruit linear, 1.5–2.2 cm × 1.5–2.5 mm, latiseptate, not twisted; valves glabrous or pilose with simple trichomes, midvein distinct at least towards base, base and apex acute to subobtusate; style 1.5–2 mm. Seeds brown, oblong, 1–1.3 × 0.6–0.8 mm, wingless.

Distribution: Nepal, E Himalaya and Tibetan Plateau.



Altitudinal range: ca. 4000 m.

Ecology: Rocky ground.

Flowering: June–July. **Fruiting:** June–July.

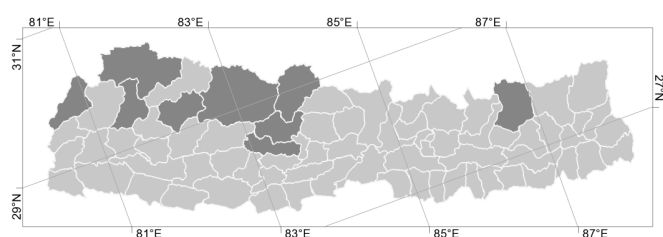
In Nepal currently known only from the type specimen, *Stainton 639* (BM).

15. *Draba amoena* O.E.Schulz, in Engl., Pflanzenr. IV. 105(Heft 89): 188 (1927).

Perennial herbs, (20–)40–80 cm. Caudex stout, unbranched, covered with petiolar remains of previous years. Stems usually single, erect, branched above, stout, pubescent with sessile, stellate or submalpighiaceus trichomes occasionally mixed with fewer simple ones, not flexuous, leafy throughout. Basal leaves rosulate, sessile or narrowed into a petiole to 1 cm; leaf blade obovate to spatulate, 3–9 × 0.7–1.7 cm, base often attenuate, apex acute, margin dentate and often with callosities, pubescent with stalked to subsessile, cruciform trichomes often at least 1 ray of which branched and trichome appearing 5–8-rayed, rarely individual rays with 1 or 2 minute lateral branches, simple trichomes absent or restricted to ciliate base. Cauline leaves numerous, middle ones oblong to oblanceolate or lanceolate, rarely ovate, (1–)3–7 × 0.6–1.7 cm, gradually reduced upward to linear or narrowly oblong, entire bracts as small as 6 × 2 mm, base cuneate, not auriculate, apex acute to obtuse, margin toothed or entire on upper ones, pubescent as basal leaves, sometimes also ciliate at base or above with a preponderance of simple trichomes. Racemes 20–50-flowered, bracteate basally or rarely throughout, elongated considerably and lax in fruit; rachis not flexuous. Sepals oblong in median pair and ovate in lateral, 3–4.5 × 1.5–

2 mm, sparsely pilose, ascending, lateral pair saccate. Petals purple to pink, obovate, 7–9 × 3–4.4 mm, apex obtuse to subemarginate. Filaments not dilated at base, lateral pair 2.5–3.5 mm, median pairs 3.5–5 mm; anthers oblong, 0.7–1 mm. Nectar glands 2, lateral, well-developed, semicircular; median glands absent. Ovules 26–40 per ovary. Fruiting pedicels (0.6–)1–2.5 cm, filiform, ascending, straight, pubescent all around with sessile stellate trichomes sometimes mixed with forked ones. Fruit oblong or rarely linear, 1–2.5(–3.7) cm × 2–3.5 mm, latiseptate, twisted or not; valves puberulent or rarely glabrous, with a distinct midvein, base and apex acute to obtuse; style 1–2.5 mm, glabrous; stigma often 2-lobed. Seeds brown, ovate, compressed, 1.1–1.5 × 0.8–1 mm, wingless.

Distribution: Nepal and E Himalaya.



Altitudinal range: 3000–4800 m.

Ecology: Stream-sides, open hillsides, damp ground in partial shade, dry ravines.

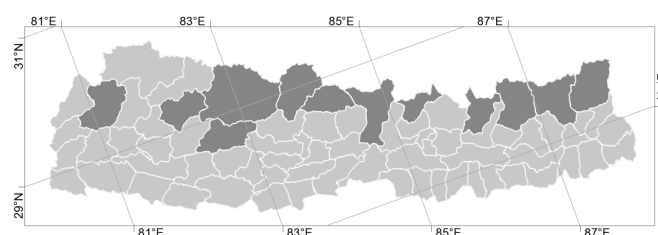
Flowering: May–July. **Fruiting:** June–August.

16. *Draba oreades* Schrenk, Enum. Pl. Nov. 2: 56 (1842). *Draba algida* var. *brachycarpa* Bunge; *D. alpicola* Klotzsch; *D. alpina* var. *rigida* Franch.; *D. kizylarti* (Korsh.) N.Busch; *D. oreades* prol. *alpicola* (Klotzsch) O.E.Schulz; *D. oreades* prol. *chinensis* O.E.Schulz; *D. oreades* prol. *exigua* O.E.Schulz; *D. oreades* prol. *pikei* O.E.Schulz; *D. oreades* var. *chinensis* O.E.Schulz; *D. oreades* var. *ciliolata* O.E.Schulz; *D. oreades* var. *commutata* (Regel) O.E.Schulz; *D. oreades* var. *dasycarpa* O.E.Schulz; *D. oreades* var. *depauperata* O.E.Schulz; *D. oreades* var. *estylola* O.E.Schulz; *D. oreades* var. *glabrescens* O.E.Schulz; *D. oreades* var. *occulata* O.E.Schulz; *D. oreades* var. *pulvinata* O.E.Schulz; *D. oreades* var. *racemosa* O.E.Schulz; *D. oreades* var. *tafelii* O.E.Schulz; *D. pilosa* var. *commutata* Regel; *D. pilosa* var. *oreades* Regel; *D. qinghaiensis* L.L.Lou; *D. rockii* O.E.Schulz; *D. tianschanica* Pohle; *Pseudobradya kizylarti* Korsh.

Perennial herbs, (0.5–)1.5–14(–20) cm, caespitose, scapose. Caudex simple to many-branched, ultimate branches terminated in rosettes and covered with petiolar remains of previous years. Stems erect, simple, often densely pubescent with a mixture of simple and subsessile forked trichomes, sometime subhirsute with almost exclusively simple trichomes, rarely glabrous. Basal leaves rosulate, persistent; petiole absent or short, rarely to 2 cm, persistent, often ciliate with simple and/or long-stalked forked trichomes; leaf blade suborbicular, obovate, spatulate, oblanceolate, or lanceolate, (0.3–)0.5–2(–3) cm × (1–)2–6(–8) mm, base cuneate to attenuate, apex obtuse to acute, margin entire or rarely 1- or 2-toothed on each side, sparsely or densely pubescent with

simple trichomes, these often mixed below with stalked forked and subsessile, 3- or 4-rayed stellate ones with unbranched rays, above with predominantly simple trichomes, rarely both surfaces glabrous except for ciliate margin. Cauline leaves absent, sometimes 1, very rarely 2, sessile, similar to basal. Racemes (2–)4–15(–25)-flowered, ebracteate, subumbellate and not elongated or rarely subracemose and slightly elongated in fruit. Sepals oblong or ovate, 1.5–2.5(–3) × 0.8–1.5(–1.8) mm, erect, caducous or rarely persistent, sparsely pilose or glabrous below, base of lateral pair not saccate, margin narrowly membranous. Petals yellow, obovate to narrowly spatulate, 2.5–5(–6) × (0.9–)1.5–2.5(–3) mm, apex emarginate or rounded; claw absent, rarely 1(–2) mm. Filaments 1.5–2.5(–3) mm; anthers ovate, 0.2–0.4(–0.6) mm. Nectar glands lateral, 1 on each side of lateral stamen, sometimes these connected and glands appearing 2; median glands absent. Ovules (4–)6–12 per ovary. Fruiting pedicels 1–7(–10) mm, divaricate or divaricate-ascending, straight or rarely slightly curved, tomentose or pilose below, glabrous above or rarely throughout. Fruit ovate to suborbicular, rarely ovate-lanceolate, (3–)4–9(–12) × 1.5–4.5(–6) mm, latiseptate and basally inflated, not twisted; valves glabrous or rarely puberulent with simple or forked trichomes, not veined, base obtuse, apex acute to subacuminate; style (0.1–)0.3–0.8(–1) mm. Seeds black to dark brown, ovate, (0.7–)1–1.5 × 0.5–0.9(–1) mm.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, N Asia and C Asia.



Altitudinal range: 2300–6100 m.

Ecology: Rock crevices, moraine, scree, alpine meadows and tundra, glacier margins, hillsides, grassy slopes, swampy meadows, muddy gravel, rocky outcrops, cliffs.

Flowering: June–August. **Fruiting:** June–August.

Hooker & Thomson (J. Proc. Linn. Soc. Bot. 5: 150. 1861), Hooker & Anderson (Fl. Brit. Ind. 1: 142. 1872) and Kitamura (Fauna Fl. E. Himalaya: 139. 1955) misapplied the name *Draba alpina* L. to this species.

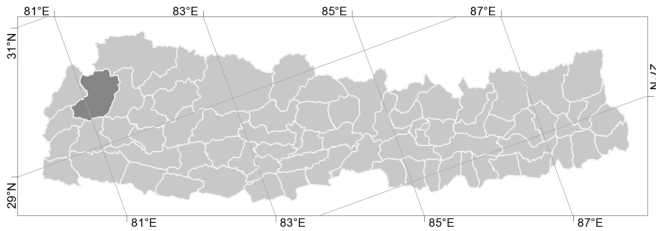
17. *Draba affghanica* Boiss., Fl. Orient. Suppl.: 55 (1888). *Draba affghanica* var. *rostrata* O.E.Schulz; *D. affghanica* var. *subtomentosa* O.E.Schulz.

Perennial herbs, 1–5 cm, laxly caespitose, scapose. Caudex covered with leaf remains of previous years, with several prostrate branches terminated in rosettes. Stems erect, simple, pubescent 1–5 mm long, persistent, thickened, ciliate with simple trichomes. Basal leaf blade lanceolate, oblanceolate, to obovate, 5–10(–15) × 1–3(–4.5) mm, base attenuate, apex

Cruciferae

obtuse or acute, margin entire, ciliate, without setose or subsetose trichomes, pubescent with sessile or short-stalked, forked or stellate trichomes with unbranched rays, sometimes with primarily simple trichomes above. Cauline leaves absent. Racemes (3–)5–10(–13)-flowered, ebracteate, elongated in fruit. Sepals oblong-ovate, 2–3 × 1–1.5 mm, erect, sparsely pubescent below with simple and forked trichomes, base of lateral pair not saccate, margin narrowly membranous. Petals yellow, broadly obovate, 4–5.5 × 2–3.5 mm, apex rounded; claw to 1 mm long. Filaments 2–3; anthers ovate, ca. 0.4 mm long. Ovules 8–10 per ovary. Fruiting pedicels 5–10 mm, divaricate, straight, pubescent all around with stellate trichomes. Fruit ovoid, 3–6(–7) × 2–4 mm, distinctly inflated at least basally, latiseptate distally, not twisted; valves puberulent with forked trichomes mixed with much fewer simple and stellate ones, not veined, base rounded to obtuse, apex acute; style (0.5–)1–2 mm long. Seeds brown, ovoid, 1–1.3 × 0.6–0.8 mm.

Distribution: Nepal, W Himalaya and SW Asia.



Altitudinal range: ca. 5800 m.

Ecology: Scree.

Flowering: May–July. **Fruiting:** May–July.

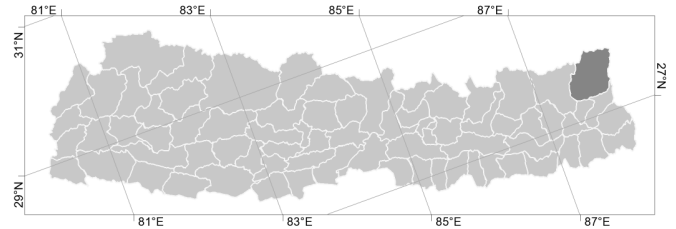
The single collection cited by Hara (Enum. Fl. Pl. Nepal 2: 42. 1979) from Nepal as '*Bowes Lyon 92*' is actually *Tyson 92* (BM).

18. *Draba humillima* O.E. Schulz, in Engl., Pflanzenr. IV. 105(Heft 89): 114 (1927).

Perennial herbs, 1–2 cm, densely caespitose, scapose. Caudex many-branched, ultimate branches terminated in rosettes and covered with leaf remains of previous years. Stems erect, simple, tomentose with stalked, forked and stellate trichomes. Basal leaves rosulate, persistent; petiole 2–7 mm, ciliate with simple and/or long-stalked forked trichomes; leaf blade oblong-elliptic, 3–8 × 1.5–3(–5) mm, base cuneate to attenuate, apex obtuse, margin entire, subhirsute with stalked, 3- or 4-rayed stellate trichomes with simple, rigid rays, sometimes glabrous above or sparsely pubescent distally, ciliate with simple and forked trichomes. Cauline leaves absent. Racemes 2–6-flowered, ebracteate, only slightly elongated in fruit. Sepals oblong, 2–2.5 × 0.7–1 mm, erect, sparsely pubescent below with simple trichomes, base of lateral pair not saccate, margin not membranous. Petals yellow, obovate, 3.5–4.5 × 1–1.5 mm, apex subemarginate; claw ca. 1 mm. Filaments 1.5–2 mm; anthers ovate-oblong, ca. 0.4 mm. Ovules 16–24 per ovary. Fruiting pedicels 2–5 mm, divaricate-ascending, straight, stout, tomentose all around.

Fruit oblong, 5–7 × 3–4 mm, inflated, latiseptate, not twisted; valves glabrous, not veined, base and apex obtuse; style 0.5–0.6 mm. Seeds dark brown, ovate, 0.9–1 × 0.6–0.7 mm.

Distribution: Nepal, E Himalaya and Tibetan Plateau.



Altitudinal range: ca. 3000 m.

Ecology: Scree, sheltered shady areas below rocks, rocky slopes.

Flowering: July–September. **Fruiting:** July–September.

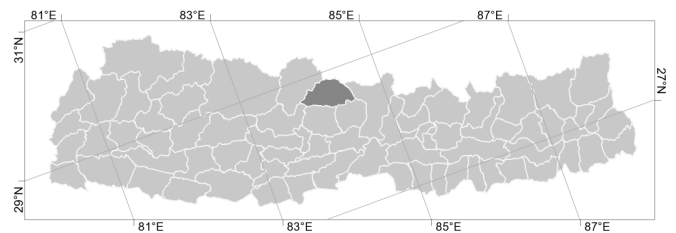
This is the first report of *Draba humillima* from Nepal, based on *Kanai et al. 1758* (TI), collected from Phujeng Danda, Taplejung District.

19. *Draba macbeathiana* Al-Shehbaz, Novon 12: 315 (2002).

Perennial herbs, ca. 6 cm, laxly branched. Caudex many-branched, ultimate branches terminated in few rosettes and covered with leaf remains of previous years. Stems erect, simple, tomentose with stalked, forked and stellate trichomes. Basal leaves rosulate, persistent; petiole to 10 mm, ciliate with simple and stalked forked trichomes; leaf blade oblanceolate, 5–15 × 2–5 mm, base cuneate to attenuate, apex acute, margin 1- or 2-toothed on each side, pilose with stalked, 3–4-rayed stellate trichomes with simple, soft rays. Cauline leaves few, similar to basal leaves. Racemes 3–6-flowered, ebracteate, elongated in fruit. Sepals oblong, 1.5–2 × ca. 1 mm, erect, sparsely pubescent below with stalked stellate trichomes, base of lateral pair not saccate, margin not membranous. Petals yellow, spatulate, ca. 3 × 1 mm, apex subemarginate. Filaments 1.5–2 mm; anthers ovate, ca. 0.4 mm. Ovules 12–14 per ovary. Fruiting pedicels 1–2 cm, horizontal to slightly reflexed, straight, slender, tomentose all around, with a well-developed axillary gland above. Fruit oblong, 8–10 × 3–4 mm, not inflated, latiseptate, twisted; valves pubescent, not veined, base and apex obtuse; style 0.5–0.6 mm. Seeds brown, oblong, ca. 1 × 0.5 mm.

Fig. 3l

Distribution: Endemic to Nepal.



Altitudinal range: ca. 5200 m.

Ecology: Stable scree.

Flowering: July. **Fruiting:** July.

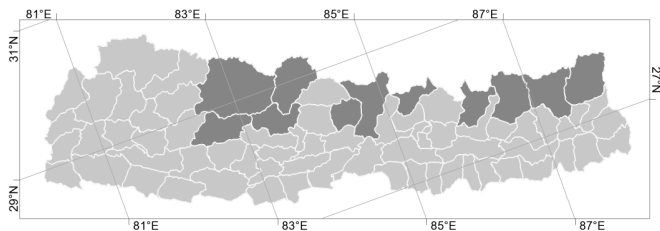
Known only from the holotype, *McBeath 1484* (E), which was collected from the Manang side of the Thorong La.

20. *Draba gracillima* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 153 (1861).

Draba granitica Hand.-Mazz.; *D. lanceolata* Klotzsch & Garcke later homonym, non Royle; *D. nepalensis* Wall. nom. nud.; *D. wardii* W.W.Sm.

Perennial herbs, 5–55 cm. Caudex with several slender branches terminated in rosettes. Stems decumbent, simple, very slender, somewhat flexuous, sparsely pubescent at base with short-stalked, 3- or 4-rayed stellate trichomes, rarely densely pilose with primarily simple trichomes, glabrous towards apex. Basal leaves rosulate, persistent; leaf blade with petiole-like base to 7 mm, broadly obovate, spatulate, to oblanceolate, 0.5–2 cm × 1.5–7(–10) mm, base cuneate to attenuate, apex subacute or obtuse, margin denticulate or subentire, often ciliate, sparsely pubescent above with short-stalked, 4-rayed stellate trichomes, rarely mixed with simple and forked ones, pilose below with simple trichomes replaced with forked or stellate ones at leaf apex, rarely blade glabrous except for margin. Cauline leaves 2–6, sessile, ovate, 2–7 × 1–3 mm, base obtuse, not auriculate, apex acute, margin entire or denticulate, pubescent as basal leaves. Racemes 3–10(–12)-flowered, ebracteate or lowermost flowers bracteate, lax, elongated considerably in fruit. Sepals oblong, 1.5–2 × 0.6–1.5 mm, erect, glabrous or rarely with a few trichomes, not saccate, margin narrowly membranous. Petals pale yellow or yellowish white, narrowly obovate to oblanceolate, 2.5–3.5 × 0.8–1.5 mm, apex obtuse or subemarginate; claw absent. Filaments 1.2–2 mm; anthers ovate, 0.2–0.4 mm. Ovules 10–20 per ovary. Fruiting pedicels 0.4–4 cm, filiform, glabrous, lowermost longest and strongly recurved, uppermost straight and ascending. Fruit narrowly oblong, linear, or linear-lanceolate, (0.5–)0.7–1.3(–1.8) cm × 1–2 mm, pendulous, latiseptate, not twisted; valves glabrous, not veined; style 0.2–0.5 mm. Seeds brown, ovate, 0.9–1.1 × 0.5–0.7 mm, subcompressed, wingless. Fl. and fr. May–August.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: 3200–5000 m.

Ecology: Mountain slopes, grassy areas, ravines, stony slopes, scree, alpine grasslands.

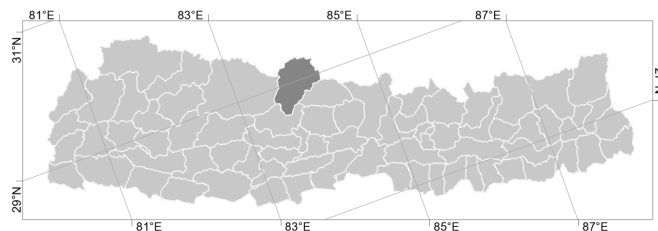
Flowering: May–August. **Fruiting:** May–August.

21. *Draba stenocarpa* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 153 (1861).

Draba media Litv.; *D. media* var. *lasiocarpa* Lipsky; *D. media* var. *leiocarpa* Lipsky; *D. stenocarpa* var. *leiocarpa* (Lipsky) L.L.Lou; *D. stenocarpa* var. *media* (Litv.) O.E.Schulz; *D. stenocarpa* var. *media* subvar. *leiocarpa* O.E.Schulz.

Annual herbs, (5–)12–45(–50) cm. Stems solitary or few from base, erect, simple or few-branched near base, densely hirsute basally with subsetose simple trichomes to 1.5 mm, these rarely mixed with fewer, smaller, stalked forked trichomes, glabrous along distal half. Basal leaves rosulate, subsessile; leaf blade oblong-obovate to narrowly oblong, (0.5–)0.8–3.5(–4.2) cm × 2–8(–12) mm, base cuneate, apex subobtusate, margin entire or 1–3-toothed, ciliate with simple trichomes, with predominantly simple trichomes mixed with fewer, stalked forked ones above, densely subhirsute below with long-stalked, 3- or 4-rayed stellate trichomes with simple rays, sometimes with a few simple trichomes. Cauline leaves 2–4(–6), sessile, oblong-ovate to oblong-lanceolate, apex obtuse to subacute, margin entire or minutely 1–3-toothed, with indumentum as basal leaves. Racemes (4–)10–50(–60)-flowered, ebracteate, elongated considerably in fruit; rachis straight. Sepals ovate-oblong, 1.5–2 × ca. 1 mm, erect, hirsute below with simple trichomes, base of lateral pair not saccate, margin narrowly membranous. Petals yellow, spatulate, 3–4 × 1–1.5 mm, apex subemarginate. Filaments 1.5–2 mm; anthers ovate, 0.2–0.3 mm. Seeds and aborted ovules (30–)36–60(–72) per fruit. Fruiting pedicels (0.1–)0.5–1.8(–2.5) cm, divaricate, slightly curved upward or straight, slender, glabrous. Fruit linear, (0.6–)0.9–2(–2.5) cm × 1.5–2.5 mm, not inflated, latiseptate, not twisted, straight or slightly curved; valves antrorsely puberulent with simple trichomes rarely mixed with forked ones, very rarely glabrous, with obscure midvein, base and apex subobtusate; style 0.1–0.2 mm. Seeds brown, ovate, 0.7–1 × 0.4–0.5 mm.

Distribution: Nepal, W Himalaya, Tibetan Plateau, E Asia, C Asia and SW Asia.



Altitudinal range: 2500–5000 m.

Ecology: Sandy areas on river sides, shady rocky areas, stony slopes, moist flats, forest margins.

Flowering: June–August. **Fruiting:** June–August.

This first record from Nepal is based on *Kriechbaum & Holtner s.n.* (WHB), from Pandag Valley, Lower Mustang.

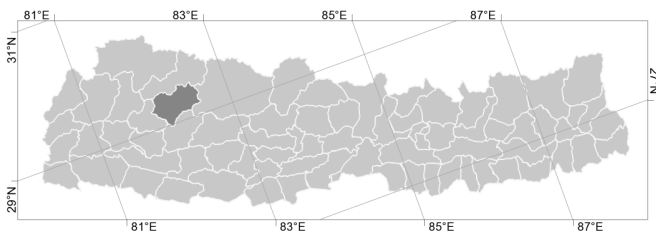
Cruciferae

22. *Draba eriopoda* Turcz., Bull. Soc. Imp. Naturalistes Moscou 15: 260 (1842).

Draba eriopoda Turcz. nom. inval.; *D. eriopoda* var. *kamensis* Pohle; *D. eriopoda* var. *sinensis* Maxim.; *D. pingwuensis* Z.M.Tan & S.C.Zhou.

Annual herbs, 4–45(–60) cm. Stems erect, simple or rarely branched above middle, sparsely to densely pubescent with a mixture of simple and subsessile stellate and forked trichomes, sometimes glabrous distally. Basal leaves subrosulate, often withered by time of flowering. Cauline leaves (5–)10–24(–30), sessile; leaf blade ovate, oblong, elliptic, or lanceolate, 0.5–2.7(–4.2) cm × 1.5–7(–15) mm, base cuneate to obtuse, apex acute, margin 1–6(–10)-toothed on each side, pubescent below with primarily 4-forked, short-stalked stellate trichomes, strigose above with simple trichomes mixed with fewer forked and smaller stellate ones. Racemes 10–45(–65)-flowered, ebracteate, elongated in fruit. Sepals oblong or ovate, 1–1.8(–2) × 0.6–0.8 mm, erect, pilose below with simple trichomes, base of lateral pair not saccate, margin membranous. Petals yellow, spatulate or narrowly obovate, 2–3(–3.5) × (0.5–)0.8–1 mm, apex emarginate; claw to 1 mm. Filaments 1–2 mm; anthers ovate, 0.1–0.2(–0.3) mm. Seeds and aborted ovules 10–24(–28) per fruit. Fruiting pedicels (0.2–)5–13(–22) mm, divaricate, straight, pubescent all around, glabrous above, or glabrous. Fruit ovate, (3–)4–9(–10) × 2–3(–4) mm, often erect, latiseptate, not twisted; valves glabrous or rarely sparsely puberulent, obscurely veined, base obtuse, apex acute; style obsolete, rarely to 0.2 mm. Seeds brown, ovate, 0.8–1.3 × 0.5–0.9 mm.

Distribution: Nepal, E Himalaya, Tibetan Plateau, E Asia and N Asia.



Altitudinal range: 3500–4000 m.

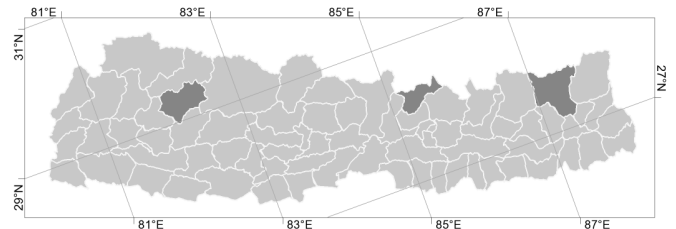
Ecology: Rocky slopes, grasslands, scrub, moist stream-sides, limestone cliffs, forests, river valleys.

Flowering: June–September. **Fruiting:** June–September.

23. *Draba ellipsoidea* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 153 (1861).

Annual herbs, (0.5–)2–12(–17) cm. Stems erect to ascending, simple, slender, flexuous, densely pubescent with short-stalked to subsessile stellate trichomes, usually glabrous distally. Basal leaves not rosulate, soon withered. Cauline leaves 3–12, obovate, elliptic-oblong, or lanceolate, (0.2–)0.5–2(–3) cm × (1.5–)3–8(–10) mm, cuneate to attenuate into a petiole-like base to 5 mm, apex obtuse or acute, margin entire or denticulate, pubescent on both surfaces with short-stalked, 4-rayed, stellate trichomes, sometimes with primarily simple trichomes mixed with fewer, forked or stellate ones above. Racemes (2–)4–10(–15)-flowered, ebracteate, lax and elongated in fruit. Sepals oblong, 0.9–1.4 × 0.4–5 mm, erect, pubescent below with simple trichomes sometimes mixed with fewer forked ones, base of lateral pair not saccate, margin not membranous. Petals white, narrowly spatulate, 0.6–1 × 0.1–0.2 mm, apex obtuse or subretuse; claw absent. Filaments 0.7–1 mm; anthers ovate, to 0.1 mm. Ovules 10–18(–22) per ovary. Fruiting pedicels (1–)3–10(–18) mm, ascending, straight, glabrous or pubescent all around with subsessile, 3- or 4-rayed stellate trichomes, slender. Fruit oblong, oblong-elliptic, or rarely suborbicular, (2–)4–8 × (1–)2–3(–4) mm, latiseptate, not twisted; valves puberulent with exclusively subsessile stellate trichomes, or with a mixture of stellate, forked, and simple trichomes, rarely only sparsely ciliate at margin, base and apex obtuse to rounded; style obsolete. Seeds blackish, ovate, 0.7–0.9 × 0.5–0.7 mm, slightly compressed, wingless.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: 3100–5400 m.

Ecology: Scree slopes, stream-sides, woods, pastures, alpine ledges, meadows, scrub.

Flowering: June–October. **Fruiting:** June–October.

5. *Brassica* L., Sp. Pl. 2: 666 (1753).

Annual, biennial, or perennial herbs, often glaucous. Trichomes absent or simple. Stems erect or ascending, simple or branched. Basal leaves petiolate, rosulate or not, simple, entire, dentate, lyrate-pinnatifid, or pinnatisect. Cauline leaves petiolate or sessile, base cuneate, attenuate, auriculate, sagittate, or amplexicaul, margin entire, dentate, or lobed. Racemes ebracteate, elongated in fruit. Fruiting pedicels straight, divaricate, or reflexed. Sepals ovate or oblong, erect, ascending, spreading, base of lateral pair saccate or not. Petals yellow, whitish-yellow or white, obovate, ovate to elliptic, apex rounded to emarginate; claw distinct, subequalling or longer than sepals. Stamens 6, tetradynamous; anthers oblong, obtuse at apex. Nectar glands 4, median and lateral, rarely 2 and lateral. Ovules 4–50 per ovary. Fruit dehiscent siliques, linear or rarely oblong, terete, 4-angled, or latiseptate, sessile or shortly stipitate,

segmented; lower segment dehiscent, 4–46-seeded, longer than upper segment, smooth or torulose, valves with a prominent midvein and obscure lateral veins; distal segment seedless or 1(–3)-seeded; replum rounded; septum complete, translucent or opaque, veinless or with a distinct midvein; style obsolete or sterile terminal segment style-like; stigma capitate, entire or 2-lobed. Seeds uniseriate or rarely biseriate, wingless, globose or rarely oblong, plump or rarely slightly flattened; seed coat reticulate, mucilaginous or not when wetted; cotyledons conduplicate.

Worldwide 35 species, primarily in Mediterranean region, especially SW Europe and NW Africa. Four species in Nepal.

Key to Species

- 1a Upper cauline leaves petiolate or subsessile, base not auriculate, amplexicaul, or cordate2
- b Upper cauline leaves sessile, base minutely auriculate to amplexicaul or deeply cordate3
- 2a Fruit strongly 4-angled, subappressed to rachis, (0.5–)1–2.5(–2.7) cm. Fruiting pedicels (2–)3–5(–6) mm..... **3 B. nigra**
- b Fruit terete, obscurely 4-angled, or slightly flattened, divaricate or ascending, (1.5–)2–4.5(–5) cm. Fruiting pedicels (5–)8–18(–20) mm..... **4 B. juncea**
- 3a Plants glabrous throughout. Sepals erect. All filaments erect at base. Petals (1.5–)1.8–2.5(–3) cm **1 B. oleracea**
- b Plants at least sparsely pubescent basally. Sepals ascending or rarely suberect. Filaments of lateral stamens curved at base. Petals (0.5–)0.7–1(–1.3) cm **2 B. rapa**

1. *Brassica oleracea* L., Sp. Pl. 2: 667 (1753).

Biennial or perennial, rarely annual herbs, (0.3–)0.6–1.5(–3) m, glabrous, glaucous. Stems erect to decumbent, branched at or above middle, sometimes fleshy at base. Basal and lowermost cauline leaves long petiolate, sometimes strongly overlapping and forming a head; petiole to 30 cm; leaf blade ovate, oblong, or lanceolate in outline, to 40 × 15 cm, margin entire, repand, or dentate, sometimes pinnatifid to pinnatisect and with a large terminal lobe and 1–13, smaller, oblong to ovate lateral lobes on each side of midvein. Upper cauline leaves sessile or subsessile in some cultivated forms, oblanceolate, ovate, to oblong, to 10 × 4 cm, base amplexicaul, auriculate, or rarely cuneate, margin entire, repand, or rarely dentate. Racemes (in cultivated forms) sometimes fleshy and condensed into a head. Sepals oblong, 0.8–1.5 cm × 1.5–2.7 mm, erect. Petals creamy yellow or rarely white, (1.5–)1.8–2.5(–3) × (0.6–)0.8–1.2 cm, ovate to elliptic, apex rounded; claw 0.7–1.5 cm. Filaments 0.8–1.2 cm, lateral pair erect at base; anthers oblong, 2.5–4 mm. Fruiting pedicels usually straight, ascending to divaricate, (0.8–)1.4–2.5(–4) cm. Fruit linear, (2.5–)4–8(–10) cm × (2.5–)3–4(–5) mm, terete, sessile or on a gynophore to 3 mm, divaricate to ascending; basal segment (2–)3–7.5(–9) cm, 20–40-seeded, valves with a prominent midvein; distal segment conical, (3–)4–10 mm, seedless or 1(or 2)-seeded; style obsolete. Seeds dark brown or blackish, globose, 1.5–2.5 mm in diameter, minutely reticulate.

Distribution: Cosmopolitan.

Ecology: Cultivated.

Flowering: March–June. **Fruiting:** April–July.

Native of Europe and cultivated throughout the world. Wild populations of the species (var. *oleracea*) are known only from the coastal cliffs of W Europe. Of the 15 varieties and 16 forms recognized by Helm (Kulturpflanze 11: 92–210. 1963), five varieties are cultivated in Nepal. Although these taxa are

widely grown they are very rarely recorded nor do they persist outside cultivation, and so no distribution maps are given.

- 1a Young raceme fleshy, forming compact, globose to obconical head2
- b Young raceme not fleshy, never compact, open, not forming heads3
- 2a Flower buds white, densely and tightly compact. Rachis and pedicels white..... var. **botrytis**
- b Flower buds green, somewhat loosely grouped. Rachis and pedicels green..... var. **italica**
- 3a Stem base fleshy, globose var. **gongylodes**
- b Stem base not fleshy, cylindric or narrowly conical.....4
- 4a Basal and lower cauline leaves numerous, densely or somewhat loosely grouped in heads. Axillary buds not forming small heads var. **capitata**
- b Basal and lower cauline leaves few to several, widely spaced, not forming heads. Axillary buds forming small, globose or obovoid heads var. **gemmifera**

Brassica oleracea var. **capitata** L., Sp. Pl. 2: 667 (1753).
Brassica capitata (L.) H.Lév.

बन्दागोभी Bandagobhi (Nepali).

Stem base highly shortened, not fleshy, conical. Basal and lower cauline leaves, numerous, strongly overlapping into a compact, globose, oblong, or rarely subconical, closed, apically rounded or flattened head. Axillary buds not forming heads. Raceme neither fleshy nor condensed into a head.

Cruciferae

Widely cultivated as a vegetable. Cabbage.

Brassica oleracea* var. *botrytis L., Sp. Pl. 2: 667 (1753).

फूलगोभी Phulgobhi (Nepali).

Stem base elongated, not fleshy, cylindric. Basal and lower cauline leaves few to several, widely spaced, not grouped into a head. Axillary buds not forming heads. Raceme white, compact, often globose, with fleshy peduncle, rachis, pedicels and flowers.

Widely cultivated as a vegetable. Cauliflower.

Brassica oleracea* var. *italica Plenck, Icon. Pl. Med. 6 (1794).

ब्रोकाउली Brokauli (Nepali).

Stem base elongated, not fleshy, cylindric. Basal and lower cauline leaves few to several, widely spaced, not grouped into a head. Axillary buds not forming heads. Raceme green, somewhat loose, usually obconical, with fleshy peduncle, rachis, pedicels and flowers.

Cultivated occasionally as a vegetable. Broccoli.

Brassica oleracea* var. *gemmifera (DC.) Zenker, Fl. Thüringen.

Brassica oleracea var. *bullata* subvar. *gemmifera* DC., Syst. Nat. 2: 585 (1821); *Brassica gemmifera* (DC.) H.Lév.; *B. oleracea* subsp. *gemmifera* (DC.) Schwarz.

Stem base strongly elongated, not fleshy, cylindric. Basal and lower cauline leaves few to several, widely spaced, not overlapping into a head. Axillary buds forming small, subglobose to obovoid heads. Raceme neither fleshy nor condensed into a head.

Cultivated occasionally as a vegetable. Brussels sprouts.

Brassica oleracea* var. *gongylodes L., Sp. Pl. 2: 667 (1753). *Brassica caulorapa* (DC.) Pasq.; *B. oleracea* var. *caulorapa* DC.

ग्याँठगोभी Gyanthgobhi (Nepali).

Stem base highly shortened, fleshy, globose. Basal and lower cauline leaves numerous, strongly overlapping into a head. Axillary buds not forming heads. Raceme neither fleshy nor condensed into a head.

Cultivated occasionally as a vegetable. Kohlrabi.

2. *Brassica rapa* L., Sp. Pl. 1: 666 (1753).

Brassica campestris subsp. *rapa* (L.) Hook.f. & T.Anderson; *B. campestris* subsp. *rapifera* (Metzg.) Sinskaya; *B. campestris* var. *rapa* (L.) Hartm.; *B. rapa* subsp. *rapifera* Metzg.; *Raphanus rapa* (L.) Crantz.

Annual or biennial herbs, 30–120(–190) cm, glabrous or sparsely pubescent basally, rarely glaucous, sometimes with fleshy taproots. Stems erect, simple or branched above. Basal and lowermost cauline leaves petiolate, not rosulate or obscurely to strongly rosulate and forming a compact, oblong

head; petiole (1–)2–10(–17) cm, slender or thickened and fleshy, sometimes strongly winged; leaf blade ovate, oblong, or lanceolate in outline, (5–)10–40(–60) × 3–10(–20) cm, margin entire, repand, dentate, or sinuate, sometimes pinnatifid to pinnatisect and with a large terminal lobe and 1–6, smaller, oblong to ovate lateral lobes on each side of midvein. Upper cauline leaves sessile, ovate, oblong, or lanceolate, 2–8(–12) × 0.8–3 cm, base amplexicaul, deeply cordate, or auriculate, margin entire or repand. Sepals oblong, (3–)4–6.5(–8) × 1.5–2 mm, ascending. Petals bright yellow, rarely pale or whitish yellow, 7–10(–13) × (2.5–)3–6(–7) mm, obovate, apex rounded. Filaments 4–6(–7) mm, lateral pair curved at base; anthers oblong, 1.5–2 mm. Fruiting pedicels straight, ascending to divaricate, (0.5–)1–2.5(–3) cm. Fruit linear, (2–)3–8(–11) cm × 2–4(–5) mm, terete, sessile, divaricate to ascending; basal segment (1.3–)2–5(–7.5) cm, 16–305-seeded, valves with a prominent midvein; distal segment conical, (0.3–)1–2.5(–3.5) cm, seedless or rarely 1-seeded; style obsolete. Seeds dark to reddish brown, globose, 1–1.8 mm in diameter, minutely reticulate.

Distribution: Asia, Europe and Africa.

Ecology: Cultivated, sometimes escaping.

Flowering: March–May. **Fruiting:** May–July.

Widely cultivated in Asia, Europe and elsewhere, sometimes escaping and semi-naturalized, but not persisting and so no distribution maps are given. Forms with three of four valves have been recognized as *Brassica trilocularis* Roxb. and *B. quadrivalvis* Hook.f. & Thomson, respectively. They were treated by Jafri (Fl. W. Pakistan 55: 24. 1973) as subspecies of *B. napus* L., but both have $2n = 20$, and therefore they should be reduced to synonymy of or, at most, treated as a variety of *B. rapa*. Of the six varieties generally recognized in *B. rapa*, the following two occur in Nepal.

- 1a Taproot fleshy, napiform; plants biennial var. ***rapa***
- b Taproot not fleshy, cylindric; plants annual or rarely biennial var. ***oleifera***

Brassica rapa L. var. ***rapa***

गान्तेमूला Gantemula (Nepali).

Biennial herbs. Taproot expanded, fleshy, napiform. Basal leaves rosulate; petiole slender; leaf blade lyrate-pinnatifid or rarely sinuate-dentate.

Cultivated for its fleshy roots. Turnip.

Brassica rapa* var. *oleifera DC., Syst. Nat. 2: 591 (1821). *Brassica asperifolia* Lam.; *B. asperifolia* var. *sylvestris* Lam.; *B. campestris* L.; *B. campestris* subsp. *nipposinica* (L.H.Bailey) G.Olsson; *B. campestris* subsp. *oleifera* Schübl. & Mart.; *B. campestris* var. *dichotoma* (Roxb.) G.Watt; *B. campestris* var. *oleifera* DC.; *B. campestris* var. *sarson* Prain; *B. chinensis* var. *angustifolia* B.S.Sun; *B. chinensis* var. *utilis* Tsen & S.H.Lee; *B. dichotoma* Roxb. ex Fleming nom. nud.; *B. dubiosa*

L.H.Bailey; *B. japonica* Makino; *B. napus* var. *dichotoma* (Roxb.) Prain; *B. napus* var. *quadrivalvis* (Hook.f. & Thomson) O.E.Schulz; *B. napus* var. *trilocularis* (Roxb.) O.E.Schulz; *B. perviridis* (L.H.Bailey) L.H.Bailey; *B. quadrivalvis* Hook.f. & Thomson; *B. rapa* subsp. *campestris* (L.) A.R.Clapham; *B. rapa* subsp. *nipposinica* (L.H.Bailey) Hanelt; *B. rapa* subsp. *oleifera* (DC.) Metzg.; *B. rapa* subsp. *sylvestris* (Lam.) Janch.; *B. rapa* var. *campestris* (L.) Peterm.; *B. rapa* var. *chinoleifera* Kitam.; *B. rapa* var. *dichotoma* Kitam.; *B. rapa* var. *perviridis* L.H.Bailey; *B. rapa* var. *quadrivalvis* (Hook.f. & Thomson) Kitam.; *B. rapa* var. *trilocularis* (Roxb.) Kitam.; *B. trilocularis* (Roxb.) Hook.f. & Thomson; *Sinapis dichotoma* Roxb.; *S. trilocularis* Roxb.; *S. trilocularis* Roxb. nom. nud.

तोरी Tori (Nepali).

Annual or rarely biennial herbs. Taproot not fleshy, cylindric. Basal leaves not rosulate or obscurely so; petiole slender; leaf blade subentire, sinuately lobed, pinnatifid, or incised with irregularly serrate lobes.

Fig. 4a-c

Forms of subsp. *oleifera* with three or four-valved fruits have been recognized as var. *trilocularis* and var. *quadrivalvis*, respectively. However, these forms are only anomalies that do not merit recognition. Although var. *oleifera* is often found as an escape from cultivation it does not truly naturalize, so a distribution map is not included here.

Widely cultivated in Asia as a source of seed oil, but also grown as a vegetable. Rapeseed.

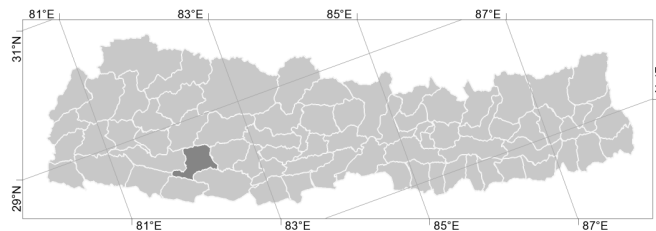
3. *Brassica nigra* (L.) W.D.J.Koch, *Deutschl. Fl.*, ed. 3, 4: 713 (1833).

Sinapis nigra L., *Sp. Pl.* 2: 668 (1753); *Sisymbrium nigrum* (L.) Prantl.

कालो तोरी Kalo tori (Nepali).

Annual herbs, 0.3–2(–3.1) m, sparsely hirsute at least basally. Stems erect, branched above. Basal and lowermost cauline leaves long petiolate; petiole to 10 cm; leaf blade ovate, oblong, or lanceolate in outline, 6–30 × 1–10 cm, lyrate-pinnatifid to pinnatisect; terminal lobe ovate, dentate; lateral lobes 1–3 on each side of midvein, much smaller than terminal lobe, dentate. Upper cauline leaves petiolate, lanceolate to linear-oblong, to 5 × 1.5 cm, cuneate, margin entire or rarely dentate. Sepals oblong, 4–6(–7) cm × 1–1.5 mm, spreading to ascending. Petals yellow, (6–)7.5–11(–13) × (2.5–)3–4.5(–5.5) mm, ovate, apex rounded; claw 3–6 mm. Filaments 3.5–5 mm; anthers oblong, 1–1.5 mm. Fruiting pedicels straight, slender, erect to ascending, subappressed to rachis, (2–)3–5(–6) mm. Fruit linear or narrowly oblong-elliptic, (0.5–)1–2.5(–2.7) cm × (1.5–)2–3(–4) mm, 4-angled, sessile, subappressed to rachis; basal segment (0.4–)0.8–2(–2.5) cm, 4–10(–16)-seeded, slightly torulose, valves with a prominent midvein; distal segment style-like, sometimes narrowly conical, (1–)2–5(–6) mm, seedless. Seeds dark brown, grey, or blackish, globose, 1.2–2 mm in diameter, minutely reticulate.

Distribution: Asia, Europe and Africa.



Altitudinal range: 900–2800 m.

Ecology: Slopes, steppes, field margins.

Flowering: April–July. **Fruiting:** April–July.

Black mustard. Cultivated and frequently naturalized, but under recorded in Nepal.

Tender leaves and shoots are cooked as vegetable or fermented to make gundruk.

4. *Brassica juncea* (L.) Czern. & Coss., in Czern., *Consp. Pl. Charc.*: 8 (1859).

Sinapis juncea L., *Sp. Pl.* 2: 668 (1753); *Brassica argyri* H.Lév.; *B. integrifolia* (H.West) O.E.Schulz; *B. integrifolia* (A.Stokes) Rupr. nom. nud.; *B. japonica* (Thunb.) Siebold; *B. juncea* subsp. *integrifolia* (H.West) Thell.; *B. juncea* subsp. *rugosa* (Roxb.) Prain; *B. juncea* var. *crispifolia* L.H.Bailey; *B. juncea* var. *cuneifolia* (Roxb.) Kitam.; *B. juncea* var. *foliosa* L.H.Bailey; *B. juncea* var. *gracilis* Tsen & S.H.Lee; *B. juncea* var. *integrifolia* (A.Stokes) Sinskaya; *B. juncea* var. *japonica* (Thunb.) L.H.Bailey; *B. juncea* var. *longidens* L.H.Bailey; *B. juncea* var. *longipes* Tsen & S.H.Lee; *B. juncea* var. *multiceps* Tsen & S.H.Lee; *B. juncea* var. *multisecta* L.H.Bailey; *B. juncea* var. *rugosa* (Roxb.) Kitam.; *B. juncea* var. *strumata* Tsen & S.H.Lee; *B. juncea* var. *subintegrifolia* Sinskaya; *B. lanceolata* (DC.) A.E.Lange; *B. napiformis* var. *multisecta* (L.H.Bailey) A.I.Baranov; *B. rugosa* (Roxb.) L.H.Bailey; *B. rugosa* var. *cuneifolia* Prain; *B. taquetii* H.Lév.; *B. wildenowii* Boiss.; *Raphanus junceus* (L.) Crantz; *Sinapis cernua* Poir.; *S. chinensis* var. *integrifolia* A.Stokes; *S. cuneifolia* Roxb. nom. nud.; *S. cuneifolia* Roxb.; *S. integrifolia* H.West; *S. japonica* Thunb.; *S. lanceolata* DC.; *S. patens* Roxb.; *S. ramosa* Roxb.; *S. rugosa* Roxb. nom. nud.; *S. rugosa* Roxb.

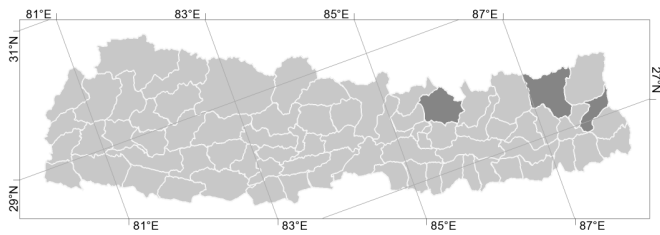
रायो Rayo (Nepali).

Annual herbs, (20–)30–100(–180) cm, pubescent or rarely glabrous, glaucous or not, sometimes with fleshy taproots. Stems erect, branched above. Basal and lowermost cauline leaves long petiolate; petiole (1–)2–8(–15) cm; leaf blade ovate, oblong, or lanceolate in outline, (4–)6–30(–80) × 1.5–15(–28) cm, lyrate-pinnatifid to pinnatisect; terminal lobe ovate, repand, dentate, or incised; lateral lobes 1–3 on each side of midvein, much smaller than terminal lobe, crisped incised, dentate, repand, or entire. Upper cauline leaves petiolate or subsessile, oblanceolate, oblong, lanceolate, or linear, to 10 × 5 cm, base cuneate to attenuate, margin entire or repand, rarely dentate. Petals yellow, (6.5–)8–11(–13) × 5–7.5 mm, ovate to obovate, apex rounded to emarginate; claw 3–6 mm. Filaments 4–7 mm; anthers oblong, 1.5–2 mm. Fruiting pedicels straight, divaricate, (0.5–)0.8–1.5(–2) cm. Sepals

Cruciferae

oblong, (3.5–)4–6(–7) × 1–1.7 mm, spreading. Fruit linear, (2–)3–5(–6) cm × 3–4(–5) mm, terete or slightly 4-angled, sessile, divaricate to ascending; basal segment (1.5–)2–4.5 cm, 12–30(–40)-seeded, slightly torulose, valves with a prominent midvein; distal segment conical, (4–)5–10(–15) mm, seedless; style obsolete. Seeds dark to light brown or grey, globose, 1–1.7 mm in diameter, minutely reticulate.

Distribution: Asia and Europe.



Altitudinal range: 1000–3500 m.

Ecology: Fields, waste places, roadsides. Cultivated throughout Nepal, sometimes an escape from cultivation.

Flowering: March–June. **Fruiting:** April–July.

Schulz (Pflanzen. IV. 105(Heft 70): 59. 1919) partially misapplied the name *Brassica cernua* (Thunb.) F.B.Forbes & Hemsl. to this species.

Cultivated and widely naturalized, but under recorded in Nepal.

Mustard greens, cooked as a vegetable.

6. *Diplotaxis* DC., Mem. Mus. Hist. Nat. 7: 243 (1821).

Perennial herbs. Trichomes absent or simple. Stems erect or ascending, rarely procumbent. Basal leaves petiolate, rosulate or not, dentate, lyrate, pinnatifid, or pinnatisect, rarely bipinnatifid. Cauline leaves petiolate or sessile and sometimes auriculate. Racemes ebracteate or rarely lowermost flowers bracteate, elongated in fruit. Sepals oblong or linear, erect or spreading, base of lateral pair often not saccate. Petals yellow, obovate, apex obtuse or emarginate; clawed. Stamens 6, tetradynamous; filaments not dilated at base; anthers oblong, obtuse at apex. Nectar glands 4; median glands large; lateral glands smaller. Ovules 60–120 per ovary. Fruiting pedicels ascending, divaricate, or reflexed. Fruit dehiscent siliques, linear, latiseptate or terete, glabrous, sessile or long stipitate, unsegmented or segmented; proximal segment well developed, dehiscent, numerous seeded, much longer than distal segment, torulose, with a distinct midvein; distal segment indehiscent, seedless or 1- or 2-seeded; replum rounded; septum complete; style obsolete or to 2 mm; stigma capitate, entire or 2-lobed. Seeds biseriate, wingless, oblong, ovoid, or ellipsoid, slightly flattened; seed coat smooth or minutely reticulate, slightly mucilaginous or not mucilaginous when wetted; cotyledons conduplicate.

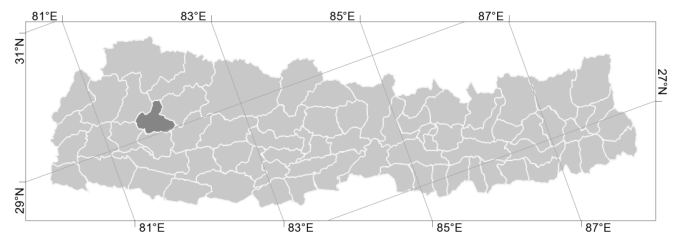
Worldwide about 25 species in NW Africa, Macaronesia, and Europe, extending into C Asia. One species in Nepal.

1. *Diplotaxis harra* (Forssk.) Boiss., Fl. Orient. 1: 388 (1867).

Sinapis harra Forssk., Fl. Aegypt.-Arab.: 118 (1775); *Diplotaxis nepalensis* H.Hara.

Herbs, (10–)20–60(–80) cm, glabrous or hirsute basally with simple trichomes. Basal leaves rosulate; petiole 0.5–2.5(–4) cm; leaf blade obovate, spatulate, oblanceolate, or ovate, (1–)2–10(–13) × (0.5–)1–3(–4) cm, base cuneate to attenuate, apex acute or obtuse, margin dentate, sinuate, or lyrate, rarely subentire. Cauline leaves short petiolate to sessile, not auriculate, smaller than basal ones. Fruiting pedicels slender, divaricate or reflexed, arcuate or straight, (0.6–)0.8–1.5(–2.3) cm. Sepals narrowly oblong, 4–7 × 1.5–2 mm, pubescent or rarely glabrous. Petals yellow, obovate, (7–)8–13 × 3–5 mm, cuneate to a short claw. Filament 4–6 mm; anthers oblong, 1.5–2.5 mm. Ovules 66–120 per ovary. Fruit (2–)2.5–4(–4.5) cm × 2–3 mm, usually deflexed, compressed, slightly torulose; gynophore 1–4 mm; style stout, beaklike, obsolete or to 2 mm; stigma 2-lobed. Seeds ovoid or ellipsoid, 0.6–0.9 × 0.4–0.5 mm. Fig. 2d

Distribution: Nepal, W Himalaya, SW Asia, Europe and Africa.



Altitudinal range: 1000–1200 m.

Ecology: Cliffs, sandy areas.

Flowering: April–August. **Fruiting:** April–August.

7. *Raphanus* L., Sp. Pl. 2: 669 (1753).

Annual or biennial herbs, glabrous, scabrous or hispid. Trichomes simple. Stems erect or prostrate, simple or branched. Basal leaves petiolate, rosulate or not, simple, dentate, lyrate, pinnatifid, or pinnatisect. Cauline leaves similar to basal, petiolate or uppermost subsessile. Racemes several-flowered, ebracteate, elongated in fruit. Sepals oblong or linear, erect, base of lateral pair saccate. Petals, white, pink, or purple, usually with darker veins, obovate or suborbicular, apex rounded or emarginate; claw subequalling or longer than sepals. Stamens 6, strongly tetradynamous; filaments not dilated at base; anthers oblong or oblong-linear, obtuse at apex. Nectar glands 4; median pair oblong; lateral pair prismatic. Ovules 2–22 per ovary. Fruiting pedicels divaricate to ascending. Fruit indehiscent siliques or silicles, often lomentaceous, breaking into 1-seeded units, linear, oblong, ovoid, ellipsoid, or lanceolate, terete or polygonal, sessile, segmented; proximal segment rudimentary, seedless, as thick as or slightly thicker than pedicel, or absent; distal segment few- to many seeded, wingless, corky, smooth to slightly torulose, not ribbed, antrorsely or retrorsely scabrous, or glabrous; replum absent; septum absent; style prominent; stigma capitate, entire or slightly 2-lobed. Seeds uniseriate, wingless, globose to ovoid; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons conduplicate.

Worldwide three species native to the Mediterranean region. One species in Nepal.

1. *Raphanus sativus* L., Sp. Pl. 2: 669 (1753).

Raphanus acanthiiformis J.M.Morel; *R. chinensis* Mill.; *R. macropodus* H.Lév.; *R. niger* Mill.; *R. raphanistroides* (Makino) Nakai; *R. raphinastrium* var. *sativus* (L.) Domin; *R. sativus* forma *raphanistroides* Makino; *R. sativus* var. *hortensis* Backer; *R. sativus* var. *macropodus* (H.Lév.) Makino; *R. sativus* var. *raphanistroides* (Makino) Makino.

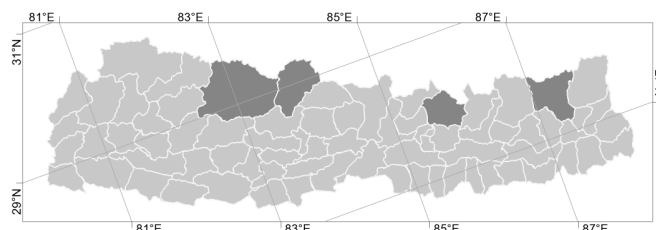
मूला Mula (Nepali).

Herbs, 10–130 cm, Roots fleshy, white, pink, red, or black, linear, fusiform, oblong, or globose, 1–100 × 0.5–45 cm. Stems simple or branched. Basal leaves with petioles 1–30 cm; leaf blade oblong, obovate, oblanceolate, or spatulate in outline, lyrate to pinnatisect, sometimes undivided, 2–60 × 1–20 cm, apex obtuse to acute, margin dentate; lateral lobes 1–12 on each side of midvein, sometimes absent, oblong to ovate, to 10 × 5 cm. Uppermost cauline leaves subsessile, often undivided, dentate. Sepals narrowly oblong, 6–10 × 1–2 mm, glabrous or sparsely pubescent. Petals purple, pink, or sometimes white, often with darker veins, broadly obovate, 1.2–2.2 cm × 3–8 mm, apex obtuse to emarginate; claw to 1.4 cm. Filaments slender, 5–12 mm; anthers 1.5–2 mm, sagittate at base. Fruiting pedicels, straight, 0.5–4 cm. Fruits fusiform to lanceolate, sometimes ovoid or cylindric; seedless proximal segment 1–3.5 cm; seed-bearing distal segment (1–)3–15(–25) × (0.5–)0.7–1.3(–1.5) cm, corky, rounded at base, conical at apex, smooth or rarely slightly constricted between seeds, not

ribbed; style 1–4 cm; stigma entire. Seeds, 2.5–4 mm in diameter.

Fig. 2e

Distribution: Cosmopolitan.



Altitudinal range: 300–3100 m.

Ecology: Fields, roadsides, waste areas.

Flowering: All year. **Fruiting:** All year.

A very variable species with regards to size, colour, and shape of fleshy roots, plant height, size and degree of division of leaves, flower colour, and fruit shape and size. Numerous infraspecific taxa have been recognized, and their taxonomy is controversial and highly confused. The interested reader should consult Pistrick (Kulturpflanze 35: 225–321. 1987).

Cultivated worldwide, primarily as a vegetable and often naturalized. Radish.

8. *Arabidopsis* (DC.) Heynh. nom cons., in Holl & Heynh., Fl. Sachsen 1: 538 (1842).

Cardaminopsis (C.A.Mey.) Hayek; *Hylandra* Å.Löve.

Annual herbs with stolons or woody caudex. Trichomes simple, mixed with stalked, 1–3-forked ones. Stems erect, often several from base, usually glabrous above. Basal leaves rosulate, entire, toothed, or pinnately lobed. Cauline leaves subsessile, entire, dentate, or rarely lyrate. Racemes few- to several-flowered, ebracteate. Sepals oblong, erect or ascending, glabrous or pubescent, base of lateral pair not saccate. Petals white, spatulate, apex obtuse or emarginate; claw distinct or not. Stamens 6, erect, slightly tetradynamous; filaments not dilated basally; anthers oblong, obtuse. Nectar glands confluent, subtending bases of filaments. Ovules 15–80 per ovary. Fruiting pedicels ascending or divaricate or slightly reflexed. Fruit dehiscent siliques, linear, terete, shortly stipitate or subsessile; valves papery, midvein distinct, glabrous, smooth or somewhat torulose; replum rounded; septum complete; style obsolete or to 1 mm; stigma

Cruciferae

capitate, entire. Seeds numerous, uniseriate, wingless or margined, ellipsoid, plump; seed coat minutely reticulate, mucilaginous or not when wetted; cotyledons incumbent.

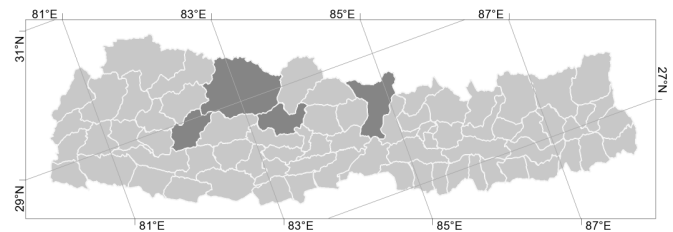
Worldwide nine species in Eurasia and N America. One species in Nepal.

1. *Arabidopsis thaliana* (L.) Heynh., Fl. Sachsen 1: 538 (1842).

Arabis thaliana L., Sp. Pl. 2: 665 (1753); *Sisymbrium thalianum* (L.) J.Gay & Monnard.

Herbs, (2–)5–30(–50) cm. Stems erect, 1 or few from base, simple or branched above, basally with predominantly simple trichomes, apically glabrous. Basal leaves short petiolate; leaf blade obovate, spatulate, ovate, or elliptic, 0.8–3.5(–4.5) cm × (1–)2–10(–15) mm, apex obtuse, margin entire to repand or dentate, with predominantly simple and stalked 1-forked trichomes above. Cauline leaves sessile, usually few; blade lanceolate, linear, oblong, or elliptic, (0.4–)0.6–1.8(–2.5) cm × 1–6(–10) mm, entire or rarely few-toothed. Sepals 1–2(–2.5) mm, glabrous or distally sparsely with simple hairs, inner pair not saccate. Petals white, spatulate, 2–3.5 × 0.5–1.5 mm, base attenuate to a short claw. Filaments white, 1.5–2 mm. Fruiting pedicels slender, divaricate, straight, 3–10(–15) mm. Fruit linear, terete, smooth, (0.8–)1–1.5(–1.8) cm × 0.5–0.8 mm; valves with a distinct midvein; style to 0.5 mm. Seeds ellipsoid, plump, light brown, 0.3–0.5 mm.
Fig. 4d-f

Distribution: Asia, Europe, Africa and N America.



Altitudinal range: 300–4200 m.

Ecology: Plains, mountain slopes, river banks, roadsides.

Flowering: January–June(–October). **Fruiting:** January–June(–October).

The most widely studied flowering plant and considered to be the model organism for studies in genetics, development, physiology, biochemistry, and related fields. A naturalized weed throughout much of the world and under recorded in Nepal.

9. *Capsella* Medik., Pfl.-Gatt.: 85 (1792).

Annual or biennial herbs. Trichomes sessile and stellate, sometimes mixed with simple or forked ones. Stems erect. Basal leaves rosulate, simple, usually pinnately lobed, lyrate, or runcinate, rarely entire or toothed. Cauline leaves sessile, saggitate to amplexicaul or rarely auriculate, entire, dentate, or sinuate. Racemes many-flowered, ebracteate. Sepals oblong, erect or ascending, glabrous or pubescent, base of lateral pair not saccate. Petals white, rarely pinkish or yellowish, much longer or shorter than sepals, obovate, apex obtuse; claw distinct from blade. Stamens 6, erect, tetradynamous; filaments not dilated at base; anthers ovate, obtuse at apex. Median glands absent; lateral glands 1 on each side of lateral stamen. Ovules (12–)20–40 per ovary. Fruiting pedicels slender, divaricate. Fruit dehiscent silicles, obdeltoid to obdeltoid-obcordate, strongly flattened and angustiseptate, sessile; valves papery, prominently veined, strongly keeled; replum rounded; septum complete; style less than 1 mm, included or exerted from apical notch; stigma capitate, entire. Seeds uniseriate, wingless, oblong, plump; seed coat reticulate, mucilaginous when wetted; cotyledons incumbent.

Worldwide one species, a cosmopolitan weed.

1. *Capsella bursa-pastoris* (L.) Medik., Pfl.-Gatt.: 85 (1792). *Thlaspi bursa-pastoris* L., Sp. Pl. 2: 647 (1753).

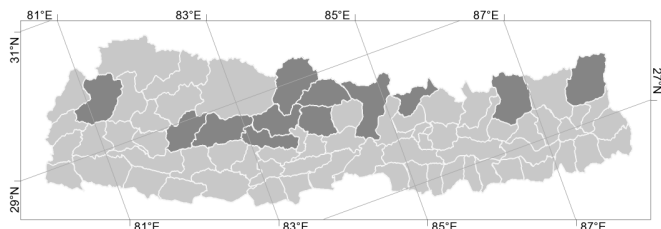
चाल्ने Chalne (Nepali).

Herbs (2–)10–50(–70) cm, sparsely to densely pubescent with sessile 3–5-rayed stellate hairs often mixed near base of plant with much longer simple trichomes. Stems erect, simple or branched. Basal leaves rosulate; petiole 0.5–4(–6) cm; leaf

blade oblong to oblanceolate, (0.5–)1.5–10(–15) × 0.2–2.5(–5) cm, base cuneate to attenuate, apex acute to acuminate, margin pinnatisect, pinnatifid, runcinate, lyrate, dentate, repand, or entire. Cauline leaves sessile, narrowly oblong to lanceolate or linear, 1–5.5(–8) cm × 1–15(–20) mm, margin entire to dentate. Sepals green or reddish, 1.5–2 × 0.7–1 mm, margin membranous. Petals white, rarely pinkish or yellowish, obovate, (1.5–)2–4(–5) × 1–1.5 mm. Filaments white, 1–2 mm; anthers ovate, to 0.5 mm. Fruiting pedicels (3–)5–15(–20) mm, divaricate, usually straight, slender, glabrous. Fruit (3–)4–9(–

10) × (2–)3–7(–9) mm, flat, base cuneate, apex emarginate to truncate; valves with subparallel lateral veins, glabrous; style 0.2–0.7 mm. Seeds brown, 0.9–1.1 × 0.4–0.6 mm. Fig. 2f

Distribution: Cosmopolitan.



Altitudinal range: 100–4900 m.

Ecology: Roadsides, gardens, fields, waste areas, mountain slopes.

Flowering: April–July. **Fruiting:** April–July.

Cosmopolitan weed native of Europe and adjacent SW Asia. Under recorded in Nepal.

10. *Crucihimalaya* Al-Shehbaz, O'Kane & R.A.Price, Novon 9: 298 (1999).

Annual or biennial herbs, rarely perennial with a caudex. Trichomes simple and stalked, 1- or 2-forked, sometimes stellate. Stems erect or decumbent to ascending. Basal leaves rosulate or not, entire or dentate, rarely pinnately lobed. Cauline leaves sessile or subsessile, auriculate or not, sagittate or attenuate, entire, dentate, or rarely pinnately lobed, rarely absent. Racemes several- to many-flowered, ebracteate or bracteate. Sepals oblong, erect, pubescent, base of lateral pair not saccate. Petals white, lavender or purple, rarely pink, longer than sepals, spatulate to narrowly oblanceolate, rounded; claw obscurely distinct from blade. Stamens 6, erect, slightly tetradynamous; filaments not dilated at base; anthers ovate or oblong, obtuse at apex. Nectar glands confluent and subtending bases of filament. Ovules (30–)40–160 per ovary. Fruiting pedicels erect, ascending or divaricate. Fruit dehiscent siliques, linear, terete or somewhat 4-angled, rarely latiseptate, sessile or subsessile; valves with a distinct midvein, glabrous or densely pubescent, smooth or torulose; replum rounded; septum complete; style to 1 mm; stigma capitate, entire. Seeds uniseriate to sub-biseriate, wingless, oblong to subovoid, plump; seed coat minutely reticulate, mucilaginous when wetted; cotyledons incumbent.

Worldwide nine species in SW Asia, C Asia, E Asia, N Asia and the Himalayas. Five species in Nepal.

Key to Species

- 1a Fruit valves densely and coarsely stellate. Pedicels pubescent all around. Fruits often subappressed to rachis **1 *C. lasiocarpa***
- b Fruit valves glabrous or very rarely puberulent. Pedicels glabrous above, rarely (*C. wallichii*) pubescent all around. Fruits not appressed to rachis **2**
- 2a Cauline leaves distinctly auriculate or rarely sagittate at base **3 *C. himalaica***
- b Cauline leaves petiolate or sessile, neither auriculate nor amplexicaul at base (minutely auriculate in *C. wallichii*), sometimes absent **3**
- 3a Lowermost flowers of main raceme ebracteate. Basal leaves lyrate to pinnatifid, often canescent, persistent at time of flowering or fruiting **5 *C. wallichii***
- b Lowermost flowers of main raceme bracteate. Basal leaves entire to dentate, not canescent, withering by time of flowering or fruiting **4**
- 4a Cauline leaves with stellate stalked trichomes above, linear-lanceolate. Plants (18–)30–85(–120) cm. Only lowermost flowers of main raceme bracteate **2 *C. stricta***
- b Cauline leaves with simple and forked trichomes above, ovate to elliptic or oblong, rarely oblanceolate. Plants 4–15(–20) cm. Main raceme bracteate nearly throughout **4 *C. axillaris***

1. *Crucihimalaya lasiocarpa* (Hook.f. & Thomson) Al-Shehbaz, O'Kane & R.A.Price, Novon 9: 300 (1999). *Sisymbrium lasiocarpum* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 162 (1861); *Arabidopsis lasiocarpa* (Hook.f. & Thomson) O.E.Schulz; *A. lasiocarpa* var. *micrantha*

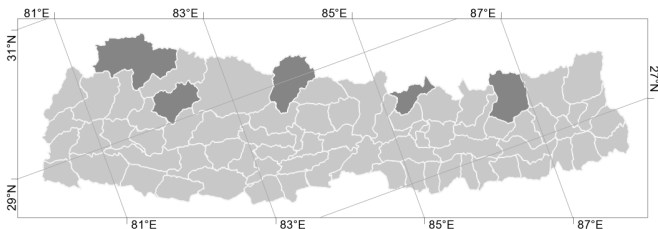
W.T.Wang; *A. monachorum* (W.W.Sm.) O.E.Schulz; *Guillenia duthiei* (O.E.Schulz) Bennet; *Hesperis lasiocarpa* (Hook.f. & Thomson) Kuntze; *Microsisymbrium duthiei* O.E.Schulz; *Sisymbrium bhutanicum* N.P.Balakr.; *S. monachorum* W.W.Sm.

Cruciferae

Annual or biennial herbs, (10–)25–70(–120) cm. Stems erect, simple or branched at base, densely hirsute with horizontal simple trichomes to 1.3 mm, these sometimes sparser on raceme, mixed throughout with much smaller, short-stalked stellate trichomes. Basal leaves not rosulate, petiolate, often caducous by time of fruiting; petiole (0.3–)1–3 cm; blade spatulate, (0.3–)1–5(–7) cm × (2–)6–11(–20) mm, apex obtuse, margin dentate or rarely lyrate lobed, stellate pubescent and often mixed with simple or forked trichomes. Middle cauline leaves obovate to oblong or elliptic, sessile and broad at base, (0.6–)1–2(–2.5) cm × (3–)6–11 mm, stellate pubescent on both surfaces, dentate to repand or entire, reduced in size upward. Raceme bracteate throughout or only lower flowers bracteate; bracts similar to uppermost cauline leaves. Pedicel slender, stellate pubescent all around, suberect to rarely divaricate, (0.5–)1–4(–6) mm. Sepals oblong, 1.5–2(–2.5) × 0.8–1 mm, densely pubescent, sometimes narrowly membranous. Petals white to lavender, spatulate to narrowly oblanceolate, 2–3(–4) × 0.6–0.9 mm, attenuate to base; claw to 1 mm. Filaments 1.5–2.5 mm; anthers oblong-ovate, 0.3–0.4 mm. Ovules 70–160 per ovary. Fruit linear, terete, straight, often appressed to rachis, 1.5–3(–4.2) cm × 0.7–1(–1.3) mm; valves densely stellate pubescent, rounded at apex and base, with an inconspicuous midvein; style 0.3–0.6(–1) mm. Seeds light brown, oblong to subovoid, uniseriate to sub-biseriate, 0.5–0.6 × 0.3–0.4 mm.

Fig. 2g

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: 900–4600 m.

Ecology: Fields, forest margins, grassy slopes, river banks, roadsides.

Flowering: April–August. **Fruiting:** May–September.

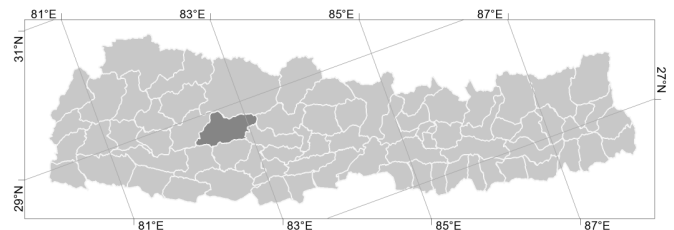
2. *Crucihimalaya stricta* (Cambess.) Al-Shehbaz, O'Kane & R.A.Price, Novon 9: 300 (1999).

Malcolmia stricta Cambess., in Jacquem., Voy. Inde 4(1): 16 (1841); *Arabidopsis himalaica* var. *kunawurensis* O.E.Schulz; *A. stricta* (Cambess.) N.Busch; *A. stricta* var. *bracteata* O.E.Schulz; *Hesperis stricta* (Cambess.) Kuntze; *Sisymbrium strictum* (Cambess.) Hook.f. & Thomson.

Annual or biennial herbs, (10–)22–85(–125) cm. Stems erect, simple or sometimes branched at base, densely pubescent with short-stalked stellate trichomes, often basally hirsute with horizontal simple trichomes to 1.4 mm. Basal leaves not rosulate, petiolate, often caducous by time of fruiting; petiole to 3 cm; blade spatulate, 4–9 × 1–2 cm, apex obtuse, margin

coarsely dentate or rarely lyrate lobed, stellate pubescent and sometimes mixed with simple or forked trichomes. Middle cauline leaves narrowly oblong to lanceolate-linear or narrowly oblanceolate, sessile, reduced in size upward, (1–)2–5(–8) cm × (2–)3.5–10(–17) mm, base attenuate, margin dentate to repand or entire, stellate pubescent on both surfaces. Raceme basally or rarely lowermost 1 or 2 flowers bracteate; bracts similar to uppermost cauline leaves. Pedicel slender, stellate pubescent laterally and below, glabrous above, divaricate or rarely ascending, (0.5–)1–4(–6) mm. Sepals oblong, 1.7–2.5 × 0.6–0.8 mm, densely pubescent, sometimes narrowly membranous. Petals white to lavender or purple, spatulate, 2.5–3(–4) × 0.7–1 mm, attenuate to base; claw to 1 mm. Filaments 2–2.8 mm; anthers oblong, 0.4–0.6 mm. Ovules 60–120 per ovary. Fruit linear, terete, straight or curved, divaricate or rarely ascending, (1–)2–4(–5.5) cm × 0.6–1 mm; valves glabrous or very rarely puberulent, rounded at apex and base, with a conspicuous midvein; style (0.2–)0.6–1.3(–1.8) mm. Seeds brown, oblong to subovoid, uniseriate, 0.6–0.9 × 0.3–0.4 mm.

Distribution: Nepal, W Himalaya and Tibetan Plateau.



Altitudinal range: 1600–4200 m.

Ecology: Forest margins, grassy areas.

Flowering: April–August. **Fruiting:** May–September.

Schulz (Notizbl. Bot. Gart. Berlin-Dahlem 9: 1061. 1927) cited one collection (*Duthie* 5352) from Budhi village in western Nepal. *Stainton, Sykes & Williams* 3365 (BM, E, G), collected from Jagat and misidentified as *Arabidopsis mollissima* (C.A.Mey.) O.E.Schulz is also *Crucihimalaya stricta*.

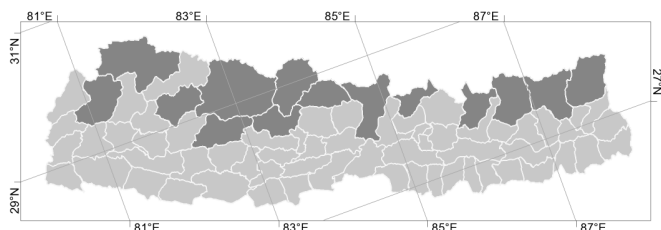
3. *Crucihimalaya himalaica* (Edgew.) Al-Shehbaz, O'Kane & R.A.Price, Novon 9: 301 (1999).

Arabis himalaica Edgew., Trans. Linn. Soc. London 20: 31 (1846); *Arabidopsis brevicaulis* (Jafri) Jafri; *A. himalaica* (Edgew.) O.E.Schulz; *A. himalaica* var. *harrissii* O.E.Schulz; *A. himalaica* var. *integrifolia* O.E.Schulz; *A. himalaica* var. *rupestris* (Edgew.) O.E.Schulz; *Arabis brevicaulis* Jafri; *A. rupestre* Edgew.; *Hesperis himalaica* (Edgew.) Kuntze; *Sisymbrium himalaicum* (Edgew.) Hook.f. & Thomson; *S. rupestris* (Edgew.) Hook.f. & Thomson.

Annual or biennial herbs, very rarely perennial, (3–)10–50(–70) cm. Stems erect, simple or few- to many-branched at base, densely pubescent with coarse, stalked, stellate and forked trichomes, often basally hirsute with horizontal simple or forked trichomes to 1.8 mm, rarely glabrescent above. Basal leaves rosulate, petiolate, often withering by time of fruiting; petiole (0.3–)0.7–1.5(–2) cm, often ciliate; blade spatulate,

oblanceolate, ovate, or oblong, (0.4–)1–3 (–4) cm × 2–10 (–14) mm, apex obtuse, margin coarsely dentate or rarely subentire, densely pubescent with coarse, stalked, stellate and forked trichomes. Middle cauline leaves oblong, rarely ovate or lanceolate, sessile, 0.5–2.5 (–3.2) cm × 2–7 (–11) mm, base auriculate or rarely sagittate, apex acute, margin coarsely dentate or rarely entire, pubescent as basal leaves, rarely glabrescent. Raceme bracteate throughout or only lowermost few flowers bracteate. Pedicel slender, stellate pubescent laterally and below, glabrous above, divaricate, (1–)2–7 (–11) mm. Sepals often lavender, oblong, 1.5–2.5 (–3) × 0.7–1 mm, densely pubescent, sometimes narrowly membranous. Petals purple to lavender or rarely white, spatulate, 2–3.5 (–5) × (0.6–)1–1.5 (–2) mm, attenuate to base; claw to 1 mm. Filaments 1.5–3 mm; anthers oblong, 0.3–0.5 mm. Ovules 50–110 per ovary. Fruit linear, terete, straight or rarely slightly curved, erect to divaricate-ascending, (0.8–)1.5–3.5 (–4.5) cm × (0.4–)0.5–0.8 (–1) mm; valves glabrous or rarely puberulent, rounded at apex and base, with an obscure or rarely prominent midvein; style (0.1–)0.4–0.6 mm. Seeds brown, oblong, uniseriate, 0.5–0.8 × 0.2–0.4 mm.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia and SW Asia.



Altitudinal range: 1100–4600 m.

Ecology: Rocky hillsides, grassy meadows, sandy slopes, flood plains, scree, pastures.

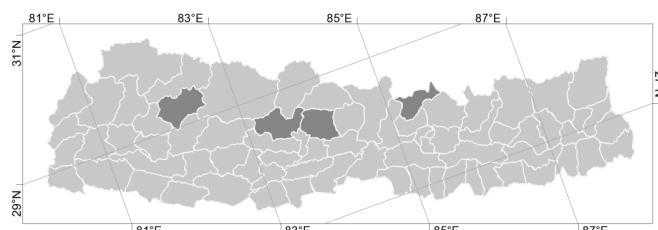
Flowering: (March) April–September. **Fruiting:** June–October.

4. *Crucihimalaya axillaris* (Hook.f. & Thomson) Al-Shehbaz, O'Kane & R.A.Price, Novon 9: 301 (1999).
Sisymbrium axillare Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 162 (1999); *Guillenia axillare* (Hook.f. & Thomson) Bennet; *Microsisymbrium axillare* (Hook.f. & Thomson) O.E.Schulz; *M. axillare* var. *brevipedicellatum* Jafri; *M. axillare* var. *dasycarpum* O.E.Schulz; *M. bracteosum* Jafri.

Annual or biennial herbs, (3–)10–20 cm. Stems decumbent to ascending, few- to many-branched at base, densely hispid with coarse, horizontal simple trichomes to 2 mm, these often mixed with coarse forked and much smaller stalked stellate trichomes, rarely glabrescent above or with only stellate trichomes. Basal leaves rosulate, petiolate, often withering by time of fruiting; petiole (0.2–)1–2 cm, often ciliate; blade spatulate, (0.6–)1–3.5 (–5) × (0.2–)0.5–1.5 cm, apex obtuse, margin coarsely dentate to sinuate or lyrate-pinnatifid, densely pubescent with stalked forked trichomes mixed with larger forked or simple ones below, with coarse simple and long-stalked forked trichomes above. Middle cauline leaves broadly oblong, elliptic, or obovate, sessile, 1–2.5 × (0.2–)0.7–1.3 cm,

base cuneate, not auriculate, apex acute, margin dentate, pubescent as basal leaves, rarely glabrescent. Raceme bracteate throughout. Pedicel slender, stellate pubescent laterally and below, glabrous above or rarely all around, divaricate to ascending, (2.5–)4–10 (–12) mm. Sepals narrowly oblong, 2–3 × 0.6–1 mm, coarsely pubescent. Petals white to lavender, spatulate, 3–4.5 × (0.8–)1–1.2 mm, attenuate to base; claw to 1 mm. Filaments 2–3 mm; anthers oblong, 0.4–0.6 mm. Ovules 60–90 per ovary. Fruit linear, terete, curved upward or sometimes straight, to divaricate, (1.4–)2.5–4 (–5) cm × 0.6–0.8 mm; valves glabrous or rarely puberulent, rounded at apex and base, with an obscure midvein; style (0.1–)0.4–1 mm. Seeds brown, oblong, uniseriate, 0.8–1 × 0.3–0.4 mm.

Distribution: Nepal, W Himalaya, E Himalaya and Tibetan Plateau.



Altitudinal range: 900–3100 m.

Ecology: Rocky hillsides, shady banks, open woodlands, roadsides, rock crevices, terraces, forests.

Flowering: March–June. **Fruiting:** May–July.

The species was listed in Hara (Enum. Fl. Pl. Nepal 2: 44. 1979) in *Microsisymbrium* O. E. Schulz, an illegitimate generic name that included the type of the genus *Guillenia* Greene.

5. *Crucihimalaya wallichii* (Hook.f. & Thomson) Al-Shehbaz, O'Kane & R.A.Price, Novon 9: 301 (1999).
Sisymbrium wallichii Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 158 (1861); *Arabidopsis campestris* O.E.Schulz; *A. mollissima* var. *afghanica* O.E.Schulz; *A. russelliana* Jafri; *A. taraxacifolia* (T.Anderson) Jafri; *A. wallichii* (Hook.f. & Thomson) N.Busch; *A. wallichii* var. *viridis* O.E.Schulz; *Arabis bucharica* Nevski; *A. taraxacifolia* T.Anderson; *Hesperis wallichii* (Hook.f. & Thomson) Kuntze; *Microsisymbrium angustifolium* Jafri.

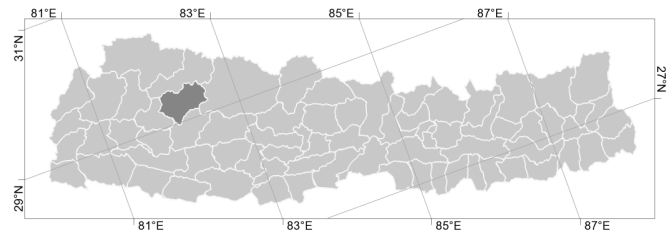
Annual or biennial herbs, (5–)12–50 (–80) cm. Stems erect, simple or few- to many-branched at base, densely to sparsely tomentose with finely branched stellate trichomes, often basally hirsute with horizontal simple or forked trichomes (0.5–)0.8–1.5 (–2) mm, rarely glabrescent above. Basal leaves rosulate, petiolate, often lyrate to pinnatifid or pinnatisect, persistent or withering by time of fruiting; petiole 0.5–1.5 (–2.5) cm, often ciliate; blade spatulate to oblanceolate or obovate in outline, 1–6 (–12) × 3–1.7 (–3) cm, margin coarsely dentate to rarely entire, with up to 8 lobes on each side of midvein; lateral lobes oblong to ovate, increasing in size above, much smaller than obovate to suborbicular terminal lobe, to 1.5 × 0.8 cm, entire to dentate, densely tomentose with finely branched

Cruciferae

stellate trichomes. Middle cauline leaves oblong to oblanceolate or linear, sessile, 0.7–4(–7) cm × 1–10(–20) mm, base usually minutely auriculate, apex acute, margin entire to coarsely dentate or lyrate, pubescent as basal leaves, rarely glabrescent. Raceme ebracteate, lax. Pedicel slender, straight, stellate pubescent all around to glabrous above, divaricate or rarely ascending, (0.2–)0.5–1.6(–2.5) cm. Sepals green to lavender, oblong, 1.5–2.5(–3) × 0.7–1 mm, densely pubescent to glabrescent, sometimes narrowly membranous. Petals purple to lavender or white, spatulate, (2–)2.5–3.5(–4.5) × 0.4–0.6 mm, attenuate to base. Filaments 2.5–3(3.5) mm; anthers oblong, 0.3–0.6 mm. Ovules 70–150 per ovary. Fruit linear, terete or rarely subcompressed, arcuate to straight, divaricate to recurved or rarely ascending, (2.5–)3.5–7.5(–9.5) cm × 0.6–1 mm; valves glabrous, obtuse to acute at apex and base, with an obscure or prominent midvein; style (0.2–)0.5–1(–1.5) mm. Seeds brown, oblong, uniseriate, 0.6–1 × 0.3–0.5 mm.

Fig. 4g-i

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, C Asia and SW Asia.



Altitudinal range: 2300–4400 m.

Ecology: Rocky slopes, hillsides, limestone crevices and ledges.

Flowering: April–August. **Fruiting:** May–September.

11. *Turritis* L., Sp. Pl. 2: 666 (1753).

Biennial, rarely short-lived perennial herbs, glaucous above. Trichomes simple and/or forked or substellate. Stems erect, simple or branched apically. Basal leaves petiolate, rosulate, simple, repand, dentate, or lobed, rarely entire. Cauline leaves sessile, auriculate, sagittate, or amplexicaul at base, entire. Racemes ebracteate, corymbose, elongated considerably in fruit. Sepals oblong, erect, base of lateral pair not saccate, margin membranous. Petals yellowish, creamy white, rarely pink; blade spatulate, oblanceolate, or rarely linear, apex obtuse; claw undifferentiated from blade. Stamens 6, erect, tetradynamous; filaments not dilated at base; anthers oblong or linear, obtuse at apex. Nectar glands confluent and subtending bases of all stamens, median glands present. Ovules 130–200 per ovary. Fruiting pedicels slender, erect. Fruit dehiscent siliques, linear, often subterete-quadrangular, sessile; valves leathery, with a prominent midvein, glabrous, smooth; replum rounded; septum complete; style short, stout; stigma capitate, subentire. Seeds biseriata, wingless, oblong to suborbicular, flattened; seed coat not mucilaginous when wetted; cotyledons accumbent.

Worldwide two species in N Africa, Eurasia and N America. One species in Nepal.

1. *Turritis glabra* L., Sp. Pl. 2: 666 (1753).

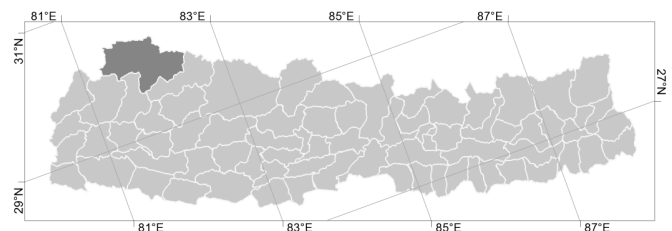
Arabis glabra (L.) Bernh.; *A. perfoliata* Lam.; *A. pseudoturritis* Boiss. & Heldr.; *Turritis glabra* var. *ilacina* O.E.Schulz; *T. pseudoturritis* (Boiss. & Heldr.) Velenovsky.

Herbs (30–)40–120(–150) cm, sparsely to densely pilose basally with simple and short-stalked forked trichomes, glabrous and glaucous above. Stems erect, simple basally, often branched above. Basal leaves rosulate, petiolate; leaf blade spatulate, oblanceolate, or oblong, (4–)5–12(–15) × 1–3 cm, apex obtuse, margin pinnatifid, sinuate, dentate, repand, or rarely entire, pubescent or rarely glabrous. Cauline leaves sessile, lanceolate, oblong-elliptic, or ovate, 2–9(–12) × (0.5–)1–2.5(–3.5) cm, base sagittate or auriculate, apex acute, margin dentate or entire. Sepals, (2.5–)3–5 × 0.5–1.2 mm, glabrous. Petals pale yellow, creamy white, rarely pink, linear-oblanceolate, narrowly spatulate, or rarely linear, 5–8.5 × 1.3–1.7 mm, apex obtuse. Median filament pairs 3.5–6.5 mm, lateral pair 2.5–4.5 mm; anthers narrowly oblong, 0.7–1.5 mm. Fruiting pedicels, (0.6–)0.7–1.6(–2) cm, slender, appressed to rachis, glabrous. Fruit linear, (3–)4–9(–10) cm × 0.7–1.5 mm, erect and appressed to rachis; valves glabrous, not torulose,

with a prominent midvein extending full length; style 0.5–0.8(–1) mm. Seeds brown, 0.6–1.2 × 0.5–0.9 mm.

Fig. 4j-l

Distribution: Nepal, E Asia, N Asia, C Asia, SW Asia, Europe, Africa, N America and Australasia.



Altitudinal range: 2900–3500 m.

Ecology: Mountain slopes, forest margins, valleys, fields, meadows, woods, fields, river banks, roadsides.

Flowering: April–July. **Fruiting:** May–August.

12. *Barbarea* R.Br., in Aiton, Hortus Kew., ed. 2, 4: 109 (1812).

Biennial herbs, with rhizomes or woody caudex. Trichomes simple or absent. Stems erect, angular. Basal leaves rosulate or not, lyrate-pinnatifid or pinnatisect, rarely undivided. Cauline leaves petiolate or sessile, auriculate or amplexicaul, entire, dentate, pinnatifid, or pinnatisect. Racemes many-flowered, often ebracteate; rachis striate. Sepals oblong, erect, base of lateral pair saccate. Petals yellow, oblanceolate, apex rounded; claw obscurely differentiated. Stamens 6, tetradynamous; filaments not dilated at base; anthers oblong, obtuse at apex. Nectar glands 4; median pair tooth-like; lateral pair annular. Ovules 10–40 per ovary. Fruiting pedicels slender or thickened, erect to ascending rarely divaricate. Fruit dehiscent siliques, linear, terete to slightly compressed, 4-angled, or latiseptate, sessile or shortly stipitate; valves with a prominent midvein and distinct marginal veins, mostly glabrous, smooth or torulose; replum rounded; septum complete; style to 5 mm; stigma capitate, entire or slightly 2-lobed. Seeds uniseriate, wingless, margined, ovate to ovate-oblong, plump or slightly compressed; seed coat reticulate, rarely tuberculate, not mucilaginous when wetted; cotyledons accumbent.

Worldwide about 22 species distributed mainly in Europe and neighbouring Asia, with the centre of greatest diversity in the E Mediterranean. One species naturalized in Nepal.

1. *Barbarea intermedia* Boreau, Fl. Centre France 2: 48 (1840).

Barbarea vulgaris var. *sicula* Hook.f. & T.Anderson; *Campe intermedia* (Boreau) Rauschert.

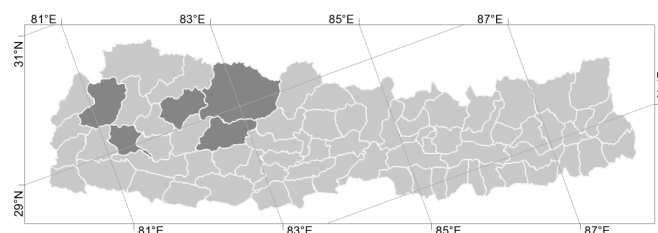
खोले साग Khole saag (Nepali).

Herbs with stems 15–60 cm, erect, angled, glabrous. Basal and lowermost cauline leaves petiolate; petiole 0.5–3(–4.5) cm, glabrous or ciliate; leaf blade 1.5–7 cm, lyrate-pinnatifid, with 1–4(–7) lobes on each side of rachis, not fleshy; lateral lobes oblong to ovate, 3–10(–15) × 1–5(–7) mm, entire to repand; terminal lobe ovate, considerably larger than lateral ones, 1–3 × 0.7–1.5 cm. Cauline leaves pinnatifid to pinnatisect, with 1–4 lateral lobes, entire, sessile, conspicuously auriculate; auricles ovate to narrowly oblong, to 10 × 5 mm, ciliate; lateral lobes linear to linear-oblong, to 2.5 × 0.5 cm, glabrous or ciliate, entire; terminal lobe obovate-oblong, larger than lateral lobes and to 4 × 1.5 cm, entire or repand to rarely dentate. Racemes ebracteate, elongated considerably in fruit. Sepals yellow, oblong, 2–3 × 1–1.3 mm, erect, margin scarious, lateral pair slightly saccate. Petals 4–6 × 1–1.5 mm, attenuate to base. Filaments yellow, erect, 3–4 mm; anthers oblong, ca. 1 mm. Fruiting pedicels (2–)3–5 mm, terete to subquadrangular, glabrous, stout, slightly narrower than fruit. Fruit linear, (1–)1.5–3 cm × 1.5–2 mm, torulose, erect to erect-ascending;

gynophore to 0.5 mm; valves with a prominent midvein and lateral veins; style 1–1.5 mm. Seeds brown, 1.2–1.7 × 1–1.2 mm.

Fig. 5a

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, SW Asia and Europe.



Altitudinal range: 3000–4100 m.

Ecology: Along ditches, damp slopes, marshy areas.

Flowering: June–July. **Fruiting:** July–August.

Tender shoots and leaves are eaten as a green vegetable.

13. *Cardamine* L., Sp. Pl. 2: 654 (1753).

Dentaria L.; *Loxostemon* Hook.f. & Thomson.

Annual, biennial, or rhizomatous or tuberous perennial herbs. Trichomes absent or simple. Stems erect, ascending or decumbent, leafy or rarely leafless and plant scapose. Basal leaves petiolate, rosulate or not, simple and entire, toothed, or 1–3-pinnatisect, or palmately lobed, sometimes trifoliate, pinnately, palmately, or bipinnately compound. Cauline leaves alternate, rarely opposite or whorled, simple, or compound as basal leaves, petiolate or sessile and base cuneate, attenuate, auriculate, or sagittate. Racemes ebracteate or rarely bracteate, elongated in fruit. Sepals ovate or oblong, base of lateral pair saccate or not. Petals white, pink, purple, lilac, mauve, violet or lavender, never yellow, rarely absent, obovate, spatulate, oblong, or oblanceolate, apex obtuse or emarginate; claw absent or

Cruciferae

strongly differentiated from blade. Stamens 6 and tetradynamous, rarely 4 and equal in length; anthers ovate, oblong, or linear, obtuse at apex. Nectar glands confluent and subtending bases of all stamens; median glands 2 or rarely 4 or absent. Ovules 8–40 per ovary. Fruiting pedicels slender or thickened, ascending, erect, divaricate, or reflexed. Fruit dehiscent siliques, linear, latiseptate, sessile; valves papery, not veined, smooth or torulose, dehiscent elastically, spirally or circinate coiled; replum strongly flattened; septum complete; style distinct or rarely obsolete; stigma capitate, entire. Seeds uniseriate, wingless, rarely margined or winged, oblong, ovate or subquadrate, flattened; seed coat smooth, reticulate, colliculate, or rugose, mucilaginous or not when wetted; cotyledons accumbent or very rarely incumbent.

Worldwide about 200 species. Eleven species in Nepal.

Hara (Enum. Fl. Pl. Nepal 2: 41. 1979) noted that the type of *Cardamine nasturtioides* D. Don (Prodr. Fl. Nepal.: 201. 1825) has not been found and so taxonomic placement is uncertain. He suggested that this species is probably a synonym of *Cardamine scutata* subsp. *flexuosa* (With.) H. Hara (syn. *C. flexuosa* With.), but until the type is discovered this species is excluded from Flora of Nepal.

Key to Species

- 1a Cauline leaves auriculate or sagittate at base, sometimes petiole absent and proximal pair of leaflets attached at or directly above node2
- b Cauline leaves not auriculate or sagittate at base6
- 2a Cauline leaves simple, divided or not. Petals 10–17 × 4–7 mm3
- b Cauline leaves compound. Petals 1.5–8(–9) × 1.5–3.5(–5) mm4
- 3a Cauline leaves undivided. Fruiting pedicels 0.8–3 cm2 ***C. violacea***
- b Cauline leaves with 1–3 lateral lobes on each side, lobes much smaller than terminal one. Fruiting pedicels to 1 cm3 ***C. nepalensis***
- 4a Cauline leaves sessile. Petals purple to lavender, 6–9 mm7 ***C. griffithii***
- b Cauline leaves petiolate. Petals white, 1.5–5(–6) mm5
- 5a Lateral leaflets of cauline leaves 1–3 on each side of rachis. Rhizomatous perennials8 ***C. yunnanensis***
- b Lateral leaflets of cauline leaves (4–)6–11 on each side of rachis. Annuals or biennials10 ***C. impatiens***
- 6a Annuals or biennials. Petals 2.5–4(–5) mm11 ***C. flexuosa***
- b Rhizomatous or stoloniferous perennials. Petals 5–17 mm7
- 7a Fruiting pedicels reflexed. Raceme rachis flexuous9 ***C. elegantula***
- b Fruiting pedicels divaricate, ascending or suberect. Raceme rachis not flexuous8
- 8a Rhizome with bulbils. Stems narrowed basally to a fragile slender attachment to rhizome9
- b Rhizome without bulbils. Stem stout at attachment to rhizome, if slender then leaflets more than 1 cm wide10
- 9a Axils of cauline leaves with bulbils. Filaments of median stamens flattened, toothed. Leaves with 1(or 2) pairs of lateral leaflets4 ***C. pulchella***
- b Axils of cauline leaves without bulbils. Filaments of median stamens slender, toothless. Leaves with 2–5 pairs of lateral leaflets5 ***C. loxostemonoides***
- 10a Petals purple or lilac, (8–)10–17 mm. Leaflets more than 2 cm1 ***C. macrophylla***
- b Petals white, 5–8 mm. Leaflets less than 1.5 cm6 ***C. trifoliolata***

1. *Cardamine macrophylla* Willd., Sp. Pl., ed. 5[as 4], 3(1): 484 (1800).
Cardamine foliosa Wall. nom. nud.; *C. macrophylla* subsp. *polyphylla* (D. Don) O. E. Schulz; *C. macrophylla* var. *crenata* Trautv.; *C. macrophylla* var. *dentariaefolia* Hook. f. & T. Anderson; *C. macrophylla* var. *diploidonta* T. Y. Cheo; *C. macrophylla* var. *foliosa* Hook. f. & T. Anderson; *C. macrophylla* var. *lobata* Hook. f. & T. Anderson; *C. macrophylla* var. *moupinensis* Franch.; *C. macrophylla* var. *polyphylla* (D. Don)

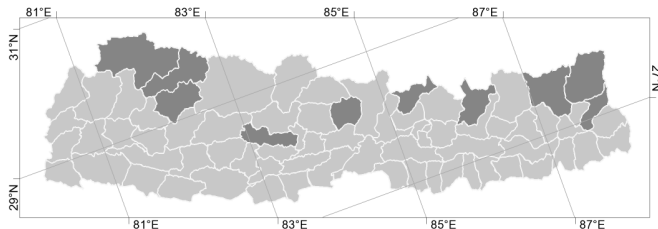
T. Y. Cheo & R. C. Fang; *C. macrophylla* var. *sikkimensis* Hook. f. & T. Anderson; *C. polyphylla* D. Don; *C. sachalinensis* Miyabe & Miyake; *C. sinomanshurica* (Kitag.) Kitag.; *C. urbaniana* O. E. Schulz; *Dentaria gmelinii* Tausch; *D. macrophylla* (Willd.) Bunge ex Maxim.; *D. sinomanshurica* Kitag.; *D. wallichii* G. Don; *D. willdenowii* Tausch.

तिउली Tiuli (Nepali).

Perennial herbs, (20–)30–95(–115) cm. Rhizomes creeping, not scaly, 2–10(–30) mm in diameter, not stoloniferous. Stems stout or slender, erect, simple or rarely branched above, glabrous or pubescent. Basal leaves (4–)10–40(–50) cm; petiole (1–)3–20(–25) cm; terminal leaflet sessile or petiolulate, lanceolate, elliptic, oblong, ovate, or obovate, (1–)2–15(–25) × (0.5–)1–3.5(–5) cm, base cuneate, apex acuminate, acute, or subobtusate, margin serrate, crenate, dentate, or rarely 3–5-lobed; lateral leaflets (1 or)2–6 pairs, similar to terminal but smaller. Cauline leaves compound, 3–12(–18); petiole (1–)2–5(–6.5) cm, not auriculate at base; terminal leaflet as those of basal leaves, sessile or with a petiolule to 1 cm, (2–)4–12(–20) × 1–4(–5) cm, base cuneate, apex acute, rarely acuminate, margin ciliolate and crenate, serrate, or serrulate, rarely subentire or double serrate; lateral leaflets 2–7(–11) pairs, sessile or petiolulate, base cuneate or obliquely decurrent, similar to but slightly smaller than terminal leaflet. Racemes 10–30-flowered. Sepals oblong, 3.5–6.5(–8) × 1.5–3 mm. Petals purple or lilac, obovate to spatulate, (0.8–)1–1.7 cm × 3.5–8 mm, apex rounded or rarely subemarginate. Median filament pairs 7–9(–11) mm, lateral pair 6–7 mm; anthers oblong, 1–2(–2.5) mm. Ovules 8–12(–16) per ovary. Fruiting pedicels ascending or rarely divaricate, (0.3–)0.8–2.5(–3.1) cm, straight, thickened. Fruit linear, (2.2–)2.5–6(–7) cm × 1.5–2.5(–3) mm; valves sparsely pubescent or glabrous; style (1–)2–6.5(–9) mm. Seeds brown, ovoid to oblong, (1.5–)2–3(–4) × 1–1.7(–2) mm.

Fig. 5b-c

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, N Asia and C Asia.



Altitudinal range: 500–4600 m.

Ecology: Damp forests, river banks, tundra, rock crevices, meadows, damp woodlands, thickets, stream-sides, valleys, ravines, mountain slopes, amongst boulders.

Flowering: (March–)April–October. **Fruiting:** May–October.

Cardamine macrophylla is highly variable, especially in leaflet number, shape, size, margin, and base. A critical study of the species from its entire range reveals that only a small number of the variants have been recognized formally and that the variation does not show any correlation among characters and/or geography. Some of the variants on which varieties are based occur within the same population, and a thorough study at the population level is needed before the species is divided into infraspecific taxa.

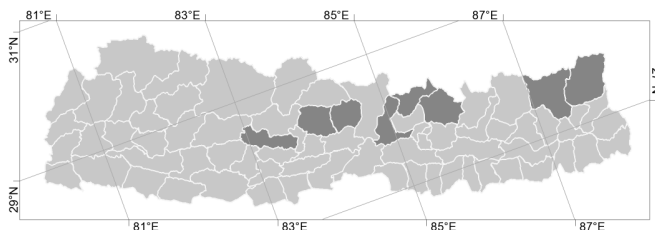
2. *Cardamine violacea* (D. Don) Wall. ex Hook. f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 144 (1861).

Erysimum violaceum D. Don, Prodr. Fl. Nepal.: 202 (1825);
Cardamine violacea subsp. *bhutanica* Grierson.

टुकी झार Tuki jhar (Nepali).

Perennial herbs, 20–100 cm, shortly pilose or subglabrous. Rhizomes stout, to 1 cm in diameter. Stems erect, simple, stout, glabrous. Basal leaves not seen. Middle cauline leaves simple, sessile; blade lanceolate to linear-lanceolate or ovate-lanceolate, 3.5–20 × 0.7–3.5 cm, strongly auriculate, sagittate, to amplexicaul at base, apex acuminate to caudate, margin ciliolate and dentate, denticulate, or entire, puberulent to subpilose above, glabrous below; auricles oblong to ovate, 2–10 × 2–7 mm. Racemes 5–25-flowered. Flowering pedicels spreading to reflexed. Sepals oblong, 5–7 × 1.5–3 mm, glabrous or sparsely pilose, base of lateral pair saccate. Petals purple, spatulate to obovate, 1–1.7 cm × 4.5–7 mm. Median filament pairs 7–9 mm, lateral pair 6–7 mm; anthers oblong, 1.5–2 mm. Ovules 10–16 per ovary. Fruiting pedicels divaricate to ascending, 0.8–3 cm, glabrous, straight. Fruit linear, 2–6 cm × 1.4–2.5 mm; valves smooth, glabrous; style 3–8 mm. Seeds brown, oblong, 2–3 × 1.4–1.8 mm, wingless.

Distribution: Nepal, E Himalaya and E Asia.



Altitudinal range: 1800–4000 m.

Ecology: Grassy slopes, stream-sides, open forests, pastures, thickets, roadside banks, sandy moist forests, forest ravines.

Flowering: May–August. **Fruiting:** July–September.

Tender shoots and leaves are cooked as a vegetable.

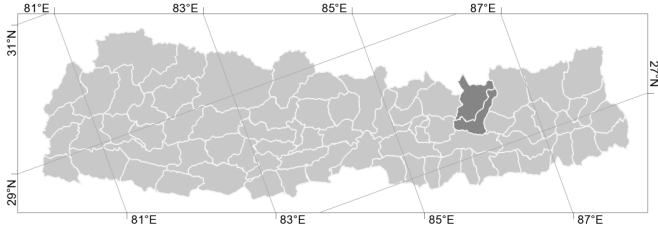
3. *Cardamine nepalensis* N. Kurosaki & H. Ohba, J. Jap. Bot. 64: 135 (1989).

Perennial herbs, 60–100 cm, shortly pilose or subglabrous. Rhizomes stout. Stems erect, simple, stout, glabrous, 10–18-leaved. Rhizomal leaves not seen. Middle cauline leaves simple, petiolate, minutely auriculate; blade pinnatisect, 4–15 × 1.5–5.5 cm, sparsely pilose; terminal lobe lanceolate, base cuneate, apex acuminate, margin coarsely and irregularly dentate; lateral lobes 1–3 on each side of midvein, smaller than terminal lobe, decurrent at base, apex acute, margin denticulate. Racemes 5–25-flowered. Flowering pedicels spreading to reflexed. Sepals oblong, 4–6 × 1.5–2.5 mm, glabrous or subapically sparsely pilose, base of lateral pair saccate. Petals purple, spatulate to obovate, 1–1.5 cm × 4–7 mm. Median filament pairs 7–8 mm, lateral pair 6–7 mm; anthers oblong, 1–1.5 mm. Ovules 10–14 per ovary. Fruiting

Cruciferae

pedicels to 1 cm, glabrous. Fruit linear, 2.5–4 cm × 1–2 mm; valves smooth, glabrous; style 1–1.5 mm. Seeds brown, oblong, ca. 2 × 1 mm, wingless.

Distribution: Nepal and E Himalaya.



Altitudinal range: 2500–3700 m.

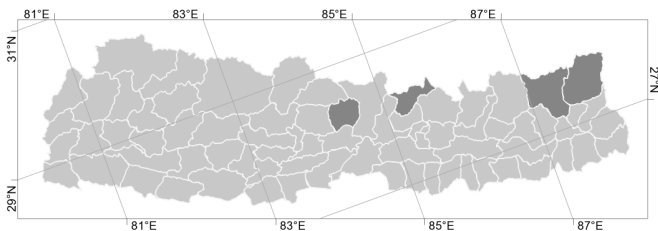
Ecology: Sandy forest floors and stream-sides. *Abies* forest.

Flowering: July. **Fruiting:** August.

4. *Cardamine pulchella* (Hook.f. & Thomson) Al-Shehbaz & G. Yang, Harvard Pap. Bot. 3(1): 77 (1998).
Loxostemon pulchellus Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 147 (1861).

Perennial herbs, (5–)8–15(–20) cm, hirsute or glabrescent. Rhizomes to 1 cm, with stolons and numerous bulbils; bulbils whitish, fleshy scales ovoid to subglobose, with rudimentary apical appendages. Stems erect, simple; underground lower part slender, glabrous; aboveground part green to purplish, slender or stout, pilose to glabrous; bulbils of leaf axils ovoid, to 3 × 2 mm. Rhizomal leaves 1(or 2), (1.5–)3–7 cm; petiole (1–)2.2–6 cm; terminal leaflet broadly ovate to oblong, 3–10 × 2–4(–7) mm, with a petiolule to 3 mm; lateral leaflets 1(or 2) pairs, similar to terminal one. Cauline leaves compound, 1–3, 1.2–5 cm; petiole 0.5–3.5 cm, base not auriculate; terminal leaflet oblong to narrowly elliptic, (4–)6–12(–15) × (1–)1.5–4(–6) mm, base cuneate, apex mucronate, margin entire; lateral leaflets 1(or 2) pairs, similar to terminal one. Racemes 2–4(or 5)-flowered. Sepals ovate, 1.5–3 × 1–1.5 mm, margin membranous, ciliate or glabrous. Petals deep purple to mauve, broadly obovate, 5–8 × 2–4 mm, apex rounded. Median filament pairs 2–3 × 0.7–1.1 mm, flattened, extended apically into a tooth; lateral pair slender, 1–2 mm; anthers oblong, 0.5–0.6 mm. Ovules 12–16 per ovary. Fruiting pedicels ascending, 5–13 mm, straight. Fruit linear, 1–1.7 cm × 1–1.2 mm; valves smooth, glabrous; style 0.5–1 mm. Seeds brown, broadly oblong, 1.3–1.6 × 0.8–1.1 mm, wingless.

Distribution: Nepal, E Himalaya, Tibetan Plateau, Assam-Burma and E Asia.



Altitudinal range: 2700–4600 m.

Ecology: Grassy marshlands, moist rocky places, stony stream banks, scree, mountain slopes.

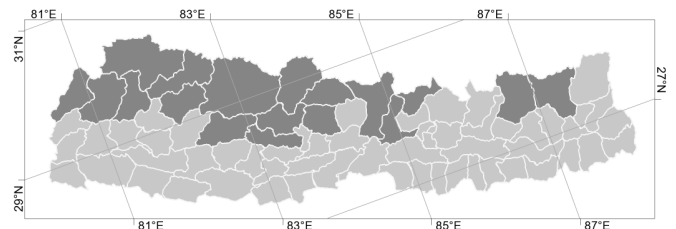
Flowering: May–August. **Fruiting:** July–September.

5. *Cardamine loxostemonoides* O.E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 9: 1069 (1926).
Cardamine tibetana Rashid & H. Ohba; *Loxostemon incanus* R.C. Fang ex T.Y. Cheo & Y.Z. Lan; *L. loxostemonoides* (O.E. Schulz) Y.Z. Lan & T.Y. Cheo.

चम्सुरे घाँस Chamsure ghans (Nepali).

Perennial herbs, (5–)12–30(–35) cm, glabrous or sparsely to densely pilose. Rhizomes slender, with several bulbils and stolons; bulbils with fleshy, white, scaly leaves apically with rudimentary appendages. Stems somewhat decumbent and slender below, simple. Basal leaves glabrous or pilose, compound; petiole (0.7–)2–15(–20) cm; terminal leaflet with a petiolule 3–10 mm, blade undivided and suborbicular, oblanceolate, or linear, or trifid and suborbicular to broadly obovate in outline and with obovate or oblong lobes the basal pair of which sometimes with a tiny lobule, terminal lobe 0.6–2(–3) cm × 2–5 mm; lateral leaflets 2–5 pairs, sessile or petiolulate, similar in shape and division to terminal lobe but smaller. Cauline leaves 1–4; petiole (0.3–)1–3(–4) cm, not auriculate at base; terminal and lateral leaflets similar in shape, size, and number to those of basal leaves. Racemes 2–14-flowered. Fruiting pedicels (5–)1–2.5 cm, ascending to suberect, glabrous. Sepals broadly ovate, 2.5–5 × 1.5–2.5 mm, glabrous, broadly membranous at margin and apex, base of lateral pair subsaccate. Petals purple with darker veins, broadly obovate, 0.8–1.2(–1.4) cm × 5–8(–8.5) mm, not clawed, apex rounded. Median filament pairs (3.5–)4.5–6 mm, lateral pair 2.5–4 mm; anthers narrowly oblong, 1.4–2 mm. Ovules 14–20 per ovary. Fruits linear, 2.5–3.5 cm × 1.2–1.5 mm; valves glabrous; style 1–3 mm. Seeds brown, ovate, ca. 1.5 × 1 mm, wingless.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, Assam-Burma and E Asia.



Altitudinal range: 2400–5500 m.

Ecology: Mountains slopes, along ditches, damp ground by streams, open grass and gravel, scree.

Flowering: June–July. **Fruiting:** August–September.

Hooker & Anderson (Fl. Brit. Ind. 1: 138. 1872) misapplied the name *Cardamine pratensis* L. to this species.

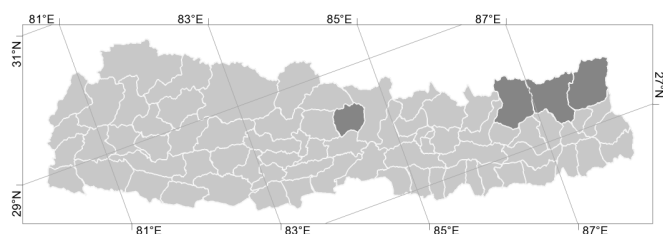
Tender shoots and leaves are cooked as a vegetable.

6. *Cardamine trifoliolata* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 145 (1861).

Cardamine flexuosoides W.T.Wang; *C. flexuosoides* var. *glabricaulis* W.T.Wang; *Loxostemon smithii* var. *wenchuanensis* Y.Z.Lan & T.Y.Cheo.

Perennial herbs, (4–)6–18(–25) cm, often sparsely pilose at least basally. Rhizomes slender, thickened at stem base, with few stolons. Stems erect or decumbent, slender, simple or few-branched. Basal leaves 1–3, 3 or 5(or 7)-foliolate, rarely simple; petiole 1–4(–5.5) cm; terminal leaflet broadly obovate or rarely ovate, 2–12 × 3–14 mm, with a petiolule 1–6(–8) mm, base subtruncate, cordate, or rounded, apically subtruncate or obtusely 3-lobed, margin entire and obscurely 5-lobed or -crenate; lateral leaflets 1(–3) pairs, subsessile or petiolulate, resembling terminal leaflet, or not lobed and oblong or ovate, smaller. Cauline leaves 1 or 2(or 3), 3(or 5)-foliolate; petiole 0.5–1.5 cm, not auriculate at base; terminal leaflet similar to that of basal leaf, with a petiolule 0.5–3 mm; lateral leaflets similar to those of basal leaves. Racemes lax, 2–8-flowered, rachis straight. Fruiting pedicels ascending to divaricate, 0.5–1.5(–2) cm, straight, glabrous. Sepals ovate to oblong, 2–3 × 1–1.4 mm, glabrous, lateral pair subsaccate. Petals white, obovate to spatulate, 5–8 × 2.5–4 mm, not clawed, apex rounded. Median filament pairs 3–4.5 mm, slender; lateral pair 2–3 mm; anthers oblong, 0.8–1 mm. Ovules 8–12 per ovary. Young fruits glabrous. Mature fruits and seeds not seen.

Distribution: Nepal, E Himalaya, Assam-Burma and E Asia.



Altitudinal range: 2500–4300 m.

Ecology: Moist rocky crevices, meadows, moist forests, mossy banks, rocky areas.

Flowering: May–July. **Fruiting:** July–September.

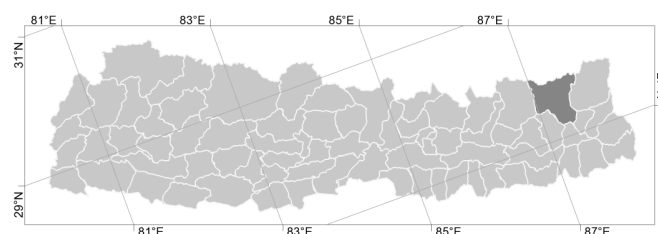
7. *Cardamine griffithii* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 146 (1861).

Cardamine griffithii var. *pentaloba* W.T.Wang.

Perennial herbs, (20–)30–100(–115) cm, glabrous throughout except for leaflet margin. Rhizomes creeping, without stolons. Stems erect, simple or branched above, striate, angled, (9–)12–28(–37)-leaved. Cauline leaves compound, sessile; lower and middle ones (1–)2–9(–11) × (0.7–)1–3.5(–4.5) cm; terminal leaflet orbicular to broadly ovate or obovate, (0.5–)1–3(–3.5) × (0.3–)0.6–1.9(–2.5) cm, with a petiolule 2–10(–15) mm, base subcordate to rounded or rarely cuneate, apex obtuse to

rounded, margin repand or entire and sparsely ciliate; lateral leaflets 2–4(or 5) pairs, slightly to distinctly smaller than terminal one, base obtuse or rarely slightly oblique, apex obtuse to rounded, margin entire or repand and sparsely ciliate; proximal pair of lateral leaflets auricle-like, attached at or just above node, often giving appearance of amplexicaul leaf base. Uppermost leaves smaller. Sepals ovate to oblong, 2.5–3 × 1.5–2 mm, erect. Petals purple to lavender, spatulate to obovate, 6–9 × (2.5–)3–5 mm, not clawed, apex rounded to subemarginate. Median filament pairs 3.5–4.5 mm, lateral pair 2.5–3 mm; anthers oblong, 0.9–1.1 mm. Ovules 10–22 per ovary. Fruiting pedicels ascending to divaricate, (0.4–)0.7–1.5 cm, slender, straight. Fruit linear, (1.5–)2–4 cm × 0.9–1.2 mm; valves smooth, glabrous; style 0.5–1(–2) mm; stigma 2-lobed, distinctly broader than style. Seeds brown, oblong, 1.4–1.7 × 0.8–1.1 mm, wingless.

Distribution: Nepal, E Himalaya, Tibetan Plateau, Assam-Burma and E Asia.



Altitudinal range: 2400–4500 m.

Ecology: Mountain slopes, valleys, stream-sides, pastures, marshy places, moist forest floors, shady rocky areas.

Flowering: May–August. **Fruiting:** June–September.

8. *Cardamine yunnanensis* Franch., Bull. Soc. Bot. France 33: 398 (1886).

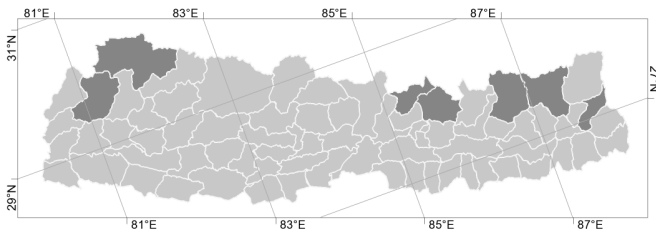
Cardamine bijiangensis W.T.Wang; *C. heterophylla* T.Y.Cheo & R.C.Fang; *C. hirsuta* var. *oxycarpa* Hook.f. & T.Anderson; *C. inayatii* O.E.Schulz; *C. levicaulis* W.T.Wang; *C. longipedicellata* Z.M.Tan & G.H.Chen; *C. longistyla* W.T.Wang; *C. muliensis* W.T.Wang; *C. sikkimensis* H.Hara; *C. sinica* Rashid & H.Ohba; *C. weixiensis* W.T.Wang.

Short-lived perennial herbs with slender rhizomes, (10–)15–45(–60) cm, often pilose or puberulent, sometimes glabrescent above. Stems simple or branched from base, angled. Basal leaves petiolate, often withered by time of flowering, 3–5-foliolate, rarely simple; petiole 1–6(–8) cm; leaf blade or terminal leaflet suborbicular, ovate, to lanceolate, 0.5–3 × 0.5–2.5 cm, dentate to crenate or rarely subsinuate; lateral leaflets absent or 1 or 2 pairs. Middle cauline leaves 3–7-foliolate; petiole (1–)2–7(–8.5) cm, basally auriculate; auricles tooth-like to linear or lanceolate, (0.4–)1–3(–4) × 0.2–1(–1.5) mm; terminal leaflet lanceolate, elliptic, oblong, ovate, or suborbicular, (1–)1.3–4.5(–6) × (0.4–)0.6–2(–3) cm, base obtuse to cuneate, apex acute to acuminate, margin ciliate to ciliolate and dentate, crenate, sinuate, or rarely repand, sparsely pilose above, often glabrous below, with a petiolule (2–)4–14(–20) mm; lateral leaflets shortly petiolulate to subsessile, similar to terminal one and often oblique at base.

Cruciferae

Uppermost leaves often trifoliate, rarely simple. Sepals oblong to nearly ovate, 2–3 × 1–1.5 mm, base not saccate. Petals white, obovate, (2.5–)3.5–5(–6) × 2–3 mm, not clawed. Median filament pairs 2.5–4 mm, lateral pair 2–3 mm; anthers oblong, 0.5–0.8 mm. Ovules 8–18 per ovary. Fruiting pedicels ascending to divaricate, 0.5–1.8(–2.3) cm, straight, slender. Fruit linear, 1.5–2.8(–3) cm × 1–1.3 mm; valves smooth, sparsely pilose; style (0.5–)1–2.5(–3.5) mm. Seeds brown, narrowly oblong, 1.3–1.8 × 0.7–1 mm, wingless. Fig. 5d–g

Distribution: Nepal, E Himalaya, Tibetan Plateau, Assam–Burma and E Asia.



Altitudinal range: 900–4200 m.

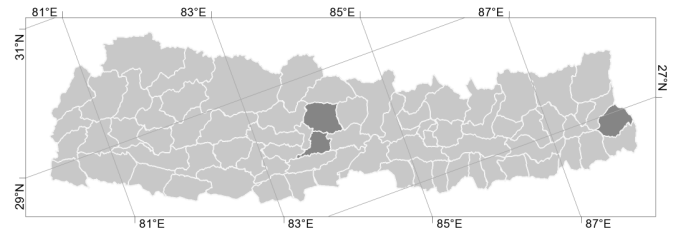
Ecology: Moist shady places, mountain slopes, valleys, grasslands, meadows, thickets, forest openings, damp stream beds.

Flowering: March–July. **Fruiting:** April–September.

9. *Cardamine elegantula* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 146 (1861).

Perennial herbs, 8–30 cm, slender, pilose on leaves and stems with trichomes to 0.6 mm. Rhizomes slender, stoloniferous. Stems simple, erect, flexuous. Basal leaves compound, rosulate, often present at time of fruiting; petiole 0.7–2 cm; terminal leaflet broadly ovate to obovate, petiolulate, sparsely pilose, base distinctly oblique, margin entire or obscurely 1-toothed on each side; lateral leaflets 2–4 on each side, with a petiolule 0.5–1.5 mm, ovate to elliptic, 2–5(–8) × 1–3.5(–5) mm, similar to terminal one or with a lateral lobe on lower margin, distinctly mucronate. Cauline leaves compound, not auriculate at base; petiolule 0.5–3 mm; terminal leaflet elliptic to linear-elliptic, 3–6(–9) × 0.5–2 mm, base attenuate to cuneate and decurrent with adjacent lateral lobes, apex mucronate, margin entire and scabrous with trichomes 0.05–0.1 mm; lateral leaflets 5–8 on each side of rachis, petiolulate, similar to terminal leaflets. Racemes 2–5-flowered, rachis strongly flexuous. Pedicels strongly reflexed, slender, straight, 4–6 mm, glabrous. Sepals ovate, 1.5–2 × 0.8–1 mm, glabrous, membranous at margin and apex. Petals pink or white, broadly obovate, 6–7 × 3–4 mm. Median filament pairs 2.5–3 mm, filiform; lateral pair 1.5–2 mm; anthers oblong, 0.4–0.5 mm. Median nectar glands obsolete. Ovules 14–20 per ovary. Fruit linear, 1.2–1.5 cm × 0.7–1 mm; valves glabrous; style 1–2 mm. Seeds pale brown, oblong, ca. 1.8 × 0.8 mm, wingless.

Distribution: Nepal and E Himalaya.



Altitudinal range: 2400–3100 m.

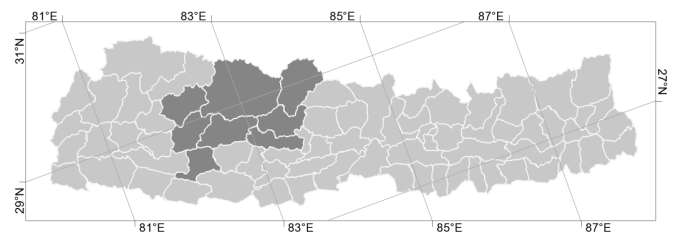
Ecology: Beneath wet rock overhang, damp rocks in forests, marshy areas along streams.

Flowering: May–June. **Fruiting:** May–June.

10. *Cardamine impatiens* L., Sp. Pl. 2: 655 (1753). *Cardamine basisagittata* W.T.Wang; *C. dasycarpa* M.Bieb.; *C. glaphyropoda* O.E.Schulz; *C. glaphyropoda* var. *crenata* T.Y.Cheo & R.C.Fang; *C. impatiens* subsp. *elongata* O.E.Schulz; *C. impatiens* var. *angustifolia* O.E.Schulz; *C. impatiens* var. *dasycarpa* (M.Bieb.) T.Y.Cheo & R.C.Fang; *C. impatiens* var. *eriocarpa* DC.; *C. impatiens* var. *fumaria* H.Lév.; *C. impatiens* var. *microphylla* O.E.Schulz; *C. impatiens* var. *obtusifolia* K.Knaf; *C. impatiens* var. *pilosa* O.E.Schulz; *C. nakaiana* H.Lév.; *C. senanesis* Franch. & Sav.

Biennial or rarely annual herbs, (12–)20–65(–90) cm, glabrous or rarely sparsely pubescent near base. Stems erect, simple at base, usually branched, above. Basal leaves rosulate, often withered by time of flowering; petiole 1–4 cm, not auriculate; leaf blade pinnatisect and appearing compound. Cauline leaves compound, up to 15 per stem; petiole auriculate, 2–6 cm; auricles lanceolate to linear, 1–8(–10) × (0.1–)0.3–1.8(–2.2) mm, often ciliate; leaf blade (1–)3–18(–22) × (0.6–)1–5.5(–7) cm, pinnatisect; terminal lobe orbicular, obovate, ovate, or lanceolate, 1–4(–5) × 0.5–1.7 cm, with a petiolule to 5 mm, entire or obscurely to strongly 3–5(–9)-toothed or -lobed; lateral lobes (4–)6–11 on each side of rachis, oblong, lanceolate, or ovate, sessile to long petiolulate, smaller than terminal lobe, margin dentate to sublaciniate, rarely entire; uppermost leaves with narrower segments. Sepals oblong, 1.2–2(–2.5) × 0.7–1(–1.2) mm. Petals white, oblanceolate, 1.5–4(–5) × 0.6–1.2 mm, rarely absent. Filaments 2–3(–4) mm; anthers ovate, 0.3–0.5 mm. Ovules 10–30 per ovary. Fruiting pedicels divaricate to ascending, 3.5–12(–15) mm, slender. Fruit linear, (1–)1.6–3(–3.5) cm × 0.9–1.5 mm; valves glabrous or rarely pilose, torulose; style 0.6–1.6(–2) mm. Seeds brown, oblong, 1.1–1.5 × 0.8–1 mm, compressed, sometimes apically narrowly winged.

Distribution: Asia, Europe, Africa and N America.



Altitudinal range: 100–4000 m.

Ecology: Shady or moist slopes, stream-sides, fields, roadsides.

Flowering: February–July. **Fruiting:** February–July.

Tender shoots and leaves are cooked as a vegetable.

11. *Cardamine flexuosa* With., Arr. Brit. Pl., ed. 3, 3: 578 (1796).

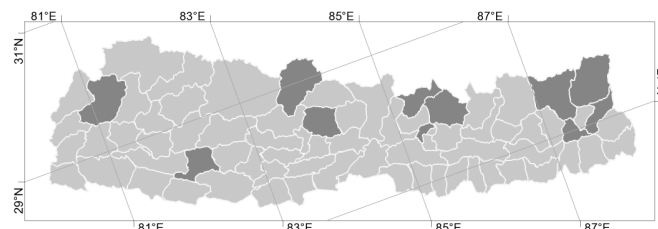
Barbarea arisanensis (Hayata) S.S.Ying; *Cardamine arisanensis* Hayata; *C. debilis* D.Don later homonym, non Banks ex DC.; *C. flexuosa* subsp. *debilis* (D.Don) O.E.Schulz; *C. flexuosa* var. *debilis* (D.Don) T.Y.Cheo & R.C.Fang; *C. flexuosa* var. *ovatifolia* T.Y.Cheo & R.C.Fang; *C. hirsuta* subsp. *flexuosa* (With.) Hook.f.; *C. hirsuta* var. *flaccida* Franch.; *C. hirsuta* var. *omeiensis* T.Y.Cheo & R.C.Fang; *C. scutata* subsp. *flexuosa* (With.) H.Hara; *C. sylvatica* Link; *C. zollingeri* Turcz.; *Nasturtium obliquum* Zoll.

चम्सुरे Chamsure (Nepali).

Annual or biennial herbs, (6–)10–50 cm, sparsely to densely hirsute basally or throughout, or glabrous. Stems erect, ascending, or decumbent, 1 to several from base, simple or branched, flexuous or straight. Basal leaves not rosulate, often withered at anthesis, petiolate; leaf blade (2–)4–10(–14) cm, lyrate; terminal lobe reniform, broadly ovate, or suborbicular, repand or 3–5-lobed; lateral lobes (1 or)2–6(or 7) on each side of midvein, petiolulate or subsessile, oblong, ovate, or elliptic, smaller than terminal lobe, entire, repand, crenate, or 3(–5)-lobed. Cauline leaves 3–15, including petiole (2–)3.5–5.5(–7) cm; petiole base not auriculate; terminal lobe 3–5-lobed; lateral lobes 2–7 on each side of midvein, suborbicular, ovate, oblong, oblanceolate, to linear, similar to or slightly smaller than terminal lobe, sessile or shortly petiolulate, entire, repand, dentate, or 3(–5)-lobed. Sepals oblong, 1.5–2.5 × 0.7–1 mm. Petals white, spatulate, 2.5–4(–5) × 1–1.7 mm. Stamens 6,

rarely 4 with lateral pair absent; filaments 2–3 mm; anthers ovate, 0.3–0.5 mm. Ovules 18–40 per ovary. Fruiting pedicels divaricate to ascending, (5–)6–14(–17) mm, slender. Fruit linear, (0.8–)1.2–2.8 cm × 1–1.5 mm; valves glabrous, torulose; style 0.3–1(–1.5) mm. Seeds brown, oblong to subquadrate, 0.9–1.5 × 0.6–1 mm, narrowly margined or not.

Distribution: Nepal, E Himalaya, Tibetan Plateau, Assam-Burma, S Asia, E Asia, SE Asia, Europe, N America, S America and Australasia.



Altitudinal range: 100–4100 m.

Ecology: Fields, roadsides, grasslands, disturbed sites, stream banks, clearings, running water, wet forests, dry sites.

Flowering: February–May. **Fruiting:** April–July.

Hooker & Anderson (Fl. Brit. Ind. 1: 138. 1872) partially misapplied the name *Cardamine hirsuta* var. *sylvatica* Link to this species.

Hara (Enum. Fl. Pl. Nepal 2: 41. 1979) treated *Cardamine flexuosa* as a variety of *C. scutata* Thunb., but the latter is an entirely different species restricted to NE Asia, and differs from *C. flexuosa* by having a straight instead of flexuous rachis and terminal leaf lobe considerably larger than the laterals. Hara also suggested that *C. nasturtioides* D.Don and *Nasturtium sparsum* D.Don could refer to this species (see notes under *Cardamine* and *Nasturtium*).

14. *Nasturtium* R.Br., in Aiton, Hortus Kew., ed. 2, 4: 110 (1812).

Perennial herbs, aquatic, rhizomatous. Trichomes absent or simple. Stems prostrate or decumbent, erect in emergent plants, rooting at lower nodes. Leaves all cauline, pinnately compound, often simple in deeply submerged plants; petiole auriculate at base; lateral leaflets 1–6(–12) pairs, petiolulate or sessile, entire, repand, or rarely dentate. Racemes many-flowered, ebracteate. Sepals oblong, erect or ascending, glabrous, base of inner pair subsaccate. Petals white to lavender, longer than sepals, obovate or narrowly spatulate, apex obtuse; clawed. Stamens 6, erect, tetradynamous; filaments base not dilated; anthers oblong, obtuse at apex. Median glands absent; lateral glands 2, annular or semiannular. Ovules 25–50 per ovary. Fruiting pedicels divaricate or recurved. Fruit dehiscent siliques, linear or rarely narrowly oblong, terete, sessile; valves obscurely veined, glabrous, smooth or slightly torulose; replum rounded; septum complete; style to 2 mm; stigma capitate, entire. Seeds biseriate, wingless, ovoid, plump; seed coat coarsely reticulate, not mucilaginous when wetted; cotyledons accumbent.

Worldwide five species in Eurasia, N Africa and N America. One species in Nepal.

Hara (Enum. Fl. Pl. Nepal 2: 44. 1979) noted that the type of *Nasturtium sparsum* D.Don (Prodr. Fl. Nepal.: 202. 1825) has not been found and so taxonomic placement is uncertain. Hara suggests that this species is probably a synonym of *Cardamine scutata* subsp. *flexuosa* (With.) H.Hara (syn. *C. flexuosa* With.), but until the type is discovered this species is excluded from Flora of Nepal.

Cruciferae

1. *Nasturtium officinale* R.Br., Hortus Kew., ed. 2, 4: 110 (1812).

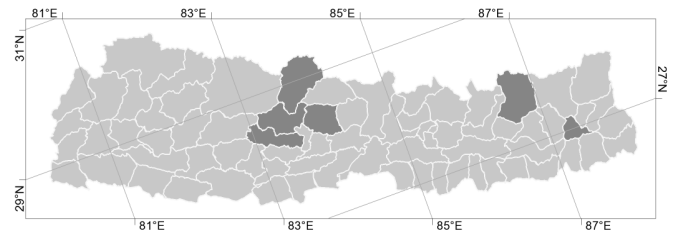
Rorippa nasturtium-aquaticum (L.) Hayek; *Sisymbrium nasturtium-aquaticum* L.

सिम साग Sim saag (Nepali).

Herbs, 10–70(–200) cm, glabrous throughout or sparsely pubescent with simple trichomes. Leaves all cauline, pinnately compound, 5–9(–13)-foliolate; petiole auriculate at base; terminal leaflet suborbicular to oblong, 1–4 cm, base obtuse, cuneate, or subcordate, apex obtuse, margin entire or repand; lateral leaflets smaller, usually sessile. Petals white to lavender, spatulate to obovate, 2.8–4.5(–6) × 1.5–2.5 mm, apex rounded; claw ca. 1 mm. Filaments white, 2–3.5 mm; anthers oblong, ca. 0.6 mm. Sepals oblong, 2–3.5 mm. Fruiting pedicels slender, 5–12(–20) mm. Fruit cylindric, 1–1.5(–2) cm × (1.8–)2–2.5(–3) mm; valves with an obscure midvein; style 0.5–1(–1.5) mm. Seeds, ovoid, 1–1.3 × 0.7–1 mm, reddish brown, coarsely reticulate, with 25–50(–60) areolae on each side.

Fig. 2h

Distribution: Cosmopolitan.



Altitudinal range: 900–3800 m.

Ecology: Streams, ditches, lakes, swamps, marshes.

Flowering: April–May. **Fruiting:** June–July.

Cultivated as a vegetable (watercress). A naturalized weed outside its native range in Eurasia.

15. *Rorippa* Scop., Fl. Carniol., ed. 2, 1: 520 (1771).

Annual, or rarely short-lived perennial herbs, usually of wet or aquatic habitats. Trichomes absent or simple. Stems erect or prostrate, simple or branched, leafy. Basal leaves petiolate, rosulate or not, simple, entire, dentate, sinuate, lyrate, pectinate, or 1–3-pinnatisect. Cauline leaves petiolate or sessile and cuneate, auriculate or sagittate at base, entire, dentate, pinnatifid, or pinnatisect. Racemes ebracteate or rarely bracteate throughout, elongated in fruit. Sepals elliptic, ovate or oblong, erect, ascending or spreading, base of lateral pair not saccate or rarely saccate, margin often membranous. Petals yellow, sometimes white or pink, rarely vestigial or absent, obovate, spatulate, oblong, oblanceolate or linear, apex obtuse or emarginate; claw sometimes distinct, often shorter than sepals. Stamens 6 and tetradynamous; anthers ovate or oblong, obtuse or rarely apiculate at apex. Nectar glands confluent, often subtending bases of all stamens. Ovules 20–170 per ovary. Fruit dehiscent siliques or silicles, linear, oblong, ovoid, or ellipsoid, terete or slightly latiseptate; valves veinless or obscurely veined, smooth or torulose; replum rounded; septum complete or rarely perforated; style obsolete or distinct; stigma capitate, entire or slightly 2-lobed. Seeds biseriate or uniseriate, wingless or rarely winged, oblong, ovoid, or ellipsoid, plump; seed coat reticulate, colliculate, rugose, tuberculate, or foveolate, mucilaginous or not when wetted; cotyledons accumbent.

Worldwide about 75 species. Four species in Nepal.

Key to Species

- 1a Raceme bracteate throughout or rarely along lower third..... **3 *R. benghalensis***
- b Raceme ebracteate, rarely lowermost 1 or 2 flowers bracteate2
- 2a Fruits oblong, ellipsoid, or oblong-ovoid, length less than 3 × width..... **4 *R. palustris***
- b Fruits linear, rarely linear-oblong, length more than 4 × width.....3
- 3a Fruit often curved, (0.7–)1–2.4(–3) cm × 1–1.5(–2) mm. Seeds biseriate or nearly so. Petals longer than sepals, (2.5–)3–4(–4.5) × 1–1.5 mm, rarely absent **1 *R. indica***
- b Fruit straight, (1.5–)2.5–4 cm × 0.7–0.9(–1) mm. Seeds uniseriate. Petals mostly absent, if present then often shorter than sepals and 1.5–2.5 × 0.2–0.7(–1)..... **2 *R. dubia***

1. *Rorippa indica* (L.) Hiern, Cat. Afr. Pl. 1(1): xxvi (1896).
Sisymbrium indicum L., Sp. Pl., ed. 2, 2: 917 (1763);
Cardamine glandulosa Blanco; *Nasturtium atrovirens*
(Hornem.) DC.; *N. diffusum* DC.; *N. heterophyllum* D.Don later

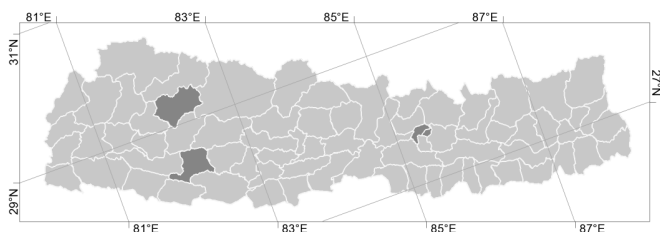
homonym, non Blume; *N. indicum* (L.) DC.; *N. montanum* Wall.
nom. nud.; *N. montanum* Wall. ex Hook.f. & Thomson; *N.*
sinapis (Burm.f.) O.E.Schulz; *Radicula montana* (Wall. ex
Hook.f. & Thomson) Hu ex C.Pei; *Rorippa atrovirens*

(Hornem.) Ohwi & H.Hara; *R. montana* (Wall. ex Hook.f. & Thomson) Small; *R. sinapis* (Burm.f.) Ohwi & H.Hara; *Sisymbrium atrovirens* Hornem.; *S. sinapis* Burm.f.

तोरी घाँस Tori ghans (Nepali).

Annual herbs, (6–)20–60(–75) cm, glabrous or rarely sparsely pubescent. Stems often branched basally and apically. Basal leaves withered by time of flowering. Lower and middle cauline leaves auriculate or not; petiole absent or 1–4 cm; leaf blade lyrate-pinnatifid or undivided, obovate, oblong, or lanceolate, (2.5–)3.5–12(–16) × (0.8–)1.5–4(–5) cm, apex obtuse to subacute margin entire or irregularly crenate to serrate; terminal lobe oblong, elliptic, to oblong-lanceolate, to 10 × 5 cm; lateral ones absent or 1–5(or 6) on each side of midvein. Uppermost leaves usually sessile, auriculate or not; leaf blade lanceolate to oblong, apex acute to acuminate, margin entire to denticulate or serrulate. Racemes ebracteate. Sepals green or pinkish, ascending, oblong-ovate, 2–3 × 0.8–1.5 mm, margin membranous. Petals yellow, obovate to spatulate, (2.5–)3–4(–4.5) × 1–1.5 mm, longer than sepals, very rarely absent. Filaments 1.5–3 mm; anthers oblong, 0.5–0.8 mm. Ovules (60–)70–110 per ovary. Fruiting pedicels slender, ascending, divaricate, or rarely slightly reflexed, straight, (2–)3–10(–15) mm. Fruit linear, (0.7–)1–2.4(–3) cm × 1–1.5(–2) mm, often curved upward; valves thin papery, not veined; style (0.5–)1–1.5(–2). Seeds reddish brown, ovate to ovate-orbicular, 0.5–0.9 × 0.4–0.6 mm, foveolate, biseriate or nearly so.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, Assam-Burma, S Asia, E Asia, SE Asia, N America and S America.



Altitudinal range: 900–2600 m.

Ecology: Roadsides, field margins, gardens, river banks.

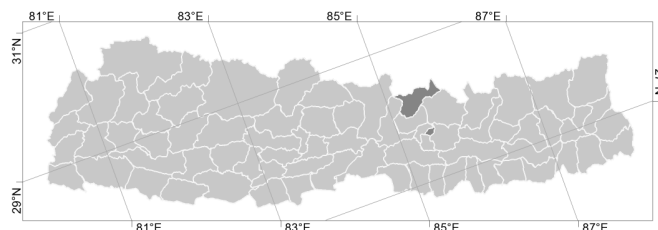
Flowering: All year. **Fruiting:** All year.

Tender parts of the plant are cooked as a vegetable.

2. *Rorippa dubia* (Pers.) H.Hara, J. Jap. Bot. 30: 196 (1955). *Sisymbrium dubium* Pers., Syn. Pl. 2(2): 199 (1807); *Cardamine sublyrata* Miq.; *Nasturtium dubium* (Pers.) Kuntze; *N. heterophyllum* Blume; *N. indicum* var. *apetalum* DC.; *N. indicum* var. *javana* Blume; *N. sublyratum* (Miq.) Franch. & Sav.; *Rorippa heterophylla* (Blume) R.O.Williams; *R. indica* var. *apetala* (DC.) Hochr.; *R. sublyrata* (Miq.) H.Hara; *R. sublyrata* (Miq.) T.Y.Cheo; *Sisymbrium apetalum* Desf.

Annual herbs, (4–)15–33(–45) cm, glabrous or rarely sparsely pubescent. Stems often branched basally and apically. Basal leaves withered by time of flowering. Lower and middle cauline leaves auriculate or not; petiole to 4 cm, rarely absent; leaf blade lyrate-pinnatifid or undivided, obovate, oblong, or lanceolate, (2–)3–11(–15) × (0.5–)1–3(–5) cm, apex obtuse to subacute, margin entire or irregularly crenate to serrate; terminal lobe oblong, elliptic, to oblong-lanceolate, to 14 × 4 cm; lateral ones absent or 1–4 on each side of midvein. Uppermost leaves usually sessile, auriculate or not; leaf blade lanceolate to oblong, apex acute to acuminate, margin entire to serrulate. Racemes ebracteate. Sepals often pinkish, ascending, oblong-linear, (2–)2.5–3 × 0.5–0.7 mm, margin membranous. Petals absent, if present then linear to narrowly oblanceolate, 1.5–2.5 × 0.2–0.7(–1) mm, shorter than sepals. Filaments 1.5–2.8 mm; anthers oblong, 0.5–0.8 mm. Ovules 70–90 per ovary. Fruiting pedicels slender, divaricate, straight, (2–)3–8(–10) mm. Fruit linear, (1.5–)2.5–4 cm × 0.7–0.9(–1) mm, straight; valves thin, papery, not veined; style 0.2–1(–1.5) mm. Seeds reddish brown, subquadrate to ovate-orbicular, 0.5–0.8 × 0.4–0.6 mm, foveolate, uniseriate.

Distribution: Nepal, Tibetan Plateau, Assam-Burma, S Asia, E Asia, SE Asia, N America and S America.



Altitudinal range: 1800–2200 m.

Ecology: Valleys, waste areas, slopes, roadsides, wet grounds, grassy places, field margins.

Flowering: All year. **Fruiting:** All year.

3. *Rorippa benghalensis* (DC.) H.Hara, J. Jap. Bot. 49: 132 (1974).

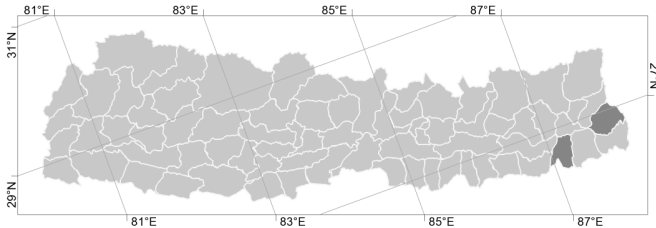
Nasturtium benghalense DC., Syst. Nat. 2: 198 (1821); *Nasturtium indicum* var. *benghalense* (DC.) Hook.f. & T.Anderson; *Rorippa dubia* var. *benghalensis* (DC.) Mukerjee; *R. indica* subsp. *benghalensis* (DC.) Bennet; *R. indica* var. *benghalense* (DC.) Deb; *Sinapis benghalensis* Roxb. ex DC. nom. inval.

Annual herbs, 15–65(–85) cm, glabrous or sparsely to densely hirsute with spreading to retrorse trichomes. Stems simple at base, few- to many-branched above. Basal leaves soon withering. Lowermost cauline leaves auriculate, with petioles to 3 cm; leaf blade oblong to oblong-obovate in outline, lyrate-pinnatifid, (1.5–)2.5–12(–15) × (0.5–)1–4(–6) cm; terminal lobe broadly ovate to oblong, 1–5 × 0.7–3 cm; lateral lobes 1–4, oblong to ovate, to 2 × 1 cm, margin serrate or dentate. Upper leaves sessile, progressively reduced in size upward into bracts. Racemes bracteate throughout or rarely only along lowermost third; bracts lanceolate-linear to oblong-linear, subentire to denticulate, minutely auriculate to cuneate at

Cruciferae

base. Sepals elliptic to oblong, 1.5–2 × 0.5–0.8 mm. Petals pale yellow, spatulate to oblanceolate, 2–2.5 × 0.5–0.9 mm, apex rounded. Filaments 2–2.5 mm; anthers oblong, 0.4–0.5 mm. Ovules 100–170 per ovary. Fruiting pedicels ascending to divaricate, slender, straight, 3–6.5(–8) mm. Fruit linear, straight or curved, 0.7–1.7(–2.1) cm × 1.2–1.6 mm; style 0.3–0.8 mm. Seeds reddish brown, subglobose to broadly ovoid, biseriate, 0.5–0.6 × 0.4–0.5 mm, minutely colliculate.

Distribution: Nepal, E Himalaya, Assam-Burma, S Asia, E Asia and SE Asia.



Altitudinal range: 200–300 m.

Ecology: Stream-sides, wet grounds, marsh edges.

Flowering: March–July. **Fruiting:** March–July.

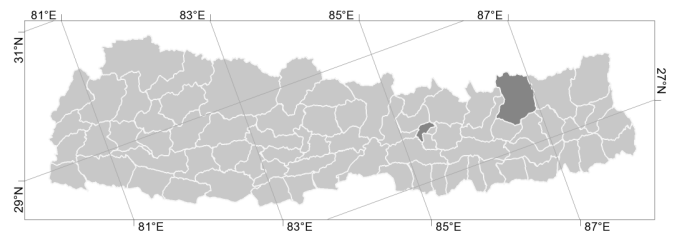
4. *Rorippa palustris* (L.) Besser, Enum. Pl.: pl. 27 (1822). *Sisymbrium amphibium* var. *palustre* L., Sp. Pl. 2: 657 (1753); *Cardamine palustre* (L.) Kuntze; *Nasturtium densiflorum* Turcz.; *N. palustre* (L.) DC.; *N. palustre* forma *longipes* Franch.; *N. palustre* forma *stoloniferum* Franch.

Annual herbs or rarely short-lived perennial, (5–)10–100(–140) cm, glabrous, rarely hirsute. Stems erect, simple or often branched above, ribbed. Basal leaves rosulate, withered early; leaf blade lyrate-pinnatisect, (4–)6–20(–30) × 1–5(–8) cm. Cauline leaves petiolate to subsessile, auriculate to amplexicaul, lyrate-pinnatisect, (1.5–)2.5–8(–12) × (0.5–)0.8–2.5(–3) cm; lateral lobes oblong to ovate, smaller than terminal lobe, (1 or)2–6(or 7) on each side of midvein, sometimes absent, margin subentire or irregularly dentate, sinuate,

serrate, or crenate. Racemes ebracteate. Sepals oblong, 1.5–2.4(–2.6) × 0.5–0.8 mm. Petals yellow, spatulate, (1.5–)1.8–2.5(–3) × 0.5–1.3(–1.5) mm. Filaments 1–2.5 mm; anthers ovate, 0.3–0.5 mm. Ovules 20–90 per ovary. Fruiting pedicels divaricate or slightly to strongly reflexed, (2.5–)3–8(–12) mm, slender, straight or curved. Fruit oblong, ellipsoid, or oblong-ovoid, often slightly curved, (2.5–)4–10(–14) × (1.5–)1.7–3(–3.5) mm; valves not veined; style 0.2–1(–1.2) mm. Seeds brown to yellowish brown, ovoid to subglobose, colliculate, biseriate, 0.5–0.9 × 0.4–0.6 mm.

Fig. 2i & Fig. 5h-j

Distribution: Nepal, E Himalaya, Tibetan Plateau, S Asia, E Asia, N Asia, C Asia, Europe, N America, S America and Australasia.



Altitudinal range: 1300–2800 m.

Ecology: Marshlands, pastures, meadows, roadsides, shores of lakes and ponds, stream banks, thickets, grasslands.

Flowering: March–October. **Fruiting:** March–October.

The first record of *Rorippa palustris* from Nepal is based on Long & McDermott 21917 (E) from Kathmandu, and it has subsequently also been collected at Lukla. It is certainly much more widespread than the distribution map indicates. The species is highly variable and has been divided into as many as four subspecies and seven varieties all of which are indigenous to North America. It is represented in Eurasia by subsp. *palustris*.

16. *Descurainia* Webb & Berthel. nom cons., Hist. Nat. Iles Canaries 1: 72 (1836).

Annual herbs. Trichomes short stalked, dendritic. Stems erect, simple basally, branched above. Basal leaves petiolate, withered by time of flowering, 2- or 3-pinnatisect. Lower cauline leaves similar to basal, upper sessile or short petiolate. Racemes ebracteate or rarely basally bracteate, elongated or not in fruit. Sepals oblong or linear, erect or ascending, base of lateral pair not saccate. Petals yellow, narrowly oblanceolate, apex obtuse; clawed. Stamens 6, tetradynamous; filaments not dilated at base; anthers oblong, apex obtuse. Nectar glands confluent, subtending bases of all stamens; median glands present. Ovules 5–100 per ovary. Fruiting pedicels slender, straight, divaricate to ascending. Fruit dehiscent siliques or silicles, narrowly linear, terete, sessile; valves with a prominent midvein, smooth or torulose; replum rounded; septum complete or perforated; style to 1 mm; stigma capitate, entire. Seeds uniseriate, wingless, oblong, plump; seed coat minutely reticulate, usually mucilaginous when wetted; cotyledons incumbent.

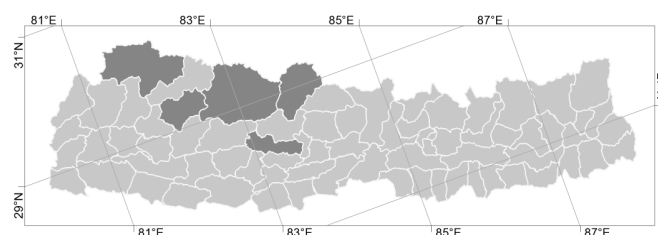
Worldwide about 40 species, mainly in N and S America and Macaronesia. One species in Nepal.

1. *Descurainia sophia* (L.) Webb ex Prantl, Nat. Pflanzenfam. 3(2): 192 (1891).
Sisymbrium sophia L., Sp. Pl. 2: 659 (1753).

मसिनो तोरीझार Masino torijhar (Nepali).

Herbs, (10–)20–70(–100) cm, eglandular, sparsely to densely pubescent with dendritic trichomes, sometimes glabrous above. Stems, simple basally, often branched above. Basal and lowermost cauline leaves 2- or 3-pinnatisect, ovate to oblong in outline, to 15 × 8 cm; petiole 0.1–2(–3) cm; leaf blade ultimate division linear to oblong, entire, acute to 10 × 2 mm. Upper cauline leaves sessile or short petiolate, smaller and often with more slender ultimate lobes, often glabrous. Sepals yellowish, oblong-linear, 2–2.5 × ca. 0.5 mm. Petals yellow, 2–2.5 × ca. 0.5 mm; claw 1.5–2 mm. Filaments 2–3 mm; anthers ca. 0.5 mm. Fruiting pedicels (0.5–)0.8–1.5(–2) cm, narrower than fruit. Fruit narrowly linear, (1–)1.5–2.7(–3) cm × 0.5–0.8(–1) mm; valves glabrous, torulose, with a prominent midvein; septum with a broad central longitudinal band appearing as 2 or 3 veins; style obsolete to 0.2 mm. Seeds uniseriate, brown, reddish, 0.7–1 × 0.3–0.6 mm.

Distribution: Nepal, E Himalaya, Tibetan Plateau, S Asia, E Asia, N Asia, C Asia, SW Asia, Europe and Africa.



Altitudinal range: 2200–4200 m.

Ecology: Roadsides, waste places, disturbed sites, fields, pastures, deserts.

Flowering: April–June. **Fruiting:** April–June.

The seeds are sometimes used as a substitute for mustard. Young shoot and leaves are eaten as a vegetable. Preparations from the plant are taken internally to eradicate worms, and externally to treat indolent ulcers.

17. *Dontostemon* Andr. ex C.A.Mey. nom cons., in Ledeb., Fl. Altaic. 3: 118 (1831).

Alaïda Dvorák; *Dimorphostemon* Kitag.

Annual or biennial herbs. Trichomes simple, straight or crisped, mixed with multicellular, multiseriate glandular ones. Stems erect or ascending, simple or branched. Basal leaves petiolate, rosulate or not, simple, entire, dentate, pinnatifid, or pectinate-pinnatifid. Cauline leaves petiolate or sessile, similar to basal. Racemes ebracteate, elongated in fruit. Sepals oblong, not saccate. Petals white, or lavender, broadly obovate or spatulate, apex obtuse or emarginate; claw subequalling sepals or longer. Stamens 6, tetradynamous; median filament pairs free and toothed or not below anther and expanded to base, dilated at base; anthers ovate or oblong-ovate, often apiculate at apex. Nectar glands 4, lateral, 1 on each side of lateral stamen; median glands absent. Ovules 14–70 per ovary. Fruiting pedicels ascending or divaricate. Fruit dehiscent siliques, linear, terete or latiseptate; valves with a prominent midvein and often distinct marginal veins, glabrous or glandular, torulose; replum flattened; septum complete; style to 3 mm; stigma capitate, slightly lobed. Seeds uniseriate, margined or not, oblong or ovate, plump or slightly flattened; seed coat reticulate, not mucilaginous when wetted; cotyledons accumbent or incumbent.

Worldwide eleven species in E and C Asia. Two species in Nepal.

Key to Species

- 1a Petals obovate, (5–)6–8 mm. Median filaments abruptly expanded and toothed below anther. Seeds apically margined. Anthers 0.6–0.8 mm **1 *D. pinnatifidus***
- b Petals spatulate, 2–4(–4.5) mm. Median filaments gradually expanded to base, toothless. Seeds not margined. Anthers 0.2–0.4 mm **2 *D. glandulosus***

1. *Dontostemon pinnatifidus* (Willd.) Al-Shehbaz & H.Hara, Novon 10: 96 (2000).
Cheiranthus pinnatifidus Willd., Sp. Pl., ed. 5[as 4], 3(1): 523 (1800); *Alaïda pectinata* (Fisch. ex DC.) Dvorák; *Andreoskia pectinata* (Fisch. ex DC.) DC.; *Andrzeiowskia pectinata* (Fisch. ex DC.) Turcz.; *Dimorphostemon asper* Kitag.; *D. pectinatus* (Fisch. ex DC.) Golubk.; *D. pectinatus* var. *humilior* (N.Busch) Golubk.; *D. pinnatus* (Pers.) Kitag.; *D. shanxiensis* R.L.Guo & T.Y.Cheo; *Dontostemon asper* Schischk.; *D. pectinatus* (Fisch. ex DC.) Ledeb.; *D. pectinatus* var. *humilior* N.Busch; *Erysimum*

glandulosum Monnet; *E. hookeri* Monnet; *Hesperidopsis pinnatifidus* (Willd.) Kuntze; *Hesperis pilosa* Poir.; *H. pinnata* Pers.; *H. punctata* Poir.; *Sisymbrium asperum* Pall.; *S. pectinatum* Fisch. ex DC.; *Torularia pectinata* (Fisch. ex DC.) Ovcz. & Junussov.

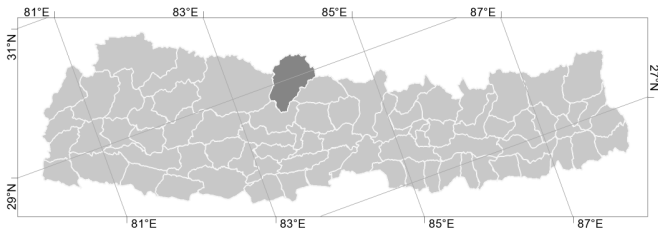
Annual or biennial herbs, (5–)10–40(–60) cm, sparsely to densely glandular. Stems erect, often simple, branched above. Basal and lowermost cauline leaves sparsely to densely pubescent with simple trichomes to 2 mm, sparsely to

Cruciferae

moderately glandular; petiole 2–10(–15) mm; leaf blade lanceolate to elliptic or oblong, (0.7–)1.5–4.5(–6) cm × (1.5–)3–10(–15) mm, base attenuate to cuneate, apex acute, margin coarsely dentate, serrate, or pinnatifid, ciliate. Middle and upper cauline leaves narrowly linear and entire, or elliptic to lanceolate and dentate to serrate. Sepals oblong, 2–3(–4) × (0.8–)1–1.5 mm, sparsely hairy apically or glabrous. Petals white, broadly obovate, (5–)6–8 × (2.5–)3–4(–5) mm, apex emarginate; claw 1–3 mm. Filaments of median stamens 2–3 mm, free, abruptly expanded and toothed below anther; filament of lateral stamens 1.5–2.5 mm, slender; anthers oblong-ovate, 0.6–0.8 mm, apiculate. Ovules 16–60 per ovary. Fruiting pedicels ascending to divaricate, often straight, (0.3–)0.5–1.5(–2.3) cm, glandular. Fruit (1.1–)1.5–4(–5) × (0.8–)1–1.3 mm, straight, erect to ascending, torulose, terete; valves sparsely to densely glandular, with prominent midvein and marginal veins; style 0.5–1.5 mm; stigma slightly lobed. Seeds brown, oblong-ovate to narrowly oblong, 1.1–2.3 × 0.7–1 mm, narrowly margined towards apex; cotyledons obliquely accumbent to incumbent.

Fig. 5n-o

Distribution: Nepal, Tibetan Plateau, Assam-Burma, E Asia and N Asia.



Altitudinal range: ca. 4200 m.

Ecology: Grassy plains, hillsides, rocky slopes, roadsides, sand dunes, flood plains, grasslands.

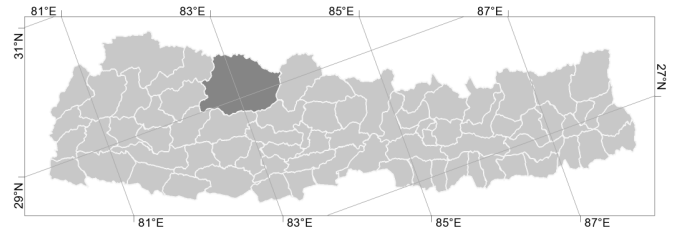
Flowering: June–August. **Fruiting:** June–August.

2. *Dontostemon glandulosus* (Karelin & Kirilov) O.E.Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 10: 554 (1930). *Arabis glandulosa* Karelin & Kirilov, Bull. Soc. Imp. Naturalistes Moscou 15: 146 (1842); *Alaïda glandulosa* (Karelin & Kirilov) Dvorák; *Dimorphostemon glandulosus* (Karelin & Kirilov) Golubk.; *D. sergievskiana* (Polozhij) S.V.Ovchinnikova; *Neotorularia sergievskiana* (Polozhij) Czerep.; *Sisymbrium glandulosum* (Karelin & Kirilov) Maxim.; *Stenophragma glandulosa* (Karelin & Kirilov) B.Fedtsch.; *Torularia glandulosa* (Karelin & Kirilov) Vassilcz.; *T. sergievskiana* Polozhij.

Annual or biennial herbs, (1.5–)5–20(–30) cm, sparsely to densely glandular. Stems erect or ascending, simple to many-branched basally. Basal and lowermost cauline leaves sparsely to densely pubescent with simple trichomes to 1.5 mm, sparsely to moderately glandular; petiole 2–10(–25) mm; leaf blade lanceolate to oblong, (0.3–)0.5–2.5(–4) cm × 2–10(–15) mm, base attenuate to cuneate, apex acute, margin coarsely dentate to pinnatifid, ciliate. Middle and upper cauline leaves narrowly linear and entire, or elliptic to lanceolate and dentate to serrate. Sepals oblong, 1–2(–3) × 0.5–1 mm, sparsely hairy apically or glabrous. Petals lavender or white, broadly spatulate, 2–4(–4.5) × (0.5–)1–1.5(–2) mm, apex obtuse or subemarginate; claw to 1.5 mm. Filaments of median stamens 1.5–2.5 mm, free, gradually expanded to base, toothless; filament of lateral stamens 1–2 mm, slender; anthers broadly ovate, 0.2–0.4 mm, apiculate. Ovules 14–70 per ovary. Fruiting pedicels ascending to divaricate, often straight, 2–8(–12) mm, glandular. Fruit (0.7–)1.3–3(–4) × 0.8–1.3 mm, straight, erect to ascending, torulose, terete; valves sparsely to densely glandular, with prominent midvein and marginal veins; style 0.5–1 mm; stigma slightly lobed. Seeds brown, ovate to oblong, 0.8–1.7 × 0.5–0.8 mm, not margined towards apex; cotyledons obliquely accumbent to obliquely incumbent.

Fig. 5k-m

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, N Asia and C Asia.



Altitudinal range: ca. 4000 m.

Ecology: Alpine meadows and steppes, sandy river banks, crevices, gravel plains, dry scrub, roadsides, scree slopes.

Flowering: June–August. **Fruiting:** June–August.

This is the first documented record of the species from Nepal, based on *Shrestha 5409* (BM) and *Grey-Wilson & Phillips 607* (K).

18. *Erysimum* L., Sp. Pl. 2: 660 (1753).

Annual or biennial herbs. Trichomes sessile, malpighiaceus or 3–5(–8)-rayed stellate. Stems simple or branched basally. Basal leaves rosulate, petiolate, simple, entire or dentate, rarely pinnatifid or pinnatisect. Cauline leaves petiolate or sessile, cuneate or attenuate at base, entire or dentate. Racemes bracteate basally, corymbose, elongated in fruit. Sepals oblong-linear, erect, pubescent, base of lateral pair saccate. Petals yellow or orange, blade oblanceolate to spatulate, apex rounded; claw differentiated from blade. Stamens 6, erect, tetradynamous; anthers linear. Nectar glands 1, 2, or 4, distinct or confluent and subtending bases of all stamens; median glands present or absent. Ovules 60–90 per ovary. Fruiting pedicels thickened and nearly as wide as fruit, erect, divaricate to ascending. Fruit

dehiscent siliques or rarely silicles, linear, terete, 4-angled, latiseptate, or angustiseptate, sessile or rarely shortly stipitate; valves with a prominent midvein, pubescent on outside, keeled or not, smooth or torulose; replum rounded; septum complete; style short, often pubescent; stigma capitate, subentire. Seeds uniseriate or rarely biseriate, winged, margined, or wingless, oblong, plump or flattened; seed coat minutely reticulate, mucilaginous when wetted; cotyledons incumbent or rarely accumbent.

Worldwide about 150 species, primarily in Eurasia, but also N and C America, N Africa and Macaronesia. One species in Nepal.

Erysimum cheiri (L.) Crantz (syn. *Cheiranthus cheiri* L.) is a cultivated ornamental plant (wallflower), but it is not known if it has become naturalized in Nepal.

1. *Erysimum benthamii* Monnet, Notul. Syst. [Paris] 2: 242 (1912).

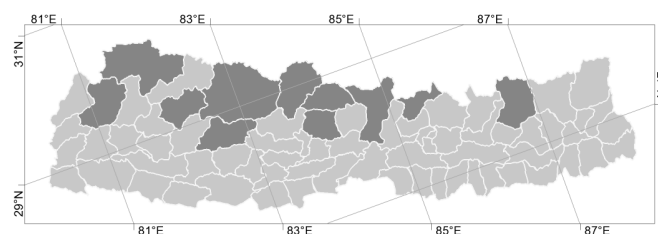
Erysimum benthamii var. *grandiflorum* Monnet; *E. dolpoense* H.Hara; *E. longisiliquum* Hook.f. & Thomson later homonym, non Schlecht.; *E. pachycarpum* Hook.f. & Thomson; *E. sikkimense* Polatschek; *E. szechuanense* O.E.Schulz.

गोड-थो-क्पा Gong-tho-kpa (Tibetan).

Herbs, (15–)30–80(–100) cm. Trichomes 3(or 4)-forked, mixed with fewer malpighiaceus ones. Stems erect, often angled, primarily with malpighiaceus trichomes. Basal leaves petiolate, rosulate, withered by time of flowering. Lower cauline leaves with petioles 1–3(–5) cm; leaf blade narrowly linear to linear-lanceolate, (2–)3–8(–11) cm × (2–)4–10(–14) mm, base attenuate to cuneate, apex acute to acuminate, margin coarsely dentate. Upper cauline leaves sessile or subsessile, denticulate to subentire. Racemes corymbose, densely flowered, elongated considerably in fruit. Sepals oblong-linear, (5–)6–8 × 1–1.5 mm, lateral pair saccate. Petals orange-yellow to yellow, (0.8–)1–1.5 cm × 2–3(–3.5) mm; claw distinct, subequalling sepals. Filaments yellow, 7–10 mm; anthers 2–3 mm. Ovules 60–90 per ovary. Fruiting pedicels divaricate to ascending, (0.5–)0.6–1.5(–2.5) cm, stout, narrower than fruit, straight. Fruit (6–)7–11(–13) cm × 1.2–1.7 mm, slightly torulose, erect to ascending, straight; valves with a prominent midvein, outside with malpighiaceus and 3- or 4-forked trichomes, inside glabrous; style slender, 1–3 mm, cylindric,

narrower than fruit; stigma capitate, subentire. Seeds oblong, 1.5–2 × 0.8–1 mm.

Distribution: Nepal, E Himalaya, Tibetan Plateau, Assam-Burma and E Asia.



Altitudinal range: 1000–4900 m.

Ecology: Dry rocky areas, *Quercus* woods, open pastures, grassy slopes, meadows, roadsides, mountain slopes.

Flowering: May–July. **Fruiting:** July–September.

The reports of *Erysimum hieraciifolium* L. from Nepal, Bhutan, and Sikkim are based on misidentified plants of *E. benthamii*. Hara (Enum. Fl. Pl. Nepal 2: 43. 1979) recognized three species of *Erysimum* in Nepal, but the collections on which these species were based clearly belong to the variable *E. benthamii*.

19. *Braya* Sternb. & Hoppe, Denkschr. Königl.-Baier. Bot. Ges. Regensburg 1(1): 65 (1815).
Platypetalum R.Br.

Perennial herbs. Caudex simple or many-branched. Trichomes simple or forked. Plants rarely glabrous or glabrescent. Basal leaves petiolate, rosulate, simple, entire or dentate, rarely pinnately lobed, petiolar base persistent. Cauline leaves absent, or few, sessile or nearly so, not auriculate, entire or rarely dentate. Racemes bracteate, ebracteate or only lowermost flowers bracteate, elongated or not in fruit. Sepals oblong, caducous or persistent, erect, base of lateral pair not saccate, margin membranous. Petals white, pink, or purple, spatulate to obovate, apex obtuse or rounded; claw shorter than sepals. Stamens 6, tetradynamous; filaments dilated at base; anthers ovate or oblong, obtuse at apex. Nectar glands 4, 1 on each side of lateral stamen; median glands absent. Ovules 8–40 per ovary. Fruiting pedicels erect, divaricate to ascending. Fruit dehiscent siliques or silicles, linear, oblong, ovoid, terete or slightly latiseptate, sessile; valves with a distinct midvein, glabrous or pubescent, smooth or torulose; replum rounded; septum complete; style obsolete or to 1 mm; stigma capitate, entire to 2-lobed. Seeds uniseriate (rarely biseriate), wingless, oblong or ovoid, plump; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons incumbent.

Worldwide about 20 polymorphic species in the alpine, subarctic, or northern temperate regions of N America, Europe, and Asia. Two species in Nepal.

Key to Species

- 1a Stems leafy. Racemes bracteate at least basally. Fruit linear siliques **1 *B. humilis***
 b Stems leafless. Racemes ebracteate. Fruit oblong or ovoid siliques **2 *B. rosea***

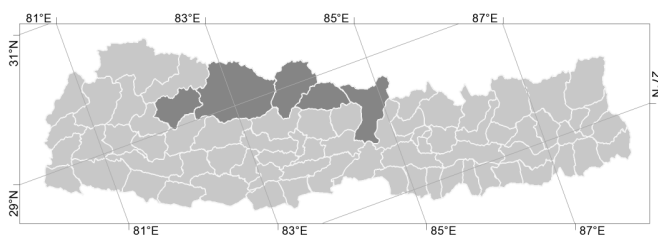
1. *Braya humilis* (C.A.Mey.) B.L.Rob., Syn. Fl. N. Amer. 1(1): 141 (1895).

Sisymbrium humile C.A.Mey., in Ledeb., Icon. Pl. 2: 16 (1830); *Arabidopsis tuernurnica* K.C.Kuan & Z.X.An; *Arabis piasezkii* Maxim.; *Dichasanthus humilis* (C.A.Mey.) Soják; *Erysimum alyssoides* Franch.; *E. stigmatosum* Franch.; *Hesperis hygrophylla* Kuntze; *H. piasezkii* (Maxim.) Kuntze; *Malcolmia perennans* Maxim.; *Neotorularia humilis* (C.A.Mey.) Hedge & J.Léonard; *N. maximowiczii* (Botsch.) Botsch.; *N. piasezkii* (Maxim.) Botsch.; *Sisymbrium humile* var. *piasezkii* (Maxim.) Maxim.; *S. nanum* Bunge; *S. piasezkii* Maxim.; *Torularia humilis* (C.A.Mey.) O.E.Schulz; *T. humilis* var. *maximowiczii* (Botsch.) H.L.Yang; *T. humilis* var. *piasezkii* (Maxim.) Jafri; *T. maximowiczii* Botsch.; *T. piasezkii* (Maxim.) Botsch.

Herbs, (4–)8–25(–35) cm, sparsely to densely covered with short-stalked to subsessile, submalpighiaceous or rarely 2-forked trichomes often mixed along petioles and stem bases with simple trichomes, rarely plants glabrescent. Stems leafy, usually few to many from the base, ascending to erect, rarely subdecumbent. Basal leaves rosulate; petiole 2–16(–35) mm; leaf blade obovate, spatulate, oblanceolate, oblong, to sublinear, (0.3–)0.5–2(–3.5) cm × 1–8(–10) mm, base attenuate to cuneate, apex acute to obtuse, margin entire, repand, dentate, to pinnatifid, sparsely to densely pubescent or rarely glabrous. Cauline leaves similar to basal leaves but progressively smaller upward, uppermost sessile to subsessile. Racemes bracteate at least basally. Sepals, 2–3 × 0.8–1.2 mm, subsaccate or not saccate at base. Petals white, pink, or purple, spatulate to broadly obovate, 3–5(–8) × (1–)1.5–2.5(–4) mm, apex rounded. Filaments 2–3(–4) mm; anthers oblong, 0.4–0.7 mm. Ovules 20–40 per ovary. Fruiting pedicels erect and subappressed to rachis to ascending or divaricate, slender, much narrower than fruit, (2.5–)3–8(–12) mm. Fruit linear, 1.2–2.5(–3.2) cm × 0.5–0.9(–1) mm, mostly straight, terete, torulose, pubescent with submalpighiaceous trichomes rarely mixed with fewer straight ones, rarely glabrescent; style slender, 0.3–0.8(–1) mm; stigma entire to strongly 2-lobed. Seeds oblong 0.6–0.9 × 0.4–0.5 mm.

Fig. 2j & Fig. 6a–c

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, Assam-Burma, N Asia, C Asia, SW Asia and N America.



Altitudinal range: 1000–5300 m.

Ecology: Sandy areas, river terraces, open stony slopes, scree, limestone ledges.

Flowering: May–August. **Fruiting:** June–August.

A highly variable species in leaf shape and margin, flower size and colour, pubescence, fruit length and orientation, cotyledonary position, chromosome numbers, and length of the bracteate portion of racemes. Numerous taxa have been described in China, Russia, and North America, but the variation is continuous and does not support the recognition of infraspecific taxa. Fully bracteate to only basally bracteate racemes are often found within the same population and throughout the range of the species. The above synonymy all pertains to E and C Asia, and it represents about half of the total synonymy on the species.

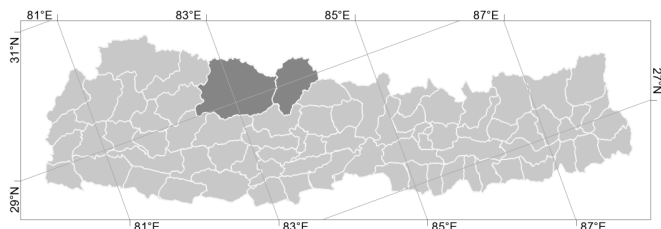
2. *Braya rosea* (Turcz.) Bunge, Del. Sem. Hort. Dorpater: 7 (1841).

Platypetalum roseum Turcz., Bull. Soc. Imp. Naturalistes Moscou 11: 87 (1838); *Braya aenea* Bunge; *B. aenea* subsp. *pseudoaenia* V.V.Petrovsky; *B. angustifolia* (N.Busch) Vassilcz.; *B. brachycarpa* Vassilcz.; *B. brevicaulis* Schmid; *B. limosella* Bunge; *B. limoselloides* Bunge ex Ledeb.; *B. marinellii* Pamp.; *B. rosea* var. *aenea* (Bunge) Malyshev; *B. rosea* var. *brachycarpa* (Vassilcz.) Malyshev; *B. rosea* var. *glabra* Regel & Schmalh.; *B. rosea* var. *leiocarpa* O.E.Schulz; *B. rosea* var. *multicaulis* B.Fedtsch.; *B. rosea* var. *simplicior* B.Fedtsch.; *B. sinuata* Maxim.; *B. thomsonii* Hook.f.; *B. tibetica* Hook.f. & Thomson; *B. tibetica* forma *linearifolia* Z.X.An; *B. tibetica* forma *sinuata* (Maxim.) O.E.Schulz; *B. tibetica* var. *breviscapa* Pamp.; *B. tinkleri* Schmid; *Hesperis limosella* (Bunge) Kuntze; *H. limoselloides* (Bunge ex Ledeb.) Kuntze; *H. rosea* (Turcz.) Kuntze; *Sisymbrium alpinum* var. *aeneum* (Bunge) Trautv.; *S. alpinum* var. *roseum* (Turcz.) Trautv.; *S. limosella* (Bunge) E.Fourn.

Herbs (1–)3–10(–16) cm, scapose, densely to sparsely pilose with short-stalked forked trichomes sometimes mixed with simple ones, rarely glabrous throughout except for petiole margin. Caudex slender, sometimes with petiolar remains of previous years, simple or few-branched. Basal leaves rosulate; petiole (0.2–)0.4–1.6(–3) cm, slender or slightly expanded at base, ciliate; leaf blade linear, oblong, oblanceolate, obovate, (0.4–)1–3(–4) cm × 0.5–3.5(–6) mm, base attenuate, apex obtuse to acute, margin entire to dentate or sinuate, densely to sparsely pilose or glabrous. Scapes densely pilose to glabrous, leafless. Raceme ebracteate, capitate or rarely considerably elongated in fruit. Sepals subapically purple or greenish, oblong, 1.5–2.5(–3) × 1–1.2 mm, glabrous to densely pubescent, broadly white margined. Petals purple, pink, to white, spatulate to obovate, (2.5–)3–4(–4.5) × (0.7–)1–1.5 mm, apex obtuse. Filaments 1.3–1.8 mm; anthers ovate, ca. 0.3 mm. Ovules 8–12 per ovary. Fruiting pedicels divaricate to

ascending, 1.5–5(–7) mm. Fruit ovoid to oblong, (2–)3–6.5(–8) × 1–2 mm, glabrous to densely pubescent; style 0.2–0.7(–1) mm. Seeds ca. 0.7–1 × 0.4–0.5 mm.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, N Asia and C Asia.



Altitudinal range: 2500–5300 m.

Ecology: Mountain slopes, river banks, scree, weathered marble rock and debris, steppe, alpine cushions.

Flowering: June–July. **Fruiting:** July–September.

This is the first documented record of this species for Nepal, and it is based on *Wald 24* (BM), *Stainton 4305* (BM) and *Grey-Wilson & Phillips 540* (K). Critical examination of numerous collections, including types and authentic material, of *Braya rosea*, *B. aenea*, *B. tibetica*, and *B. thomsonii* reveal that there is not a single character that can be used to reliably distinguish between them. There is continuous variation in the amount of indumentum, fruit length and shape, leaf shape and margin, duration of sepals, relative length of scape to basal rosette, and petal colour and shape.

20. *Christolea* Cambess., in Jacquem., Voy. Inde 4(1): 17 (1841). *Koelzia* Rech.

Perennial herbs with a woody caudex or herbaceous base. Trichomes simple. Stems branched from caudex and above, sometimes woody at base. Basal leaves absent. Cauline leaves petiolate, dentate, uppermost sometimes entire. Racemes ebracteate, elongated in fruit. Sepals oblong, caducous, base of lateral pair not saccate. Petals cream to yellow with purple base, spatulate or oblong-obovate, apex rounded; claw purple, subequalling sepals. Stamens 6, tetradynamous; filaments not dilated at base; anthers oblong, apiculate at apex. Nectar glands confluent and subtending bases of all stamens; median glands present. Ovules 10–20 per ovary. Fruiting pedicels slender, ascending, suberect, or reflexed. Fruit dehiscent siliques, linear to oblong or lanceolate, latiseptate, sessile; valves papery, with a distinct midvein, glabrous or puberulent, torulose; replum rounded, covered by connate valve margin; septum complete; style obsolete, rarely to 0.5 mm; stigma capitate, entire or slightly 2-lobed. Seeds uniseriate, wingless, sometimes appendaged towards apex, oblong, slightly flattened, often transversely oriented in locule; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons incumbent.

Worldwide two species in the Himalaya and C Asia. One species in Nepal.

1. *Christolea crassifolia* Cambess., in Jacquem., Voy. Inde 4(1): 17 (1841).

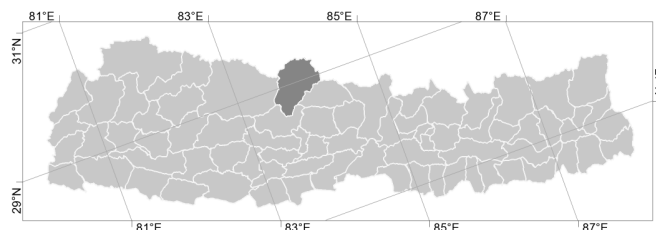
Christolea afghanica (Rech.f.) Rech.; *C. crassifolia* var. *pamirica* (Korsh.) Korsh.; *C. incisa* O.E.Schulz; *C. pamirica* Korsh.; *Ermania pamirica* (Korsh.) Ovcz. & Junussov; *Koelzia afghanica* Rech.f.; *Parrya ramosissima* Franch.

Herbs (8–)15–40(–50) cm. Caudex woody, compactly branched, to 2.5 cm in diameter. Stems branched, sometimes woody at base, hirsute with simple trichomes to 1.2 mm, rarely glabrous. Leaves all cauline, several to many; petiole (2–)5–12(–15) mm; leaf blade highly variable in shape, pubescence, or margin, usually obovate, spatulate, rhomboid, oblong, or elliptic, (0.8–)1.3–3.5(–5) × 0.4–1.6(–2.5) cm, base cuneate to attenuate, apex acute to obtuse, margin dentate to rarely incised along upper half, sometimes entire, leathery, densely to sparsely pubescent, rarely glabrous. Raceme several- to many-flowered. Sepals oblong, 3–4 × 1.5–2 mm, glabrous or sparsely puberulent. Petals 5–6.5 × 2–3 mm; claw 2.5–3.5 mm. Filaments white, median pairs 2.5–3 mm, lateral pair 1.5–2 mm; anthers oblong, 0.9–1.2 mm. Fruiting pedicels 5–9(–12) mm, glabrous or sparsely puberulent. Fruit (0.9–)1.5–3(–3.5)

cm × (2–)2.7–4(–4.5) mm, subappressed to rachis, flattened; valves constricted between laterally oriented seeds, glabrous or puberulent, base obtuse, apex acute to subacuminate; style obsolete or to 0.4 mm. Seeds brown, oblong, 1.8–2.3 × 0.9–1.5 mm.

Fig. 2p & Fig. 6d-e

Distribution: Nepal, W Himalaya, Tibetan Plateau, C Asia and SW Asia.



Altitudinal range: 3500–4700 m.

Cruciferae

Ecology: Alpine steppe, rocky slopes, bare slopes.

Flowering: June–September. **Fruiting:** July–October.

21. *Dilophia* Thomson, Hooker's J. Bot. Kew Gard. Misc. 5: 19 (1853).

Perennial herbs. Trichomes absent or simple. Roots fleshy, conical. Stems erect, simple to ground level, branched above. Basal leaves sessile, fleshy, rosulate, simple, entire or sinuate or dentate. Cauline leaves sessile, attenuate and not auriculate, entire. Corymbs several- to many-flowered, bracteate or ebracteate, simple or compound, not elongated in fruit. Sepals broadly ovate, persistent, erect to ascending, glabrous or puberulent, base of lateral pair not saccate. Petals white to lavender or purple, longer than sepals; blade spatulate to spatulate-linear, apex obtuse to subemarginate; claw obscure to distinct. Stamens 6, slightly spreading, slightly tetradynamous; filaments not dilated at base; anthers ovate, apiculate at apex. Nectar glands confluent and subtending bases of all filaments. Ovules 4–12 per ovary. Fruiting pedicels ascending or divaricate. Fruit dehiscent siliques, obcordate, angustiseptate, sessile; valves membranous or thin papery, obscurely veined, glabrous or puberulent, rounded, smooth, apically gibbous and cristate; replum strongly flattened, base much broader; septum complete or perforated; style to 0.5 mm, included in apical notch of fruit; stigma capitate, entire. Seeds wingless, broadly oblong, slightly flattened; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons incumbent or oblique.

Worldwide two species in the Himalayas. One species in Nepal.

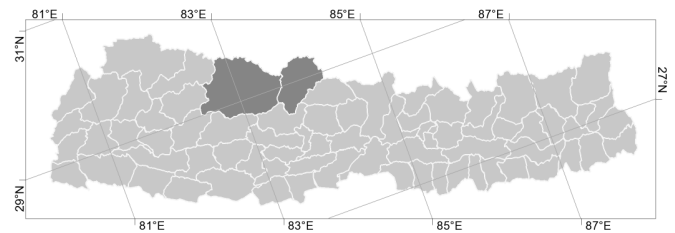
1. *Dilophia salsa* Thomson, Hooker's J. Bot. Kew Gard. Misc. 5: 20 (1853).

Dilophia dutreuilii Franch.; *D. kashgarica* P.Rupr.; *D. salsa* var. *hirticalyx* Pamp.

Herbs glabrous throughout, or sparsely to densely pubescent on fruit valves and/or sepals with simple flattened trichomes to 0.5 mm. Stems erect, somewhat fleshy, 1.5–10 cm, often arranged in a flat mat 1–12 cm in diameter. Leaves spatulate to linear-spatulate or oblong to linear, (3–)6–20(–30) × (1–)2–3(–5) mm, fleshy, base attenuate, apex obtuse, margin sinuate to dentate or repand, sometimes entire. Corymbs few- to many-flowered, lowermost or most flowers bracteate, sometimes flowers solitary from centre of rosette. Sepals (1–)1.5–2.5 × 1–1.5 mm, glabrous to densely pubescent, margin broadly membranous, apex denticulate or entire. Petals white to lavender, drying purplish, 1.8–2.5(–3.2) × 0.5–1(–1.5) mm, apex obtuse to subemarginate; claw to 2 mm. Filaments white, 1.1–1.6 mm; anthers ovate, (0.2–)0.3–0.5 mm, apicula triangular, 0.05–0.1 mm. Fruiting pedicels 3–10 mm. Fruit valves oblong to ovate, glabrous to densely pubescent, 1–2.5 mm, apical cristae 3–14; replum 1.2–2.5 mm wide at base; style 0.2–0.5 mm. Seeds brown to blackish, broadly oblong, (2 or)4–8(–12) per fruit, 0.7–1.1(–1.5) × 0.5–6 mm.

Fig. 6f-g

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, E Asia, N Asia and C Asia.



Altitudinal range: 2200–5500 m.

Ecology: Among sand in river bottoms or by marshes, damp mud by stream-sides, debris covered glacial moraine, scree, grassland in valley, steep slopes with semiconsolidated scree, turf cushions, sand plains, permafrost, salty pastures, dunes, alpine steppe.

Flowering: June–August. **Fruiting:** July–September.

22. *Lepidostemon* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 161 (1861).

Chrysobraya H.Hara.

Annual or caespitose perennial herbs. Trichomes dendritic, forked, submalpighiaceous, or simple, often more than 1 kind present. Stems erect, simple from rosettes, leafy or leafless. Basal leaves petiolate, rosulate or not, simple, entire or dentate. Cauline leaves absent or similar to basal, sometimes pinnatifid. Racemes few- to many-flowered, ebracteate or bracteate throughout, elongated in fruit, sometimes flowers solitary on long pedicels originating from axils of rosette leaves. Sepals oblong, persistent or caducous, base of lateral pair not saccate, margin membranous. Petals yellow, white, lavender, or purple, broadly obovate, apex rounded or emarginate; claw subequalling sepals. Stamens 6, tetradynamous; filaments winged or wingless, toothed or rarely toothless; anthers reniform, obtuse at apex. Nectar glands 4, lateral; median glands absent. Ovules 8–28 per ovary. Fruiting pedicels slender, ascending to

divaricate or recurved. Fruit dehiscent siliques, linear-oblong to linear, terete or latiseptate, sessile; valves papery, obscurely veined, rarely marginal veins prominent, pubescent, torulose or rarely smooth; replum rounded; septum complete or rarely perforate; style distinct, to 2 mm; stigma capitate, entire. Seeds uniseriate, wingless, oblong or ovate, plump; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons accumbent.

Worldwide five species in Bhutan, China and Sikkim. Three species in Nepal.

Hara (Enum. Fl. Pl. Nepal 2: 38. 1979) did not record the genus for Nepal. Instead, he listed one species (*Lepidostemon glaricola* (H.Hara) Al-Shehbaz) as *Chrysobraya* and another (*L. williamsii* (H.Hara) Al-Shehbaz) as *Draba*.

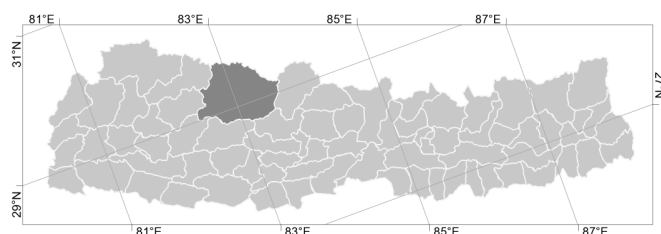
Key to Species

- 1a Annuals. Filaments of median stamens flattened, often appendaged. Cotyledons accumbent.....1 ***L. gouldii***
- b Perennials. Filaments of median stamens slender, unappendaged. Cotyledons incumbent.....2
- 2a Racemes ebracteate. Stems leafless. Trichomes exclusively dendritic. Nectar glands clavate, 0.5–1 mm. Petals bright yellow2 ***L. glaricola***
- b Racemes bracteate throughout. Stems leafy. Most trichomes submalpighiaceus. Nectar glands to 0.2 mm. Petals white..... 3 ***L. williamsii***

1. *Lepidostemon gouldii* Al-Shehbaz, Novon 10: 331 (2000).

Annual herbs, 2–15 cm. Trichomes simple, stalked forked, or subsessile and submalpighiaceus on stems and pedicels, almost exclusively simple and to 1.5 mm long on leaves. Basal leaves rosulate, smaller than and somewhat similar to cauline ones, dry by flowering time. Cauline leaves few to many, well-spaced below raceme; petiole obsolete or rarely to 2 mm; leaf blade spatulate to oblanceolate, 2–15 × 1–3(–4) mm, base attenuate, apex obtuse, margin entire or obscurely dentate with 1 or 2 teeth on each side, sparsely pubescent. Racemes 3–12-flowered, ebracteate, elongated considerably in fruit. Sepals oblong, 1.5–2 × 1–1.5 mm, spreading, caducous. Petals purple, lavender, or rarely white, broadly obovate, 4.5–6 × 3–4 mm, caducous, apex emarginate; claw 1–2 mm. Filaments 1.5–2.5 mm, caducous; median pairs with a linear wing 0.3–0.5 mm wide, unexpanded portion of filament to 0.3 mm; lateral pair entire; anthers reniform, 0.3–0.5 mm. Nectar glands ovate, 0.2–0.3(–0.4) mm. Ovules 8–12 per ovary. Fruiting pedicels divaricate, recurved, 5–12 mm. Fruit (immature) narrowly oblong, 5–10 × ca. 1 mm, terete; valves densely pubescent with stalked or dendritic trichomes; style ca. 1 mm; stigma wider than style, entire. Immature seeds oblong.

Distribution: Nepal and E Himalaya.



Altitudinal range: ca. 3600 m.

Ecology: Sandy soil near streams, moist *Abies* forest.

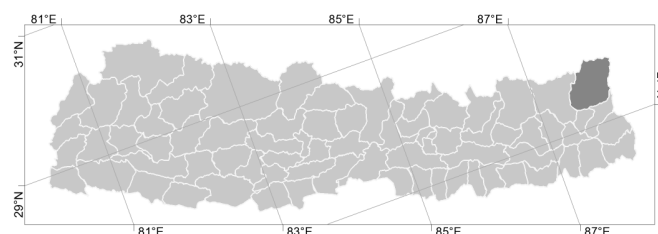
Flowering: May–July. **Fruiting:** July–August.

2. *Lepidostemon glaricola* (H.Hara) Al-Shehbaz, Novon 10: 333 (2000).

Chrysobraya glaricola H.Hara, J. Jap. Bot. 49: 195 (1974).

Perennial caespitose herbs, 1–10 cm. Trichomes crisped, dendritic or rarely few forked. Basal leaves rosulate, many; petiole 3–12 mm; leaf blade spatulate to obovate or oblanceolate, 3–15 × 1.5–5 mm, base attenuate, apex subacute to obtuse, margin 1–4-toothed on each side, rarely subentire. Cauline leaves absent. Racemes numerous-flowered, ebracteate, elongated in fruit. Sepals oblong, 2–2.5 × 1–1.5 mm, slightly spreading, hairy, persistent. Petals bright yellow, broadly obovate, 3–6 × 2–4 mm, persistent, apex emarginate to rounded; claw 1–2 mm. Filaments 1.5–2.5 mm, persistent, neither winged nor dentate; anthers reniform, 0.5–0.6 mm. Nectar glands clavate, 0.5–1 mm. Ovules 8–12 per ovary. Fruiting pedicels ascending to divaricate, slender, straight or slightly curved, (0.5–)1–3 cm. Fruit linear-oblong, 4–11 × 1.2–2 mm, terete; valves torulose, densely pubescent with dendritic trichomes, obscurely veined; septum complete or perforate; style 0.3–1 mm; stigma wider than style, entire. Seeds oblong, 1–1.2 × 0.5–0.6 mm; cotyledons incumbent.

Distribution: Nepal and E Himalaya.



Altitudinal range: ca. 4100 m.

Ecology: Rocks, mossy boulder scree, wet stream beds, scree with running water, meadows, rock crevices.

Cruciferae

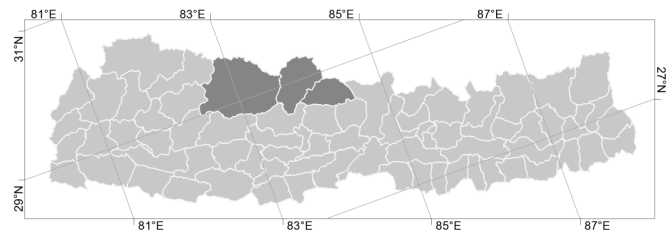
Flowering: May–July. **Fruiting:** July–October.

3. *Lepidostemon williamsii* (H.Hara) Al-Shehbaz, Edinburgh J. Bot. 59(3): 446 (2000).

Draba williamsii H.Hara, J. Jap. Bot. 52: 353 (1977).

Perennial herbs, 1.5–12 cm. Trichomes simple and subsetose on sepals and along leaf margin and upper surface, to 1.2 mm, those on stems, pedicels, lower leaf surface, and fruits stalked-forked or subsessile and submalpighiaceous. Stems simple at base. Basal leaves not rosulate, soon withered. Cauline leaves subsessile or with petioles to 5 mm; leaf blade spatulate, oblanceolate, or lanceolate, 3–25 × 1–5 mm, base attenuate, apex acute to obtuse, margin dentate with 1–4 teeth on each side. Racemes 3–20-flowered, bracteate throughout, elongated considerably in fruit. Sepals oblong, 2–3 × 1–1.5 mm, ascending, caducous. Petals white, broadly obovate, 4–6 × 2.5–4 mm, caducous, apex emarginate; claw 2–3 mm. Filaments 1.5–2.5 mm, caducous, slender, unappendaged; anthers reniform, 0.3–0.5 mm. Nectar glands ca. 0.1 mm, subconfluent. Ovule number unknown. Fruiting pedicels divaricate, recurved, 5–15 mm. Fruit linear, 8–13 × ca. 1 mm, terete, not torulose; valves densely pubescent; style 0.4–0.8 mm; stigma as wide as style, entire. Seeds ovate, brown, 0.7–0.8 × ca. 0.5 mm; cotyledons incumbent.

Distribution: Endemic to Nepal.



Altitudinal range: 3100–4600 m.

Ecology: Grassy slopes, among rocks in river shingles, edge of pastures, wet stony slopes, rock crevices, exposed soil near snow patches.

Flowering: June–July. **Fruiting:** June–July.

One of the paratypes cited by Hara (1977) as *Draba williamsii*, Ludlow & Sherriff 16839 (BM), is the closely related *Lepidostemon gouldii* Al-Shehbaz. *Lepidostemon williamsii* differs from *L. gouldii* by having fully bracteate instead of ebracteate racemes and unappendaged instead of apically appendaged median staminal filaments.

23. *Pycnolinthopsis* Jafri, Pakistan J. Bot. 4: 73 (1972).

Perennial herbs, caespitose, scapose. Caudex simple to many-branched. Trichomes eglandular, dendritic or forked, occasionally with few simple ones. Stems reduced to tiny portions added annually to the apex of caudex or its branches. Basal leaves petiolate, not fleshy, forming well-defined rosette; petiole caducous, thin; leaf blade simple, coarsely dentate to incised towards apex. Cauline leaves absent. Racemes solitary flowers borne on long pedicels originating from centre of rosette. Sepals united into campanulate calyx, persistent, not saccate; lobes ovate to deltoid. Petals white, longer than sepals, broadly obovate, shallowly emarginate at apex; claw obscurely differentiated from blade, much shorter than calyx. Stamens 6, included, erect, tetradynamous; filaments filiform, wingless, unappendaged, not dilated at base, glabrous, free; anthers blackish, ovate, sagittate at base, apiculate at apex. Nectar glands 2, lateral, semiannular and intrastaminal; median glands absent. Ovules 8–20 per ovary. Fruiting pedicels slender, terete, strongly recurved, much shorter than leaves. Fruit dehiscent capsular siliques or silicles, linear to oblong, terete, sessile, unsegmented, geocarpic; valves papery, not navicular, not keeled, torulose, wingless, unappendaged, obscurely veined; replum rounded; septum complete; gynophore absent; style to 1.5 mm, cylindric, persistent, glabrous; stigma capitate, entire. Seeds uniseriate, wingless, oblong, plump; seed coat obscurely reticulate, not mucilaginous when wetted; cotyledons incumbent.

Worldwide one species in Nepal, Bhutan, Sikkim, India and China.

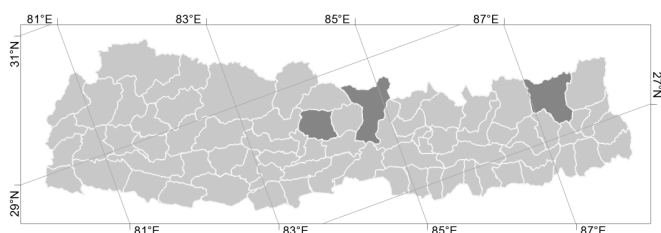
1. *Pycnolinthopsis bhutanica* Jafri, Pakistan J. Bot. 4: 74 (1972).

Pegaeophyton bhutanicum H.Hara; *Pycnolinthopsis minor* Jafri.

Herbs with slender to stout, apically branched or rarely unbranched caudex to 2 cm in diameter. Petiole (0.2–)0.5–3(–5) cm, thin, flattened, not persistent; leaf blade spatulate to oblanceolate, rarely obovate, (0.5–)1–4(–4.5) × 0.4–1.6 cm, base subattenuate to cuneate, apex acute, margin subincised to deeply dentate towards apex and with (3–)4–8(–12) teeth on each side, thin, glabrous to densely pubescent above in upper

half with forked to dendritic, often crisped trichomes to 0.6 mm. Calyx (2.5–)3.5–5 mm, membranous, persisting with fruit, sometimes splitting as fruit develops; lobes ovate-deltoid, 1.5–3.5 × 1–2.5 mm. Petals white, broadly obovate, (5.5–)8–13 × (4–)5.5–8 mm, apex subemarginate; claw obscure, rarely to 1 mm. Filaments slender, median pairs 2–3.5 mm, lateral pair 1.5–2 mm; anthers ca. 0.4 mm. Fruiting pedicels, (0.5–)1–2.5(–4) cm. Fruit linear to oblong, 5–11 × 2–3 mm; valves papery; style 0.5–1 mm. Seeds oblong, light brown, 1–1.4 × 0.6–8 mm.

Distribution: Nepal, E Himalaya, Tibetan Plateau and Assam-Burma.



Altitudinal range: 3000–4500 m.

Ecology: Stony areas at stream edge, crevices of steep wet rocks, open scree, mossy areas below waterfalls, wet rock ledges.

Flowering: May–July. **Fruiting:** August–September.

24. *Solms-laubachia* Muschl., Notes Roy. Bot. Gard. Edinburgh 5: 205 (1912).

Desideria Pamp.; *Ermaniopsis* H.Hara; *Oreoblastus* Suslova.

Perennial herbs, sometimes pulvinate. Caudex branched covered with petioles of previous years. Trichomes simple, rarely shortly stalked, branched. Stems minute or present and simple, leafy or leafless. Basal leaves petiolate, rosulate, simple, entire or 3–9(–11)-toothed, pinnately or palmately veined. Cauline leaves absent or similar to basal ones and short petiolate to sessile, not auriculate. Flowers in (3–)6–35-flowered, bracteate or ebracteate corymbose racemes elongated or not in fruit. Sepals oblong to ovate, free or united, persistent or caducous, erect, equal, base of inner pair not saccate, margin membranous. Petals purple, blue to lilac, greenish-blue, pink, or rarely white, suborbicular, obovate, to spatulate, apex obtuse to emarginate; claw subequalling or longer than sepals. Stamens 6; filaments free, dilated or not at base; anthers oblong-linear to ovate, not apiculate at apex; nectar glands 2 and lateral, or confluent and subtending bases of all filaments; median nectaries absent or present. Ovules 6–30 per ovary. Fruit dehiscent siliqua or silicle, linear, oblong, ovate, or lanceolate, latiseptate, sessile, readily detached at maturity from pedicel, rectangular in cross section; valves papery, reticulate veined, with a prominent midvein and marginal veins, glabrous or pubescent, smooth, adnate with replum at fruit apex, margin angled; replum rounded, concealed by connate valve margins; septum complete or rarely perforate or reduced to a rim, membranous, translucent, rarely absent; style obsolete, rarely to 1 mm long; stigma capitate, entire or 2-lobed, lobes not decurrent. Seeds uniseriate or biseriate, wingless, broadly ovate to suborbicular or oblong, flattened; seed coat reticulate, rugose, or papillate, not mucilaginous when wetted; cotyledons accumbent.

Worldwide 26 species in the Himalayas, E and C Asia. Five species in Nepal.

Key to Species

- 1a Leaves entire.....**4 S. jafrii**
- b Leaves dentate.....**2**
- 2a Sepals united, persistent.....**2 S. nepalensis**
- b Sepals free, caducous.....**3**
- 3a Racemes ebracteate. Filaments flattened, subapically toothed **1 S. haranensis**
- b Racemes bracteate throughout. Filaments not flattened or toothed.....**4**
- 4a Fruit linear, (0.8–)1–1.7(–2) mm wide. Petals 4–5(–5.5) × 1.5–2.5 mm. Seeds uniseriate, 0.8–1.1 × 0.5–0.8 mm**3 S. linearis**
- b Fruit lanceolate to linear-lanceolate, (3–)4–6 mm wide. Petals (6–)6.5–8 × 3–4 mm. Seeds biseriate, (1.5–)1.8–2(–2.3) × 1–1.4 mm**5 S. himalayensis**

1. *Solms-laubachia haranensis* (Al-Shehbaz) J.P.Yue, Al-Shehbaz & H.Sun, Ann. Missouri Bot. Gard. 95: 534 (2008). *Desideria haranensis* Al-Shehbaz, Ann. Missouri Bot. Gard. 87: 559 (2001); *Ermaniopsis pumila* H.Hara.

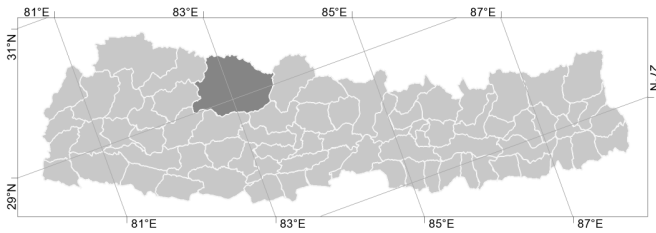
Herbs 2–6 cm. Trichomes simple, straight, to 0.5 mm, mixed on leaves with short-stalked unequally branched forked ones. Stems erect, simple, pilose to hirsute. Basal leaves fleshy,

persistent; petiole 2–12 mm, sparsely to densely pilose with simple trichomes, ciliate at base, not expanded or papery at base; leaf blade broadly ovate, suborbicular, to obovate, 3–13 × 3–11 mm, base cuneate or obtuse, apex obtuse, margin 1–5-toothed, sparsely to densely pubescent. Cauline leaves absent. Racemes 3–8-flowered, ebracteate. Pedicel divaricate, straight, 4–12 mm, pilose. Sepals free, oblong, 3.5–4.5 × 1.7–2 mm, caducous, pilose, base not saccate, margin membranous.

Cruciferae

Petals white tinged with greenish blue, obovate, 6.5–8 × 3–4 mm, apex obtuse; claw 3–4 mm. Filaments white, flattened and subapically toothed, median pairs 3–4 mm, lateral pair 2–3 mm; anthers oblong, 0.9–1.1 mm. Ovules 10–14 per ovary. Immature fruit linear, flattened, sessile, straight, retrorsely pilose; septum complete; style-like glabrous apex to 1.5 mm; stigma capitate, subentire. Seeds not seen.

Distribution: Endemic to Nepal.



Altitudinal range: 5000–5900 m.

Ecology: Scree slopes.

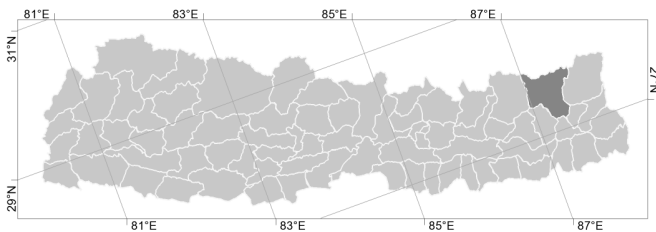
Flowering: June.

Known from two collections from Dolpa District.

2. *Solms-laubachia nepalensis* (H.Hara) J.P.Yue, Al-Shehbaz & H.Sun, Ann. Missouri Bot. Gard. 95: 535 (2008). *Desideria nepalensis* H.Hara, J. Jap. Bot. 50: 264 (1975).

Herbs 2–3 cm. Trichomes simple, straight, to 1 mm. Stems minute, simple, glabrous. Basal leaves slightly fleshy; petiole 2–5 mm, sparsely pilose with simple trichomes, ciliate at base, not expanded or papery at base; leaf blade broadly obovate to subflabellate, 2–3 × 1–3 mm, base cuneate, apex acute, margin 3–5-toothed, densely pubescent. Cauline leaves absent. Flowers 2–4, ebracteate. Pedicel ascending, straight, 3–5 mm, solitary from basal rosette, spreading, pilose. Sepals united, 5–6 × 3–4 mm, densely pilose, base not saccate; calyx lobes ovate, 1.5–2 mm, margin membranous. Petals purplish, obovate, 11–13 × 5–6 mm, apex obtuse; claw 6–7 mm. Filaments 4–5.5 mm, slightly dilated at base, median pairs 4.5–5.5 mm, lateral pair 3–4 mm; anthers oblong, 0.9–1.1 mm. Ovules number, fruits, and seeds unknown.

Distribution: Endemic to Nepal.



Altitudinal range: ca. 5400 m.

Ecology: Unknown.

Flowering: May.

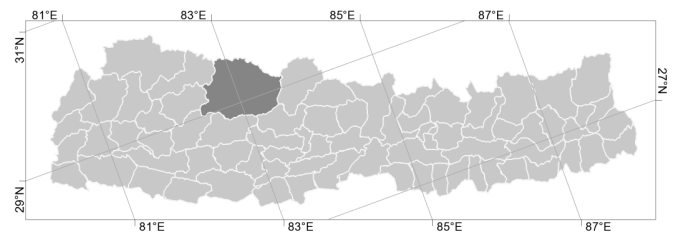
Solms-laubachia nepalensis is currently known only from the type collection, Swan 71-72 (BM), collected in the Barun Valley, Sankhuwasabha District.

3. *Solms-laubachia linearis* (N.Busch) J.P.Yue, Al-Shehbaz & H.Sun, Ann. Missouri Bot. Gard. 95: 535 (2008). *Christolea linearis* N.Busch, Fl. URSS 8: 636 (1939); *Desideria linearis* (N.Busch) Al-Shehbaz; *Ermania kachrooi* Dar & Naqshi; *E. kashmiriana* Dar & Naqshi; *E. linearis* (N.Busch) Botsch.; *E. parkeri* O.E.Schulz; *Oreoblastus linearis* (N.Busch) Suslova; *O. parkeri* (O.E.Schulz) Suslova.

Herbs 4–15 cm, densely pilose throughout to subglabrous. Trichomes simple, to 1.5 mm. Stems simple, pilose to glabrous. Basal leaves not fleshy, pilose to glabrous, persistent; petiole 2–7(–12) mm, not ciliate; leaf blade broadly obovate to spatulate, 4–15 × 2–12 mm, base cuneate to attenuate, apex acute, margin 3–5-toothed or rarely entire. Cauline leaves similar to basal or linear to lanceolate, 5–10 × 1–3 mm, often entire, short petiolate to subsessile. Racemes 8–20-flowered, bracteate throughout; bracts similar to cauline leaves but smaller, often adnate to pedicel. Sepals free, oblong to ovate, 2–3 × 1–1.5 mm, caducous, pilose or with a terminal tuft of hairs, base not saccate, margin membranous. Petals purple or lavender with paler base, narrowly spatulate, 4–5(–5.5) × 1.5–2.5 mm, apex rounded; claw 2–2.5 mm. Filaments white, slightly dilated at base, median pairs 2.5–3.5 mm, lateral pair 1.8–2.5 mm; anthers ovate, 0.4–0.5 mm. Ovules 16–26 per ovary. Fruiting pedicels ascending, straight, 2–8(–12) mm, pilose or glabrous. Fruit linear, (1.5–)2–3.5(–4.2) cm × (0.8–)1–1.7(–2) mm, flattened; valves pilose or glabrous, distinctly veined; septum complete, membranous; style obsolete; stigma 2-lobed. Seeds brown, ovate, 0.8–1.1 × 0.5–0.8 mm, uniseriate, minutely reticulate.

Fig. 6h-i

Distribution: Nepal, W Himalaya, N Asia and C Asia.



Altitudinal range: 4800–5800 m.

Ecology: Gravelly or sandy slopes, scree, gravelly moraine below glacier.

Flowering: June–August. **Fruiting:** July–September.

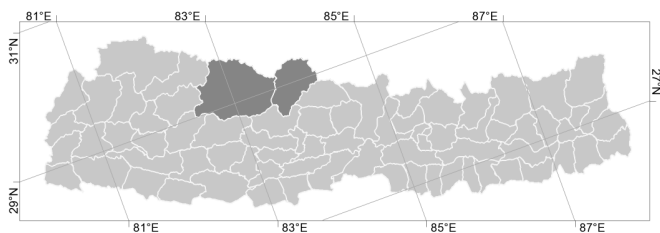
Hedge (Fl. Iranica Cruciferae: 211. 1968) misapplied the name *Ermania himalayensis* (Cambess.) O.E.Schultes to this species.

4. *Solms-laubachia jafrii* (Al-Shehbaz) J.P.Yue, Al-Shehbaz & H.Sun, Ann. Missouri Bot. Gard. 95: 534 (2008).

Phaeonychium jafrii Al-Shehbaz, Nord. J. Bot. 20: 160 (2000).

Herbs 8–30 cm. Caudex stout, woody, few- to many-branched, to 3 cm in diameter, covered with petiolar bases of previous years. Trichomes simple and forked stalked or sessile, crisped, flattened. Stems erect, simple and to 25 from caudex, tomentose. Basal leaves rosulate; petiole 1–5(–7) cm, ciliate with simple trichomes to 2 mm, becoming thickened and corky, to 6 mm wide at base; leaf blade green, broadly ovate to oblong, occasionally lanceolate to oblanceolate, 1–5.5(–7) × 1–2.5 cm, base cuneate to attenuate, apex obtuse to acute, margin entire, subtomentose. Cauline leaves absent. Racemes (8–)12–35-flowered, ebracteate. Sepals oblong, 3–4 × 1.5–2 mm, tomentose, persistent, margin membranous. Petals lavender to white flushed basally with purplish, obovate, 6.5–10 × 4–5 mm, apex obtuse; claw 3–4 mm. Filaments purple; median pairs 3–4 mm; lateral pair 2–2.5 mm; anthers oblong, 0.9–1.1 mm. Ovules 10–16 per ovary. Fruiting pedicels suberect to ascending, straight, (0.3–)0.6–1.5(–2.5) cm, tomentose. Fruit linear, (0.9–)1.5–2.5(–3.5) cm × 1.5–2 mm uniseriate, slightly flattened, sessile, straight; valves finely tomentose, with a distinct midvein and marginal veins; style 0.3–0.7 mm; stigma capitate, entire. Seeds brown to blackish, oblong, 2–2.5 × 0.9–1.1 mm, slightly flattened, margined towards apex.

Distribution: Nepal, E Himalaya and Tibetan Plateau.



Altitudinal range: 4000–4900 m.

Ecology: Scrub, cliff ledges, steep rocky hillsides.

Flowering: July–September. **Fruiting:** July–September.

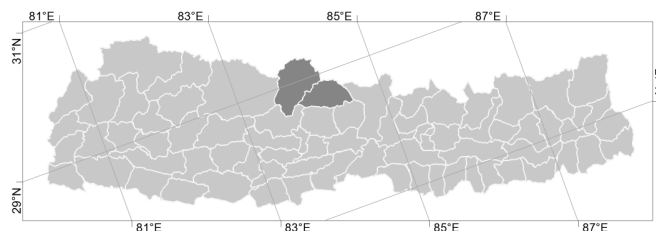
Hara (Enum. Fl. Pl. Nepal 2: 44. 1979) misinterpreted the limits of *Phaeonychium parryoides* and recorded the species in Nepal based on *Polunin, Sykes & Williams 1106* (BM), but this collection is now assigned to *Solms-laubachia jafrii*.

5. *Solms-laubachia himalayensis* (Cambess.) J.P. Yue, Al-Shehbaz & H. Sun, Ann. Missouri Bot. Gard. 95: 534 (2008). *Cheiranthus himalayensis* Cambess., in Jacquem., Voy. Inde 4(3): 14 (1844); *Cheiranthus himalaicus* Hook.f. & Thomson; *Christolea himalayensis* (Cambess.) Jafri; *Desideria himalayensis* (Cambess.) Al-Shehbaz; *Ermania himalayensis*

(Cambess.) O.E. Schulz nom. illegit.; *Oreoblastus himalayensis* (Cambess.) Suslova.

Herbs 4–20 cm, densely pilose throughout to subglabrous. Trichomes simple, to 1.5 mm. Stems simple, pilose or glabrous. Basal leaves not fleshy, pilose or glabrous, persistent; petiole 0.4–1.6(–3) cm, not ciliate; leaf blade broadly obovate to spatulate, 4–14 × 3–9 mm, base cuneate to attenuate, apex acute, margin (3–)5-toothed. Cauline leaves similar to basal or linear to lanceolate, 5–17 × 1–4 mm, often entire, short petiolate to sessile. Racemes 6–25-flowered, bracteate throughout; bracts similar to cauline leaves but smaller, sometimes adnate to pedicel. Sepals free, oblong, 3–4 × 1.2–1.5 mm, caducous, pilose or with a terminal tuft of hairs, base not saccate, margin membranous. Petals purple or lilac with yellowish centre, broadly spatulate, (6–)6.5–8 × 3–4 mm, apex subemarginate; claw 3–4 mm. Filaments white, slightly dilated at base, median pairs 3–4 mm, lateral pair 2–4 mm; anthers ovate, ca. 0.6 mm. Ovules 14–24 per ovary. Fruiting pedicels ascending, straight or curved, 3–10 mm, pilose or glabrous. Fruit lanceolate to linear-lanceolate, (1.7–)2–3.5(–4) cm × (3–)4–6 mm, strongly flattened; valves pilose or glabrous, distinctly veined; septum complete, membranous; style obsolete; stigma 2-lobed. Seeds brown, ovate, (1.5–)1.8–2(–2.3) × 1–1.4 mm, biseriate, minutely reticulate. Fig. 2k

Distribution: Nepal, W Himalaya and Tibetan Plateau.



Altitudinal range: 4200–5600 m.

Ecology: Alpine tundra, open hills, sandstone scree.

Flowering: June–August. **Fruiting:** July–October.

Hara (Enum. Fl. Pl. Nepal 2: 43. 1979) based his record of *Solms-laubachia himalayensis* (using the illegitimate *Ermania himalayensis*) on *Polunin, Sykes & Williams 37* (BM). However, this is *S. linearis* (N. Busch) J.P. Yue, Al-Shehbaz & H. Sun, a species that he correctly recorded from Nepal, as *E. linearis* (N. Busch) Botsch, based on *Lowndes 1159* (BM).

The present record of *S. himalayensis* is based on *Wald 65* (BM) from Dhaulagiri Himal, *McBeath 1406* (E) and *McBeath 1486* (E) from Marsyandi, and *Komarkova 18* (GH) from Annapurna Himal.

25. *Eutrema* R.Br., Chlor. Melvill.: 193 (1823).
Wasabia Matsum.

Cruciferae

Annual, biennial, or perennial herbs, glaucous or not above, with slender or fleshy and fusiform roots, rhizomes, or caudex. Trichomes absent or simple. Stems leafy or rarely leafless, erect, ascending, decumbent, or prostrate, simple or branched at base and/or apically. Basal leaves petiolate, rosulate or not and often withered by time of flowering, oblong, ovate, lanceolate, or reniform to cordate, simple, entire, dentate, or pinnately or palmately lobed, pinnately or palmately veined. Cauline leaves petiolate or sessile and cuneate or auriculate, sagittate, or amplexicaul at base, pinnately or palmately veined, entire, dentate, or crenate, lowermost alternate or whorled; ultimate veins ending or not with apiculate callosities. Racemes bracteate throughout or basally, or ebracteate, elongated considerably or not elongated in fruit. Sepals ovate or oblong, base of lateral pair rarely saccate. Petals white or rarely lavender, longer or shorter than sepals; blade spatulate, obovate, oblong, or obcordate, apex obtuse, rounded to emarginate; claw undifferentiated from blade. Stamens 6, tetradynamous, equal or subequal in length; filaments dilated or not at base, terete or rarely flattened and laterally toothed; anthers ovate or oblong, obtuse or apiculate at apex. Nectar glands lateral or confluent, subtending bases of all stamens; median glands present or absent. Ovules 4–12 per ovary. Fruiting pedicels erect and subappressed to stem, ascending, or divaricate, slender, straight or reflexed. Fruit dehiscent, siliques or silicles, linear, oblong, or ovoid, terete, slightly 4-angled or latiseptate, sessile or on a short gynophore; valves with an obscure or prominent midvein, smooth or torulose, glabrous or rarely papillate; replum rounded, expanded or flattened; septum complete, absent or perforate and reduced to a rim, veinless; style obsolete or distinct and up to 3 mm long, slender or clavate; stigma capitate, entire or rarely 2-lobed. Seeds uniseriate or biseriate, wingless, oblong, plump or compressed; seed coat obscurely reticulate to foveolate or papillate, slightly mucilaginous or not when wetted; cotyledons incumbent, accumbent or obliquely so.

Worldwide 26 species, primarily in the Himalaya and C and E Asia, with one extending into N America. Four species in Nepal.

Key to Species

- 1a Raceme ebracteate, subumbellate in fruit **1 *E. heterophyllum***
- b Raceme bracteate, elongated or not in fruit **2**
- 2a All leaves alternate **2 *E. hookeri***
- b At least some of the lowermost cauline leaves whorled, other leaves opposite or alternate **3**
- 3a Petals 3–5 × 1.5–2 mm. Sepals persistent. Septum present. Seeds papillate **3 *E. lowndesii***
- b Petals (7–)8–9(–10) × (3.5–)4.5–6 mm. Sepals caducous. Septum absent. Seeds foveolate **4 *E. verticillatum***

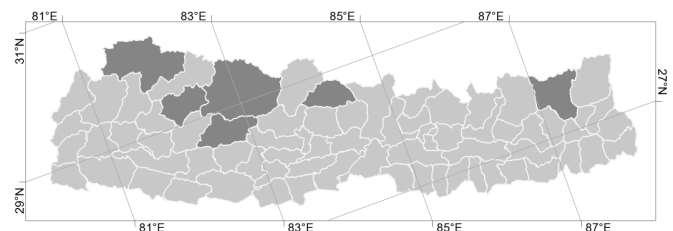
1. *Eutrema heterophyllum* (W.W.Sm.) H.Hara, J. Jap. Bot. 48: 97 (1973).

Braya heterophylla W.W.Sm., Notes Roy. Bot. Gard. Edinburgh 11: 201 (1920); *Eutrema compactum* O.E.Schulz; *E. edwardsii* var. *heterophyllum* (W.W.Sm.) W.T.Wang; *E. obliquum* K.C.Kuan & Z.X.An.

Perennial herbs, 2–15(–25) cm, glabrous throughout or rarely puberulent, with a caudex and fleshy root. Stems erect, simple, often few from caudex. Basal leaves rosulate, somewhat fleshy; petiole (0.5–)1–5.5(–7.5) cm; leaf blade ovate, suborbicular, lanceolate or rhombic, (0.3–)0.5–2(–2.5) cm × (2–)4–10(–15) mm, base cordate, truncate, to cuneate, sometimes distinctly oblique, apex obtuse to subacute, margin entire. Middle cauline leaves lanceolate, ovate, or linear-lanceolate, 0.7–2.5(–3) cm × 2–9 mm, pinnately veined, sessile, base cuneate, apex subacute, margin entire. Fruiting raceme compact, subumbellate or short racemes, little or not elongated in fruit, 0.2–2(–3.5) cm. Sepals ovate, 1.5–2 × ca. 1 mm, persistent through fruit maturity. Petals white, spatulate, 2–3.5 × 1–1.7 mm. Filaments white, 1–2 mm, slightly dilated at base; anthers ovate, 0.2–0.3 mm. Ovules 4–10 per ovary. Fruiting pedicels divaricate to slightly reflexed, 1–4(–5) mm. Fruit linear to oblong, (4–)5–10(–12) × 1.5–2 mm, slightly 4-angled, not torulose; valves cuneate at both ends, with a prominent midvein; gynophore to 0.5 mm; septum mostly perforate; style obsolete or to 0.6 mm. Seeds oblong, plump, 1.5–2 × ca. 1 mm. Cotyledons incumbent.

Fig. 2l & Fig. 6j

Distribution: Nepal, E Himalaya, Tibetan Plateau, E Asia, N Asia and C Asia.



Altitudinal range: 2500–5400 m.

Ecology: Alpine meadows, scree, grassy slopes, near glaciers, *Kobresia* turf, alpine mats, sandstone ridges.

Flowering: June–July. **Fruiting:** July–August.

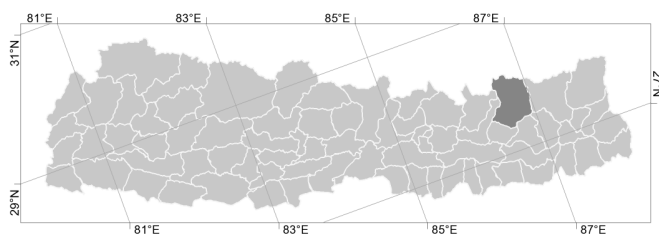
2. *Eutrema hookeri* Al-Shehbaz & S.I.Warwick, Harvard Pap. Bot. 10: 133 (2005).

Cochlearia himalaica Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 154 (1861); *Taphrospermum himalaicum* (Hook.f. & Thomson) Al-Shehbaz & Kats.Arai.

Short-lived perennial herbs, glabrous throughout except for sparsely puberulent fruit and upper portion of calyx. Root narrowly fusiform-linear, fleshy, apex with minute scale-like

leaves. Stems solitary from fleshy root then producing a rosette with prostrate or rarely ascending to erect branches, (2)–5–10(–15) cm. Leaves not rosulate; petioles of basal and lowermost leaves (0.5–)1–2.5(–4) cm, gradually shorter upward; leaf blade broadly ovate to oblong, 4–10(–15) × 2–6(–10) mm, gradually reduced in size upward, base obtuse to subcordate, apex obtuse or rounded, margin lobed or toothed to repand or entire. Racemes densely flowered, elongated considerably or not elongated in fruit, bracteate throughout; bracts leafy and representing all cauline leaves. Sepals oblong, 1.2–2 × 0.8–1 mm, persistent, membranous at margin, sparsely hairy distally. Petals white, obovate to spatulate, 2.5–4(–6) × 1.5–2.5(–3.5) mm, attenuate to base, apex slightly emarginate. Filaments white, 1.5–2 mm, median dilated at base; anthers ovate, 0.2–0.4 mm. Ovules 4–12 per ovary. Fruiting pedicels glabrous, slender, straight or strongly recurved and fruits appearing geocarpic, 4–9(–13) mm. Fruit ovoid to oblong, latiseptate, not torulose, (2)–4–8(–10) × (1.5–)2–3.4(–4) mm, obtuse at both ends; valves membranous, sparsely puberulent with papillae to 0.5 mm, rarely subglabrous, obscurely veined; septum absent; style slender, 0.5–1(–1.2) mm. Seeds (2)–6–8(–12), brown, oblong, 1–1.5 × 0.8–1 mm, foveolate; cotyledons obliquely accumbent.

Distribution: Nepal, E Himalaya, Tibetan Plateau and Assam-Burma.



Altitudinal range: ca. 4600 m.

Ecology: Rocky ground on exposed slopes, scree, deep rich soil, muddy slopes, stream banks, sandy beds, moist granite ledges, alpine pastures and dwarf scrub, *Kobresia* turf, under *Juniperus* trees.

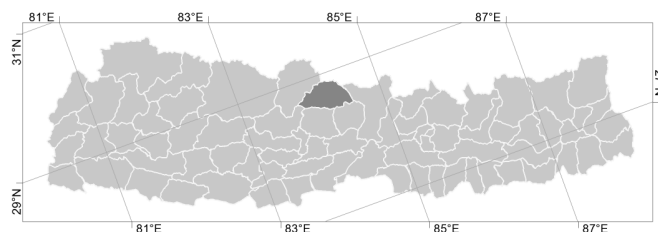
Flowering: June–August. **Fruiting:** July–September.

3. *Eutrema lowndesii* (H.Hara) Al-Shehbaz & S.I.Warwick, Harvard Pap. Bot. 10: 133 (2005).
Gliribraya lowndesii H.Hara, J. Jap. Bot. 53: 136 (1978);
Taphrospermum lowndesii (H.Hara) Al-Shehbaz.

Short-lived perennial herbs, 5–12 cm, glabrous throughout or puberulent with papillae 0.05–0.2 mm. Root slender, slightly fleshy, base with a whorl of oblong scale-like leaves ca. 2–5 × 0.5–1 mm. Stems erect, 1–3 from root, lowermost leafless part 2–9 cm. Leaves glabrous, fleshy, lowermost cauline ones whorled, others alternate; petioles 2–5 mm, gradually shorter upward; leaf blade spatulate, 3–15 × 1–5 mm, gradually reduced in size upward, base attenuate, apex retuse or rounded, margin entire. Racemes densely flowered, elongated considerably in fruit, bracteate throughout; bracts leafy, smaller than cauline leaves; rachis glabrous or papillate. Sepals oblong, 1.5–2.5 × ca. 1 mm, persistent well after fruit

dehiscence, membranous at distal margin and apex, not ciliolate, glabrous or papillate. Petals white, narrowly obovate, 3–5 × 1.5–2 mm, attenuate to claw-like base to 1.5 mm, apex obtuse. Filaments white, 1.5–2.5 mm; anthers broadly ovate, 0.2–0.3 mm. Ovules 4–6 per ovary. Fruiting pedicels glabrous, slender, straight or curved, 4–8 mm. Fruit oblong or narrowly so, strongly latiseptate, not torulose, 7–15 × 3–5 mm, obtuse to cuneate at base; valves membranous, glabrous, often distinctly veined, smooth; septum complete, membranous; style slender, (1)–2–3 mm. Seeds 3–8, brown, oblong, compressed, 1.9–2.1 × 1.2–1.4 mm, densely papillate with papillae 0.1–0.2 mm; cotyledons accumbent.

Distribution: Nepal and Tibetan Plateau.



Altitudinal range: 5000–5200 m.

Ecology: Scree slopes.

Flowering: July. **Fruiting:** July–August.

The species record from Nepal is based on the type collection, *Lowndes* L 1287 (BM), from Khangsar, Manang.

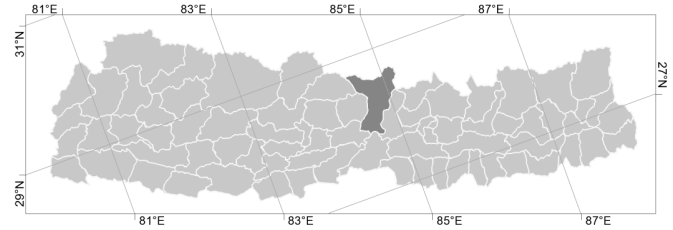
4. *Eutrema verticillatum* (Jeffrey & W.W.Sm.) Al-Shehbaz & S.I.Warwick, Harvard Pap. Bot. 10: 134 (2005).
Cardamine verticillata Jeffrey & W.W.Sm., Notes Roy. Bot. Gard. Edinburgh 8: 120 (1913); *Braya verticillata* (Jeffrey & W.W.Sm.) W.W.Sm.; *Staintoniella verticillata* (Jeffrey & W.W.Sm.) H.Hara; *Taphrospermum verticillatum* (Jeffrey & W.W.Sm.) Al-Shehbaz.

Herbs (4)–6–15(–23) cm tall, sparsely to moderately pubescent, rarely glabrous. Root narrowly fusiform-linear, fleshy, base with oblong or ovate scale-like leaves 3–7 × 1–2.5 mm. Stems erect, often solitary from fleshy root, lowermost leafless part (0.5–)4–10(–15) cm. Leaves glabrous, lowermost cauline leaves verticillate, others opposite or alternate; petioles (0.4–)0.6–2 cm, gradually shorter upward; leaf blade oblong, rarely oblanceolate, 5–15(–25) × 2–7(–9) mm, gradually reduced in size upward, base obtuse or rarely attenuate, margin entire, apex rounded. Racemes densely flowered, elongated considerably in fruit, bracteate throughout; bracts leafy, smaller than cauline leaves; rachis sparsely pubescent with retrorse trichomes 0.4–0.6 mm. Sepals oblong, 2.5–3.5(–4) × 1.5–2 mm, caducous, membranous at margin, sparsely ciliolate near apex with trichomes 0.05–0.1 mm, glabrous or distally sparsely pubescent with trichomes to 0.5 mm. Petals white or rarely lavender, broadly obovate, (7)–8–9(–10) × (3.5–)4.5–6 mm, cuneate or claw-like base to 4 mm, apex emarginate. Filaments white or lavender, (3)–3.5–4.5 mm, dilated at base; anthers ovate, 0.6–0.8 mm. Ovules 4–8 per ovary. Fruiting pedicels glabrous, slender, straight or curved,

Cruciferae

(4–)6–12(–18) mm. Fruit ovate or oblong, strongly latiseptate, not torulose, 7–13 × 4–7 mm, obtuse or cuneate at base; valves membranous, glabrous, often distinctly veined, smooth; septum absent; style slender, (1–)2–3 mm. Seeds 3–8, brown, oblong, foveolate, compressed, 1.8–2.2 × 1.2–1.4 mm; cotyledons accumbent.

Distribution: Nepal, Tibetan Plateau and E Asia.



Altitudinal range: ca. 4900 m.

Ecology: Scree, cliff ledges, glaciers, open stony moorland, siliceous scree slopes.

Flowering: June–July. **Fruiting:** July–August.

26. *Pegaeophyton* Hayek & Hand.-Mazz., Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 59: 245 (1922).

Perennial herbs. Caudex simple or branched. Trichomes absent or simple. Stems reduced to tiny portions added annually to apex of caudex or its branches. Basal leaves fleshy or not, rosulate, simple, entire or toothed. Cauline leaves absent. Flowers solitary, borne on pedicels from axils of rosette leaves. Sepals free, caducous at time of fruiting, broadly ovate or oblong, ascending or spreading, glabrous or pubescent, base not saccate. Petals white, pink, blue, lilac or violet, longer than sepals, broadly obovate or suborbicular, rarely spatulate, apex rounded or subemarginate; clawed or not. Stamens 6, erect or spreading, subequal; filaments dilated at base; anthers ovate suborbicular or oblong, obtuse at apex. Nectar glands confluent, subtending bases of all stamens. Ovules 2–15 per ovary. Fruiting pedicels ascending, straight. Fruit dehiscent silicles, rarely siliques, oblong, orbicular, ovoid, or globose, terete, latiseptate, not geocarpic, sessile or stipitate; valves membranous or papery, not veined or obscurely veined, smooth, glabrous or pubescent; replum flattened; septum absent; style obsolete or to 3 mm, subconical; stigma discoid, entire. Seeds uniseriate, wingless, oblong or broadly-ovate, plump or flattened; seed coat obscurely reticulate, not mucilaginous when wetted; cotyledons accumbent.

Worldwide six species in S and E Asia. Three species in Nepal.

Key to Species

- 1a Fruiting pedicels pubescent along one side, persisting for more than one season. Fruit narrowly oblong, length:width ratio 3–5. Sepals apically ciliate **1 *P. minutum***
- b Fruiting pedicels glabrous or distally pubescent on all sides, not persistent. Fruit oblong, ovate, orbicular, ovoid, to subglobose, length to width ratio 1–1.5(–2). Sepals not ciliate.....2
- 2a Fruit oblong, orbicular to ovate, flattened, valves papery, glabrous. Sepals (2–)2.5–6(–10) mm. Petals (3.5–)5–12(–15) mm. Seeds flattened, 1.5–3.5(–4) × 1–2.5(–3) mm..... **2 *P. scapiflorum***
- b Fruit ovoid to subglobose, valves membranous, puberulent apically. Sepals 1.1–1.3 mm. Petals 1.6–2(–2.5) mm. Seeds plump, 1–1.1(–1.3) × 0.5–0.6(–0.8) mm..... **3 *P. nepalense***

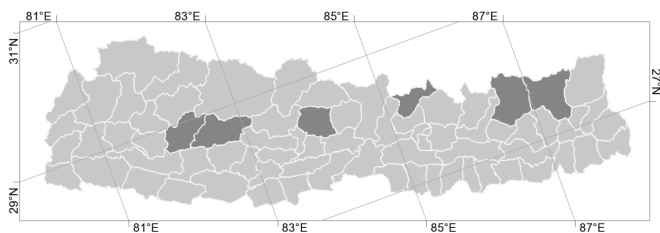
1. *Pegaeophyton minutum* H.Hara, J. Jap. Bot. 47: 270, fig. 2 (1972).

Pegaeophyton garhwalense H.J.Chowdhery & Surendra Singh.

Herbs with slender, branched caudex 0.75–2 mm in diameter. Petiole (3–)5–10(–15) mm; leaf blade obovate, spatulate, ovate, oblong, or oblanceolate, 1–4(–5) × (0.5–)1–1.5(–2) mm, somewhat fleshy, sparsely puberulent above with trichomes 0.02–0.08 mm, rarely glabrous, glabrous below, base cuneate or subattenuate, apex obtuse to subrounded, margin entire. Sepals broadly ovate, 1.2–2 × 0.8–1.2 mm, free, glabrous, distally ciliate with flattened trichomes to 0.05 mm. Petals white, lilac or violet, broadly obovate or suborbicular, (1.5–)2–3(–4.5) × 1.5–2.5(–3) mm, tapering to claw-like base 0.7–1.5

mm. Filaments dilated at base, (0.9–)1–1.5 mm; anthers broadly ovate or suborbicular, 0.3–0.4 mm. Fruiting pedicels slender, (1–)1.5–2.5(–4) cm, persistent, puberulent along 1 side of entire length with trichomes 0.02–0.08 mm. Fruit narrowly oblong, 3–5 × 1–1.2 mm; valves nearly flat, extending along part of fruit length; gynophore 0.25–0.5 mm; style 0.3–0.4 mm. Seeds 3–5, broadly ovate, brown, plump, 1–1.2 × 0.6–0.7 mm.

Distribution: Nepal, W Himalaya, E Himalaya and Tibetan Plateau.



Altitudinal range: 3600–5200 m.

Ecology: Mossy wet ledges, hillsides, streams, mossy granite or boulders, steep grassy slopes.

Flowering: May–July.

2. *Pegaeophyton scapiflorum* (Hook.f. & Thomson)

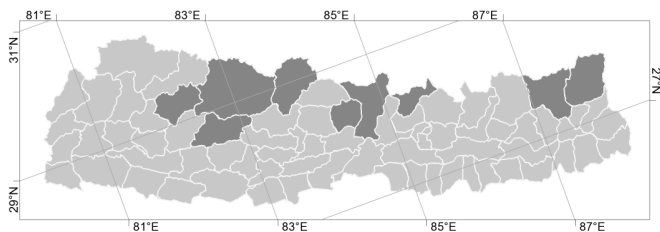
C.Marquand & Airy Shaw, J. Linn. Soc., Bot. 48: 229 (1929).
Cochlearia scapiflora Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 154 (1861); *Pegaeophyton scapiflorum* var. *pilosicalyx* R.L.Guo & T.Y.Cheo.

सो-लो-कार्पो So-lo-karpo (Tibetan).

Herbs with slender, apically branched caudex 1–8(12) mm in diameter. Petiole 1–8(–13) cm; leaf blade ovate, oblong, elliptic, obovate, spatulate, oblanceolate, or narrowly linear, (1–)1.5–8(–10) × 0.2–1.2(–2.5) cm, base cuneate or subattenuate, apex obtuse or acute, margin entire or dentate, sometimes minutely ciliate, somewhat fleshy or not, glabrous or sparsely pubescent above with trichomes 0.2–0.5 mm, glabrous below. Sepals ovate or oblong, (2–)2.5–6(–10) × 1.5–3.5(–4.5) mm, glabrous or sparsely pubescent, not ciliate. Petals white, pink, or blue, sometimes white with greenish or bluish centre, broadly obovate, spatulate, or suborbicular, (3.5–)5–7 × (1.5–)2–3(–3.5) mm, tapering to claw-like base (0.5–)1–3(–3.5) mm. Filaments dilated at base, (2.5–)3–5(–7) mm; anthers oblong to narrowly so, (0.5–)1–1.5(–2) mm, sagittate at base. Fruiting pedicels slender or stout, glabrous or rarely sparsely pubescent apically all around with trichomes 0.2–0.5 mm, (1.2–)2.5–15(–20) cm, not persistent. Fruit, oblong or orbicular to ovate, (4–)5–13(–20) × (2–)4–8(–10) mm; valves nearly flat, extending along part of fruit length, papery, glabrous; gynophore (0.5–)2–5 mm; style 1–2(–3) mm. Seeds (1–)3–10(–12), broadly ovate, brown, flattened, 1.5–2(–2.5) × 1–1.6(–1.8) mm.

Fig. 7a-b

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau, Assam-Burma, E Asia and N Asia.



Altitudinal range: 4000–5600 m.

Ecology: Alpine tundra, alpine meadows, muddy gravelly slopes, gravel near glaciers, grassy slopes, water at lake shores, moist pastures, stony slopes with unconsolidated scree, seepage areas in scree, in moss by streams, rock crevices, boggy ground by lakes, sandy soil at edge of streams, in melting snow or running water.

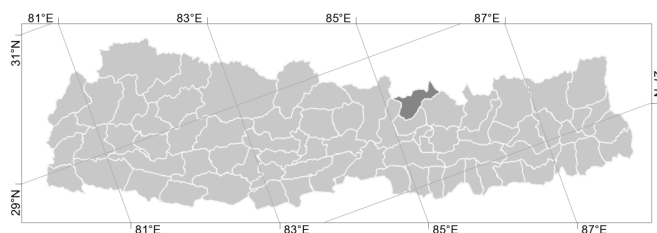
Flowering: May–August. **Fruiting:** July–September.

Pegaeophyton scapiflorum includes two subspecies, of which only subsp. *scapiflorum* occurs in Nepal. Subspecies *robustum* (O.E.Schulz) Al-Shehbaz, T.Y.Cheo, L.L.Lu & G.Yang has a stouter caudex (up to 30 mm diameter), larger petals (8–12 mm,) and seeds (2.5–3.5 mm), but is restricted to China and adjacent Bhutan.

3. *Pegaeophyton nepalense* Al-Shehbaz, Kats.Arai & H.Ohba, Novon 8: 327 (1998).

Herbs with slender caudex ca. 1 mm in diameter. Leaves 5–12 per caudex; petiole (2–)6–10(–14) mm, slender at base, glabrous or with few trichomes; blade suborbicular to broadly obovate, 2–4(–5) × 1.5–3.5(–4.5) mm, base obtuse, apex rounded or subrounded, margin entire, somewhat fleshy, moderately pubescent above with trichomes 0.3–0.5 mm, glabrous below. Flowers 3–8 per plant. Pedicels slender, distally pubescent with trichomes 0.3–0.5 mm all around, 2–5 mm at anthesis, not elongated in fruit. Sepals oblong, 1.1–1.3(–1.5) × 0.5–0.7 mm, free, spreading to ascending, not saccate, pubescent on distal half with trichomes to 0.3 mm, membranous margin 0.05–0.1 mm wide, obtuse. Petals white, broadly obovate to suborbicular, slightly emarginate, 1.6–2(–2.5) mm; blade 0.8–1.5 × 0.8–1.5 mm; claw 0.8–1.2 mm. Filaments erect, white, slightly dilated at base, 1.2–1.5 mm, persistent to fruit maturity; anthers suborbicular, 0.25–0.3 mm, slightly sagittate at base. Fruit, broadly ovoid to subglobose, 2–3 × 1.8–2 mm; valves membranous, rounded, extending along part of fruit length, glabrous or minutely puberulent distally; gynophore 0.1–0.2 mm; style 0.5–0.7 mm. Seeds oblong, brown, plump, 2–4 per fruit, 1–1.1(–1.3) × 0.5–0.6(–0.8) mm.

Distribution: Nepal and E Himalaya.



Altitudinal range: 4200–5200 m.

Ecology: Not known.

Flowering: June–August. **Fruiting:** August–September.

One collection, *Polunin 1439* (BM), included plants of both *Pegaeophyton nepalense* and *P. minutum* H.Hara, but no

Cruciferae

intermediates have yet been found and they are maintained as distinct species.

27. *Lepidium* L., Sp. Pl. 2: 643 (1753).

Annual or biennial herbs. Trichomes absent or simple. Stems erect or prostrate, simple or branched basally and/or apically. Basal leaves rosulate or not, simple, entire or pinnately dissected. Cauline leaves petiolate or sessile, base cuneate, attenuate, auriculate, sagittate, or amplexicaul, margin entire, dentate, or dissected. Racemes ebracteate, corymbose, elongated or not in fruit. Sepals oblong, base of lateral pair not saccate. Petals white to lavender, erect or spreading, sometimes rudimentary or absent, obovate or spatulate, apex obtuse, rounded, or emarginated, base attenuate or cuneate. Stamens 2 and median, 6 and tetradynamous or subequal in length, or 4 and all median or 2 median and 2 lateral; anthers ovate or oblong. Nectar glands 4 or 6, distinct; median glands present. Ovules 2 per ovary; placentation apical. Fruiting pedicels terete, slender, erect, ascending or divaricate, recurved or straight. Fruit dehiscent silicles, oblong, ovate to elliptic, strongly angustiseptate; valves veinless or prominently veined, keeled or not, apically winged or wingless; replum rounded; septum complete or perforated; style absent, obsolete, or distinct, included or exerted from apical notch of fruit; stigma capitate, entire or rarely 2-lobed. Seeds winged, margined, or wingless, oblong or ovate, plump or flattened; seed coat smooth, minutely reticulate, or papillate, usually copiously mucilaginous when wetted; cotyledons incumbent.

Worldwide about 180 species on all continents except Antarctica. Three species in Nepal.

Key to Species

- 1a Stamens 6. Fruit (4–)5–6 mm, winged all around, broadly so apically. Plants glabrous or pilose with, slender trichomes. Cotyledons 3-lobed..... **1 *L. sativum***
- b Stamens 2 or 4. Fruit 1.8–3.1 mm, obscurely winged only apically. Plants puberulent with clavate or capitate trichomes. Cotyledons not lobed **2**
- 2a Middle and upper cauline leaves usually pinnatifid. Inflorescence capitate. Petals 0.5–1 mm. Stamens **42 *L. capitatum***
- b Middle and upper cauline leaves dentate, serrate, or entire. Inflorescence elongate, racemose. Petals absent or rudimentary. Stamens 2 **3 *L. apetalum***

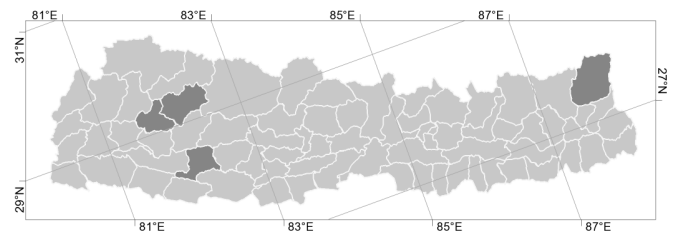
1. *Lepidium sativum* L., Sp. Pl. 2: 644 (1753).

चम्सुर Chamsur (Nepali).

Annual herbs, (10–)20–80(–100) cm. Stems erect, simple or branched, sparsely crisped pilose above. Basal leaves not rosulate; petiole 1–4 cm; leaf blade 1- or 2-pinnatifid to -pinnatisect, 2–8(–10) × 1–3(–5) cm, ultimate lobes ovate to oblong, apex acute, margin dentate. Cauline leaves petiolate; leaf blade similar to basal ones but less divided, with 1–4 lateral lobes on each side of midvein; uppermost leaves subsessile, linear, margin entire. Sepals oblong, 1–1.8 × 0.5–0.8 mm, glabrous or pubescent below. Petals white to lavender, spatulate or obovate, 2.5–3.5(–4) × 0.7–1.4 mm, base attenuate. Stamens 6; filaments 1.5–2 mm; anthers oblong, 0.4–0.5 mm. Fruiting pedicels suberect and appressed to rachis, or ascending, straight, 1.5–4(–6) mm, terete to slightly flattened, glabrous. Fruit oblong-ovate to elliptic, (4–)5–6(–7) × 3–4.5(–5.5) mm, base rounded, margin and apex winged, apex emarginate; wings all around fruit, 1–1.5 mm at apex; apical notch 0.2–0.5 mm; style 0.2–0.5(–0.8) mm, free from wings, included or rarely exerted from apical notch. Seeds reddish brown, oblong, 2–2.6 × 1–1.3 mm, wingless; cotyledons incumbent, 3-lobed.

Fig. 2m & Fig. 7c

Distribution: Cosmopolitan.



Altitudinal range: 200–3000 m.

Ecology: Cultivated or naturalized.

Flowering: June–July. **Fruiting:** August–September.

Young leaves are cooked as a vegetable.

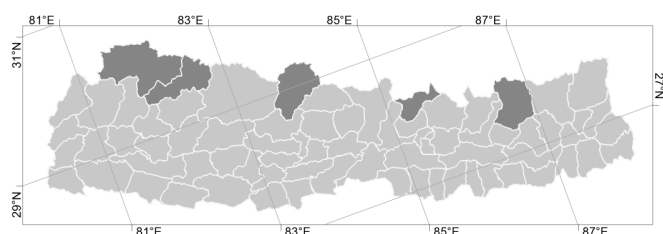
2. *Lepidium capitatum* Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 175 (1861).

Lepidium incisum Edgew.; *L. kunlunshanicum* G.L.Zhou & Z.X.An.

Annual or biennial herbs, (5–)10–35(–50) cm, densely covered with clavate or capitate papillate trichomes. Stems prostrate or rarely suberect, branched basally and above. Basal and lower cauline leaves with petioles 0.5–4 cm; leaf blade oblong to spatulate or lanceolate, (0.5–)1–4(–7) × 0.2–2 cm, usually

glabrous, pinnatifid, base attenuate; lobes oblong to lanceolate or linear, 2–8(–15) × 0.5–3(–5) mm, 1- or 2-pinnatifid or -partite, serrate, to entire. Upper cauline leaves short petiolate to sessile, similar lowermost leaves, progressively smaller upward. Racemes capitate, elongated slightly or not elongated in fruit. Sepals oblong, 0.8–1 × 0.3–0.4(–0.5) mm, glabrous or with crisped trichomes. Petals white, narrowly obovate, (0.5–)0.6–0.9(–1) × 0.2–0.3 mm, base cuneate, apex subtruncate to emarginate. Stamens 4; filaments 0.8–1 mm; anthers ovate, 0.1–0.2 mm. Fruiting pedicels slender, divaricate, slightly recurved or straight, (1–)2–3(–4) mm, puberulent above with clavate or capitate trichomes. Fruit broadly ovate, 1.8–2.5 × 1.7–1.8 mm, glabrous; wing apical, 0.1–0.3 mm; apical notch 0.05–0.3 mm; style obsolete, rarely to 0.15 mm, included in apical notch of fruit. Seeds brown, oblong-ovate, 1–1.1 × 0.6–0.7 mm; cotyledons incumbent, unlobed.

Distribution: Nepal, W Himalaya, E Himalaya, Tibetan Plateau and E Asia.



Altitudinal range: 2700–5300 m.

Ecology: Mountain slopes, disturbed areas, plains.

Flowering: June–September. **Fruiting:** June–September.

Hara (Enum. Fl. Pl. Nepal 2: 44. 1979) reported *Polunin*, Sykes & Williams 2268 (BM) as *Lepidium capitatum*, but that collection is *L. apetalum* Willd.

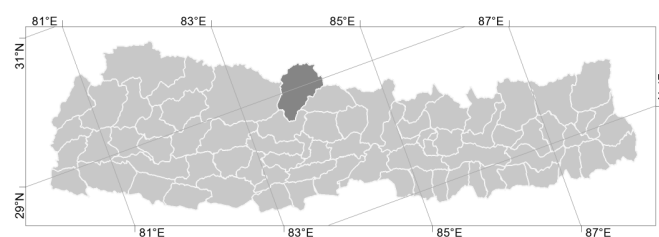
3. *Lepidium apetalum* Willd., Sp. Pl., ed. 5[as 4], 3(1): 439 (1800).

Lepidium chitungense Jacot Guill.

चकमा Chakma (Nepali).

Annual or biennial herbs, (5–)10–25(–40) cm, puberulent with clavate or capitate trichomes. Stems erect, branched basally and above. Petiole of basal leaves (0.5–)1–3 cm; leaf blade oblong, lanceolate, or oblanceolate, 1.5–4(–5) × 0.7–1.2(–1.5) cm, pinnatifid, sinuate, or dentate. Upper cauline leaves sessile; leaf blade narrowly lanceolate, linear-oblong, to linear, 6–30(–40) × 1–3(–5) mm, base subauriculate or sometimes cuneate, apex acute to subobtusate, margin remotely serrate to entire. Sepals caducous, oblong, 0.7–0.8 × 0.3–0.35 mm, glabrous or puberulent, white at margin and apex. Petals absent or rudimentary and ca. 0.3 mm. Stamens 2; filaments 0.7–0.8 mm; anthers broadly ovate, 0.1–0.2 mm. Fruiting pedicels slender, often recurved, 2–4(–5) mm, puberulent only above with clavate or capitate trichomes, slightly flattened or narrowly winged. Fruit broadly elliptic, 2.2–3.1 × 1.7–2.3 mm, widest at middle, apex with narrow winged; apical notch 0.1–0.3 mm; style 0.05–0.15 mm, included in apical notch. Seeds reddish brown, oblong-ovate, 1.1–1.3 × 0.6–0.8 mm, wingless, finely papillate; cotyledons incumbent, unlobed.

Distribution: Nepal, Tibetan Plateau, S Asia, E Asia, N Asia and C Asia.



Altitudinal range: 2500–4100 m.

Ecology: Roadsides, slopes, waste places, ravines, plains, fields.

Flowering: May–August. **Fruiting:** May–August.

Hooker & Anderson (Fl. Brit. Ind. 1: 160. 1872) and Kitamura (Fauna Fl. E. Himalaya: 139. 1955) and other authors have misapplied the name *Lepidium ruderae* L. to this species. Hara (Enum. Fl. Pl. Nepal 2: 44. 1979) misapplied the name *L. capitatum* Hook.f. & Thomson to this species.

28. *Megacarpaea* DC., Syst. Nat. 2: 417 (1821).

Perennial herbs. Caudex terminated by petiolar remains of previous years. Trichomes simple. Stems erect, simple basally, branched apically. Basal leaves petiolate, rosulate, simple, pinnately lobed, or 1–3-pinnatisect. Cauline leaves petiolate or sessile, auriculate at base, sinuate, pinnately lobed, or pinnatisect. Racemes ebracteate, in panicles, elongated in fruit. Sepals oblong, deciduous, base of lateral pair not saccate, margin membranous. Petals yellow, obovate, oblong, entire; claw much shorter than sepals. Stamens (8–)12–16(–24), slightly tetradynamous or equal in length; filaments dilated at base; anthers oblong or linear, obtuse at apex. Nectar glands confluent around bases of all stamens; median glands present. Ovules 2 per ovary. Fruiting pedicels slender, ascending, divaricate, or strongly recurved. Fruit indehiscent, schizocarpic, didymous, angustiseptate silicles, sessile or shortly stipitate; valves (mericarps) oblong, obovate or orbicular, 1-seeded, leathery, smooth, broadly winged, keeled, glabrous; replum rounded; style obsolete, rarely to 0.5 mm; stigma capitate, entire. Seeds wingless, broadly ovate, strongly flattened; seed coat smooth, not mucilaginous when wetted; cotyledons accumbent.

Cruciferae

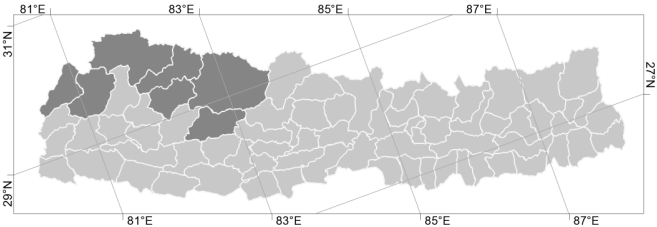
Worldwide nine species in C Asia and the Himalayas. One species in Nepal.

1. *Megacarpaea polyandra* Benth., Hooker's J. Bot. Kew Gard. Misc. 7: 356 (1855).

रुबिको साग Rubiko saag (Nepali).

Herbs, (0.5–)1–2 m, tomentose above. Caudex to 15 cm diameter. Trichomes flattened, crisped. Stems erect, branched above. Basal and lower cauline leaves oblong to oblanceolate in outline, pinnatisect, 15–60 cm, glabrous to sparsely pubescent; lateral lobes 6–12 on each side, oblong to lanceolate, 6–20 × 1–5 cm, base decurrent, apex acuminate, margin serrulate to sinuate-dentate or subentire. Upper cauline leaves auriculate, similar to lower ones but gradually reduced in size. Sepals yellowish, 3.5–5(–6) × 1.5–2.5 mm, sparsely pubescent to glabrous. Petals yellow, oblong to obovate, entire, 4–6(–7) × 2–4(–6) mm, base cuneate, apex rounded to subacute; claw 1–2 mm. Stamens (8–)12–16(–24); filaments 3.5–5 mm; anthers narrowly oblong, 1–1.3 mm. Fruiting pedicels slender, 1.5–4 cm, strongly recurved, pubescent. Fruit halves suborbicular to obovate-orbicular, 3–4 × 2.5–3 cm; wings 5–10(–18) mm wide; replum 7–16 mm; locule 1.5–2(–2.8) × 1.2–1.7 cm. Seed brown, broadly ovate, 1.4–1.7 × 0.7–1.1 cm.

Distribution: Nepal, W Himalaya and Tibetan Plateau.



Altitudinal range: 2700–4600 m.

Ecology: Slopes, rocky areas, along streams.

Flowering: May–August. Fruiting: August–October.

Megacarpaea bifida Benth., a little collected and poorly known species endemic to Kashmir, is probably conspecific (or at best infraspecific) with *M. polyandra*, but differs in its entire leaf lobes and slightly elongated fruit halves.
Young leaves and shoots are cooked as a vegetable.

29. *Noccaea* Moench, Suppl. Meth.: 89 (1802).

Perennial herbs, often glabrous and glaucous. Trichomes absent or simple. Stems erect, ascending or decumbent, simple. Basal leaves petiolate, rosulate or not, simple, entire or dentate. Cauline leaves sessile, auriculate, sagittate, or amplexicaul at base, entire or rarely denticulate. Racemes ebracteate, elongated or not in fruit. Sepals oblong, erect or ascending, base of lateral pair not saccate, margin membranous. Petals white, pale mauve to lavender, apex rounded; claw differentiated or not from blade. Stamens 6, tetradynamous; filaments dilated or not at base; anthers ovate or oblong, obtuse at apex. Nectar glands 1 on each side of lateral stamens; median glands absent. Ovules 4–10 per ovary. Fruiting pedicels slender, divaricate or slightly reflexed. Fruit dehiscent siliques or silicles, oblong, elliptic or ob-lanceolate, often apically notched, strongly angustiseptate, sessile; valves keeled, winged or wingless; replum rounded; septum complete; style usually prominent, exerted or included in apical notch of fruit; stigma capitate, entire. Seeds uniseriate, wingless, oblong, ovoid, or ellipsoid, plump; seed coat smooth or obscurely reticulate; cotyledons accumbent.

Worldwide about 65–80 species in temperate Eurasia, N America, and southern S America. Three species (one endemic) in Nepal.

Key to Species

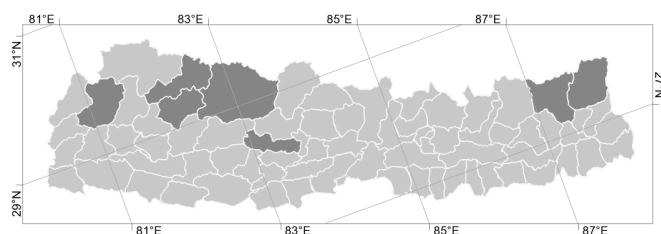
- 1a Fruit oblong, contorted, apex narrowly winged, emarginate.....3 *N. cochlearioides*
- b Fruit elliptic, straight, apex neither winged nor emarginate2
- 2a Style 0.7–1.5 mm. Fruit elliptic 5–8 × 3–4 mm. Petals (5–)6–7 × 2.5–3.5 mm1 *N. andersonii*
- b Style 3–4 mm. Fruit narrowly oblong-oblanceolate, 6–10 × 1.5–2 mm. Petals 4.5–5 × 1.5–2 mm..... 2 *N. nepalensis*

1. *Noccaea andersonii* (Hook.f. & Thomson) Al-Shehbaz, Adansonia, Ser. 3 24(1): 91 (2002).
Iberidella andersonii Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 177 (1861); *Iberidella tibetica* C.Marquand & Airy Shaw;
Thlaspi andersonii (Hook.f. & Thomson) O.E.Schulz.

Herbs (4–)6–15(–20) cm, glabrous throughout. Stems erect to decumbent, simple. Basal leaves rosulate; petiole (2–)5–10(–15) mm; leaf blade oblong, spatulate, or suborbicular, (0.3–)0.5–1.5(–1.8) cm × 2–6(–10) mm, base obtuse, apex rounded,

margin entire. Middle cauline leaves sessile, oblong, ovate, or suborbicular, 5–10(–15) × 2.5–(–7) mm, base auriculate, apex rounded, obtuse, to subacute, margin repand or entire. Sepals oblong, 2–2.5 × 1.2–1.5 mm, not saccate, margin white. Petals white with lavender tinge, spatulate, (5–)6–7 × 2.5–3.5 mm, apex rounded. Filaments 2.5–3.5 mm; anthers oblong, 0.6–0.8 mm. Ovules 4–8(–10) per ovary. Fruiting pedicels (2–)4–7 mm, slender, divaricate, straight. Fruit elliptic, 5–8 × 3–4 mm, base obtuse, apex obtuse to subacute, without apical notch; apical wings absent; style 0.7–1.5 mm. Seeds dark brown, oblong, 1.6–1.9 × 1–1.2 mm, smooth.

Distribution: Nepal, W Himalaya, E Himalaya and Tibetan Plateau.



Altitudinal range: 3000–5200 m.

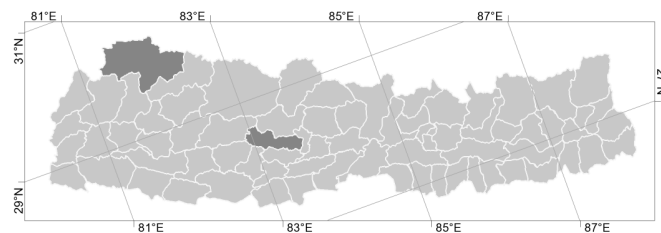
Ecology: Rocky crevices, scree, moist grounds, steep hillsides, grassy river banks.

Flowering: (March–)May–July. **Fruiting:** June–August.

2. *Noccaea nepalensis* Al-Shehbaz, Adansonia, Ser. 3 24(1): 89 (2002).

Herbs 30–40 cm, glaucous, glabrous throughout. Stems erect or ascending, simple and several from base, main stem 1-branched below raceme. Basal leaves rosulate; petiole 5–25 mm; leaf blade spatulate to suborbicular, 7–15 × 4–7 mm, base cuneate, apex rounded, margin entire or repand. Cauline leaves 5–7, widely spaced, sessile, oblong to ovate, middle ones 10–25 × 3–10 mm, base auriculate, apex obtuse, margin repand or entire; auricles 4 × 3 mm. Racemes ebracteate, corymbose, elongated considerably in fruit and to 15 cm. Sepals oblong, 2.5–3 × 1–1.2 mm, not saccate, margin white. Petals pale mauve, spatulate, 4.5–5 × 1.5–2 mm, apex rounded. Filaments 2.5–3 mm; anthers oblong, 0.7–0.8 mm. Ovules 8–10 per ovary. Fruiting pedicels 5–12 mm, slender, divaricate, straight. Fruit narrowly oblong-oblongeolate, strongly angustiseptate, carinate, widest slightly above middle 6–10 × 1.5–2 mm, wingless, base cuneate, apex obtuse, apical notch absent or obsolete; style filiform, 3–4 mm. Seeds dark brown, ovoid, ca. 1.2 × 0.6 mm.

Distribution: Endemic to Nepal.



Altitudinal range: 2700–3900 m.

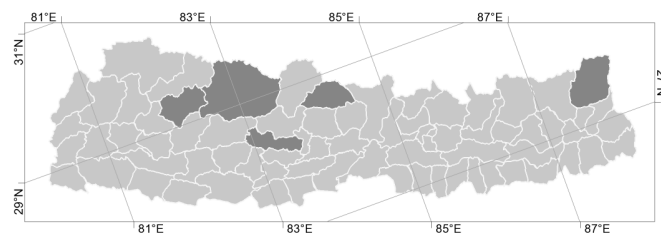
Ecology: Partial shade in mixed forests.

Flowering: May–June. **Fruiting:** May–June.

3. *Noccaea cochlearioides* (Hook.f. & Thomson) Al-Shehbaz, Adansonia, Ser. 3 24(1): 91 (2002).
Thlaspi cochlearioides Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 5: 177 (1861).

Herbs 5–10 cm, glabrous throughout. Stems erect to ascending, simple. Basal leaves rosulate; petiole (0.5–)1–3.5 cm; leaf blade broadly ovate to orbicular, 4–12 × 3–10 mm, base obtuse, apex rounded, margin entire, repand or obscurely denticulate. Middle cauline leaves sessile, oblong to ovate, 0.6–2.2 cm × 3–8(–10) mm, base auriculate, apex obtuse to acute, margin repand or entire, rarely denticulate. Sepals oblong, 1.8–2.5 × 1–1.5 mm, not saccate, margin white. Petals white, spatulate, 3.5–5.5 × 1.8–2.5 mm, apex rounded. Filaments 1.5–2.5 mm; anthers ovate, 0.4–0.6 mm. Ovules 6–10 per ovary. Fruiting pedicels 3–12 mm, slender, divaricate or slightly reflexed, straight. Fruit oblong, 5–8(–11) × 3–4 mm, usually curved and somewhat contorted, base obtuse, apex emarginate and apical notch 0.5–1 mm deep; apical wings 0.5–1 mm wide; style 0.5–1 mm. Seeds brown, ovate-oblong, 1–1.5 × 0.6–0.8 mm, obscurely reticulate.

Distribution: Nepal, W Himalaya and E Himalaya.



Altitudinal range: 2500–5800 m.

Ecology: Pasture, among rocks, stream-sides, river banks and peaty soils on consolidated scree.

Flowering: June–July. **Fruiting:** June–July.

30. *Sisymbrium* L., Sp. Pl. 2: 657 (1753).

Cruciferae

Annual herbs. Trichomes absent or simple. Stems erect, branched. Basal leaves petiolate, rosulate or not, simple, entire or variously pinnately dissected. Cauline leaves petiolate or sessile. Racemes ebracteate or rarely bracteate, often elongated considerably in fruit. Sepals ovate or oblong to linear, erect or spreading, base of lateral pair sometimes subsaccate. Petals yellow, spatulate, oblong, or oblanceolate, apex obtuse or emarginate; claw subequalling sepals. Stamens 6, tetradynamous; filaments not dilated at base; anthers oblong, obtuse at apex. Nectar glands confluent and subtending bases of all stamens; median glands present. Ovules 40–150 per ovary. Fruiting pedicels slender or thickened. Fruit dehiscent siliques, narrowly linear, terete; valves papery to subleathery, with a prominent midvein and 2 conspicuous marginal veins, smooth or torulose; replum rounded; septum complete; style distinct; stigma capitate, 2-lobed, lobes not decurrent. Seeds uniseriate, wingless, oblong, plump; seed coat reticulate or papillate, not mucilaginous when wetted; cotyledons incumbent or obliquely so.

Worldwide about 40 species distributed primarily in Eurasia and N Africa, with a few in S Africa and the New World. Two species in Nepal.

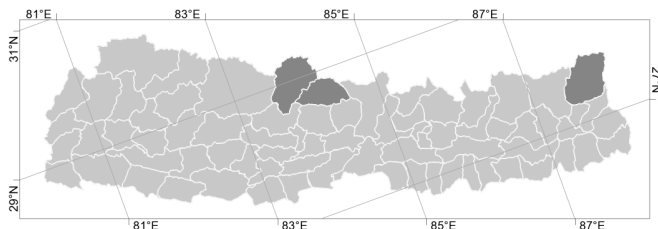
Key to Species

- 1a Fruit divaricate to recurved, (5–)7–10(–12) cm. Style 0.7–2(–2.5) mm. Sepals 4–6 mm. Petals 6–10(–12) mm **1 *S. brassiciforme***
b Fruit erect to ascending, (2.5–)3–4(–5) cm. Style 0.2–0.5 mm. Sepals 2–2.5 mm. Petals 2.5–3.5(–4) mm **2 *S. irio***

1. *Sisymbrium brassiciforme* C.A.Mey., in Ledeb., Fl. Altaic. 3: 129 (1831).
Sisymbrium ferganense Korsh.; *S. iscandericum* Kom.

Herbs (25–)35–100(–125) cm. Stems erect, branched above, glabrous or sparsely to densely soft hairy at least near base, usually glabrous above. Basal leaves rosulate, somewhat fleshy; petiole (1–)2–5(–8) cm; blade broadly oblanceolate to oblong-oblanceolate in outline, lyrate-pinnatifid to lyrate, (1.5–)3–15(–26) × (0.5–)1–6(–9) cm, dentate to rarely subentire; lateral lobes 1 or 2(or 3) on each side of midvein, much smaller than the oblong, dentate terminal lobe. Uppermost cauline leaves narrowly lanceolate to linear, often entire, rarely lobed. Sepals oblong-linear, spreading, 4–6 × 1–1.5 mm. Petals yellow, spatulate, 6–10(–12) × 1.5–2.5 mm. Filaments yellowish, erect, 3–6 mm; anthers oblong, 1.5–2 mm. Ovules 90–150 per ovary. Fruiting pedicels horizontal to divaricate-ascending, stout, narrower than fruit, 5–10(–12) mm. Fruits narrowly linear, stout, terete, (5–)7–10(–12) cm × 1–1.5 mm, usually recurved; valves glabrous or pubescent, subtorulose; style stout, 0.7–2(–2.5) mm; stigma 2-lobed; septum slightly thickened. Seeds oblong, 0.9–1.3 × 0.5–0.7 mm, inserted in depressions of septum.

Distribution: Nepal, W Himalaya, Tibetan Plateau, N Asia, C Asia and SW Asia.



Altitudinal range: 2700–3700 m.

Ecology: Roadsides, rocky places, fields.

Flowering: June–August. **Fruiting:** August–September.

The report in Hara (Enum. Fl. Pl. Nepal 2: 45. 1979) of *Sisymbrium heteromallum* C.A.Mey. from Nepal is based on plants of *S. brassiciforme* misidentified by Jafri as *S. heteromallum*. The latter species does not occur in Nepal.

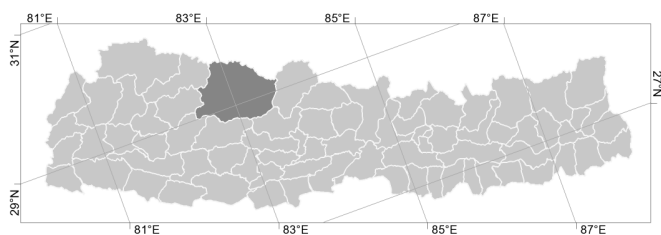
Although Hara (1979) cited only *Nakao s.n.* from Mustang in his account, there have been numerous other collections including *Stainton, Sykes & Williams 870* (BM, E), *Stainton, Sykes & Williams 7235* (BM, E), *Stainton, Sykes & Williams 1219* (BM, E) and *Stainton, Sykes & Williams 1483* (BM, E).

2. *Sisymbrium irio* L., Sp. Pl. 2: 659 (1753).
Arabis charbonnellii H.Lév.

Herbs (10–)20–60(–75) cm. Stems erect, branched below and above, glabrous to sparsely pubescent at least basally. Basal leaves not rosulate; petiole (0.5–)1–4.5(–6) cm; blade oblanceolate to oblong in outline, runcinate-pinnatisect, (1.5–)3–12(–15) × (0.5–)1–6(–9) cm; lateral lobes (1 or)2–6(–8) on each side of midvein, smaller than terminal, oblong to lanceolate, entire or dentate to lobed. Uppermost cauline leaves smaller than basal, entire or 1–3-lobed. Sepals oblong, erect, 2–2.5 × 1–1.5 mm. Petals yellow, oblong-oblanceolate, 2.5–3.5(–4) × 1–1.5 mm. Filaments yellowish, erect, 2.5–4 mm; anthers oblong, 0.5–0.9 mm. Ovules 40–90 per ovary. Fruiting pedicels divaricate to ascending, slender and much narrower than fruit, (5–)7–12(–20) mm. Fruits narrowly linear, slender, terete, (2.5–)3–4(–5) cm × 0.9–1.1 mm, erect to ascending, younger ones overtopping flowers; valves glabrous, slightly torulose; style 0.2–0.5 mm; stigma prominently 2-lobed; septum membranous. Seeds oblong, 0.8–1 × 0.5–0.6 mm, inserted in depressions of septum.

Fig. 7d

Distribution: Nepal, W Himalaya, E Asia, N Asia, C Asia, SW Asia and Europe.



Altitudinal range: 60–1700 m.

Ecology: Rocky slopes, orchards, roadsides, fields, pastures, waste grounds, prairies, disturbed sites.

Flowering: May–August. **Fruiting:** June–September.

Native of Europe and western and central Asia. This is the first report of the species from Nepal, based on *Dobremez et al.* 2722 (G).

31. *Smelowskia* C.A.Mey. nom cons., in Ledeb., Icon. Pl. 2: 17 (1830).

Perennial or annual herbs. Caudex well-developed, often branched. Trichomes dendritic, mixed with fine, simple and stalked forked ones. Stems procumbent to ascending, simple or branched above. Basal leaves petiolate, rosulate, 1- or 2-pinnatisect, sometimes flabellate. Cauline leaves petiolate or sessile, not auriculate, entire to pinnatisect. Racemes corymbose, many-flowered or bracteate, often elongated considerably in fruit. Sepals oblong, suberect to spreading, caducous or persistent, base of lateral pair not saccate. Petals white, longer than sepals; blade spatulate to obovate or suborbicular, apex rounded; claw differentiated from blade. Stamens 6, slightly tetradynamous; filaments often dilated at base; anthers ovate or oblong, obtuse at apex; nectar glands usually confluent, subtending bases of all stamens, median glands present or absent. Ovules 20–46 per ovary. Fruiting pedicels slender, erect to ascending. Fruits broadly oblong, oblong-linear or suborbicular, terete, 4-angled, latiseptate, or angustiseptate, sessile or rarely short stipitate, unsegmented; valves with a prominent or obscure midvein, glabrous to pubescent, smooth; replum rounded; septum complete or perforated; style obsolete or distinct; stigma capitate, entire or rarely slightly 2-lobed. Seeds uniseriate, wingless, oblong, plump; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons incumbent.

Worldwide 25 species in the Himalayas, C Asia, Mongolia, and the Russian Far East. One species in Nepal.

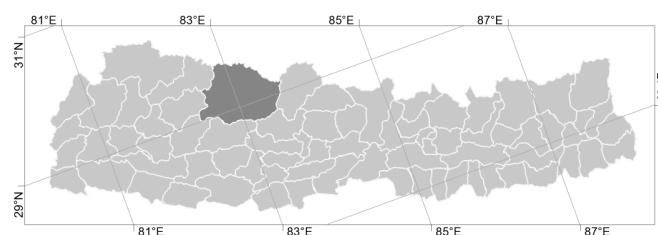
1. *Smelowskia tibetica* (Thomson) Lipsky, Trudy Imp. S.-Peterburgsk. Bot. Sada 23: 76 (1904).
Hutchinsia tibetica Thomson, Icon. Pl. 9: pl. 900 (1862);
Capsella thomsonii Hook.f.; *Hedinia elata* C.L.He & Z.X.An; *H. rotundata* Z.X.An; *H. taxkargannica* G.L.Zhou & Z.X.An; *H. taxkargannica* var. *hejigensis* G.L.Zhou & Z.X.An; *H. tibetica* (Thomson) Ostenf.

Herbs (1–)5–30(–45) cm, densely to sparsely pubescent, canescent or green. Stems procumbent to ascending, densely hirsute basally with primarily simple trichomes to 1.3 mm. Basal leaves sparsely to densely pubescent; petiole (0.2–)0.5–2(–3.5) cm, often ciliate basally; leaf blade ovate to narrowly oblong in outline, 1- or 2-pinnatisect, (0.3–)1–4(–7) × (0.2–)0.7–2(–2.5) cm; ultimate lobes ovate to oblong-linear, 1–12 × 0.5–3 mm. Cauline leaves similar to basal, reduced in size and divisions toward stem apex. Raceme bracteate throughout or rarely only basally; upper bracts subsessile, sometimes adnate to pedicel. Sepals oblong, 1.3–2 × 0.7–0.9 mm, sparsely pubescent. Petals obovate, 2–3.2 × (0.6–)0.9–1.4 mm; claw ca. 1.5 mm. Filaments 1.5–2 mm; anthers 0.3–0.4 mm. Ovules 20–46 per ovary. Fruiting pedicels straight, erect to ascending, 1.5–3.5(–5) mm, pubescent, subappressed to rachis. Fruit broadly oblong, rarely oblong-linear or suborbicular, (4.5–)5–10(–14) × 3–5 mm, flat or slightly twisted, obtuse to slightly retuse or rarely subacute at both ends, appressed to rachis;

valves glabrous to pubescent; style 0.3–0.8 mm, glabrous or rarely pubescent. Seeds light to dark brown, oblong, 0.8–1.1 × 0.4–0.6 mm.

Fig. 2n & Fig. 7e-f

Distribution: Nepal, E Himalaya, Tibetan Plateau, Assam-Burma, E Asia, N Asia and C Asia.



Altitudinal range: ca. 4500 m.

Ecology: Sandy or sandstone gravel, alpine meadows and steppes, scree, sandy slopes.

Flowering: June–August. **Fruiting:** July–September.

Cruciferae

32. *Alliaria* Heist. ex Fabr., Enum.: 161 (1759).

Biennial herbs. Trichomes simple. Stems erect. Basal leaves long petiolate, rosulate, simple, crenate or dentate. Cauline leaves petiolate, dentate. Racemes several-flowered, ebracteate, bracteate throughout, or only basally bracteate. Sepals oblong, erect, glabrous, base of lateral pair not saccate. Petals white, longer than sepals; blade oblanceolate, apex obtuse; claw obscurely differentiated from blade. Stamens 6, slightly tetradynamous; filaments not dilated at base; anthers oblong, obtuse at apex. Nectar glands confluent, subtending bases of all stamens. Ovules 14–20 per ovary. Fruiting pedicels slender or thickened, narrower than or as thick as fruit, terete. Fruit dehiscent siliques, linear, terete or 4-angled, sessile; valves with a prominent midvein and distinct marginal veins, glabrous, torulose; replum rounded; septum complete; style distinct and to 6 mm; stigma capitate. Seeds uniseriate, wingless, oblong, plump; seed coat longitudinally striate, not mucilaginous when wetted; cotyledons incumbent.

Worldwide two species, one endemic to the Caucasus and the other a Eurasian weed now cosmopolitan. One species in Nepal.

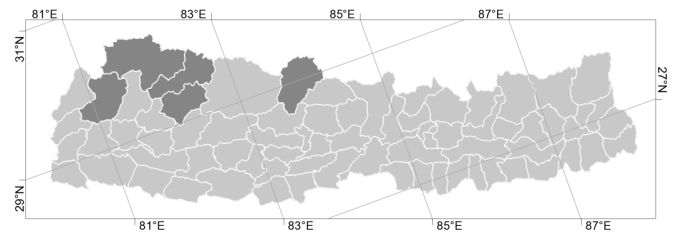
1. *Alliaria petiolata* (M.Bieb.) Cavara & Grande, Bull. Orto Bot. Regia Univ. Napoli 3: 418 (1913).

Arabis petiolata M.Bieb., Fl. Taur.-Caucas. 2: 126 (1808);

Alliaria officinalis Andr. ex DC.; *A. officinalis* Andr. ex M.Bieb. nom. inval.; *Erysimum alliaria* L.; *Sisymbrium alliaria* (L.) Scop.

divaricate-ascending; valves glabrous; style (0.2–)1–2(–3) mm. Seeds brown or black, narrowly oblong, 2–4.5 × 0.7–2 mm.

Distribution: Nepal, W Himalaya, Tibetan Plateau, N Asia, C Asia, SW Asia and Europe.



Altitudinal range: 2100–3200 m.

Ecology: Waste areas, roadsides, fields, river banks, woodlands.

Flowering: April–June. **Fruiting:** May–July.

Naturalized in many countries and under recorded in Nepal.

लसुने साग Lasune saag (Nepali).

Herbs with garlic smell when crushed. Stems erect, (15–)30–90(–130) cm, simple or branched above, glabrous or pilose basally with trichomes to 1.5 mm. Basal leaves rosulate, withered by time of fruiting; petiole 3–10(–16) cm; leaf blade reniform or cordate, (0.6–)1.5–5(–7) cm wide, shorter in length, base cordate, margin crenate or dentate, glabrous or pilose. Cauline leaves with much shorter petioles, ovate, cordate, or deltoid, to 15 × 15 cm, base cordate or truncate, apex acute, margin acutely to obtusely toothed. Racemes ebracteate or rarely lowermost flowers bracteate. Sepals oblong, (2–)2.5–3.5(–4.5) × 0.7–1.5 mm. Petals white, oblanceolate, (2.5–)4–8(–9) × (1.5–)2–3(–3.5) mm, attenuate to claw-like base. Filaments 2–3.5(–4.5) mm; anthers oblong, 0.7–1 mm. Ovules 14–20 per ovary. Fruiting pedicels divaricate or ascending, (2–)3–10(–15) mm, nearly as thick as fruit. Fruit linear, (2–)3–7(–8) cm × 1.2–2.5 mm, subtorulose, quadrangular or subterete,

33. *Thlaspi* L., Sp. Pl. 2: 645 (1753).

Annual herbs, often glabrous and glaucous. Trichomes absent or simple. Stems erect, simple or branched. Basal leaves petiolate or subsessile, subrosulate, simple, entire or dentate. Cauline leaves sessile, often auriculate, sagittate, or amplexicaul at base, entire or dentate. Racemes ebracteate, elongated in fruit. Sepals ovate or oblong, erect or ascending, base of lateral pair not saccate, margin membranous. Petals white, spatulate, apex obtuse or emarginate; claw differentiated from blade. Stamens 6, tetradynamous; anthers ovate, obtuse at apex. Nectar glands 1 on each side of lateral stamen; median glands absent. Ovules 6–16 per ovary. Fruiting pedicels slender, divaricate. Fruit dehiscent silicles, obovate or suborbicular, apically notched, strongly angustiseptate, sessile; valves keeled, winged all around or rarely only distally; replum rounded; septum complete; style absent or very short and included in apical notch of fruit; stigma capitate, entire. Seeds uniseriate, wingless, ovoid, plump; seed coat concentrically striate; cotyledons accumbent.

Worldwide six species in Europe and SW Asia. One species in Nepal.

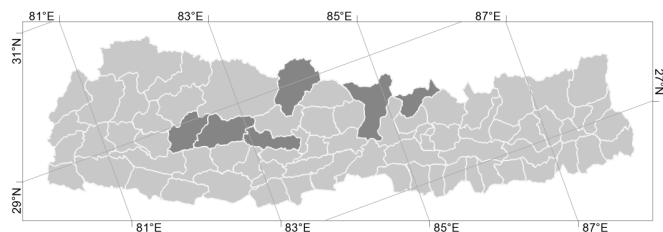
1. *Thlaspi arvense* L., Sp. Pl. 2: 645 (1753).

तिटे Tite (Nepali).

Herbs (9–)15–55(–80) cm, glabrous throughout, often glaucous, foetid when crushed. Stems erect, simple or branched above. Petiole of basal leaves 0.5–3 cm; leaf blade oblanceolate to spatulate or obovate, 1–5 × 0.4–2.3 cm, base attenuate to cuneate, margin entire, repand, or coarsely toothed, apex rounded. Middle cauline leaves sessile, oblong, (0.5–)1.5–4(–8) × (0.2–)0.5–1.5(–2.5) cm, base sagittate or auriculate, apex rounded, obtuse, to subacute, margin dentate, repand, or entire. Sepals, (1.5–)2–3(–3.3) × 1–1.5 mm, not saccate, margin white. Petals, (2.4–)3–4.5(–5) × (0.8–)1.1–1.6 mm, narrowed to a claw-like base ca. 1 mm, apex obtuse or emarginate. Filaments (1–)1.5–2 mm; anthers ovate, 0.3–0.5 mm. Fruiting pedicels (0.5–)0.9–1.3(–1.5) cm, slender, divaricate, straight or slightly curved upward. Fruit, (0.6–)0.9–2 × (0.5–)0.7–2 cm, base obtuse to rounded, apex deeply emarginate and apical notch ca. 5 mm deep; wings 1–1.5 mm wide at base, 3.5–5 mm wide apically; style absent or 0.1–0.3 mm. Seeds blackish brown, ovoid, (1.2–)1.6–2(–2.3) × 1.1–1.3 mm.

Fig. 2o & Fig. 7g-h

Distribution: Cosmopolitan.



Altitudinal range: 2000–4600 m.

Ecology: Roadsides, grassy slopes, fields, waste places.

Flowering: March–October. **Fruiting:** March–October.

A cosmopolitan weed of Eurasian origin.

Used as a medicinal plant and source of oil. Tender shoots are cooked as a vegetable. The seeds are febrifuge and anti-inflammatory, and are used against pus in the lungs and renal inflammation. Cattle feeding on the plant produce tainted milk.

Cruciferae

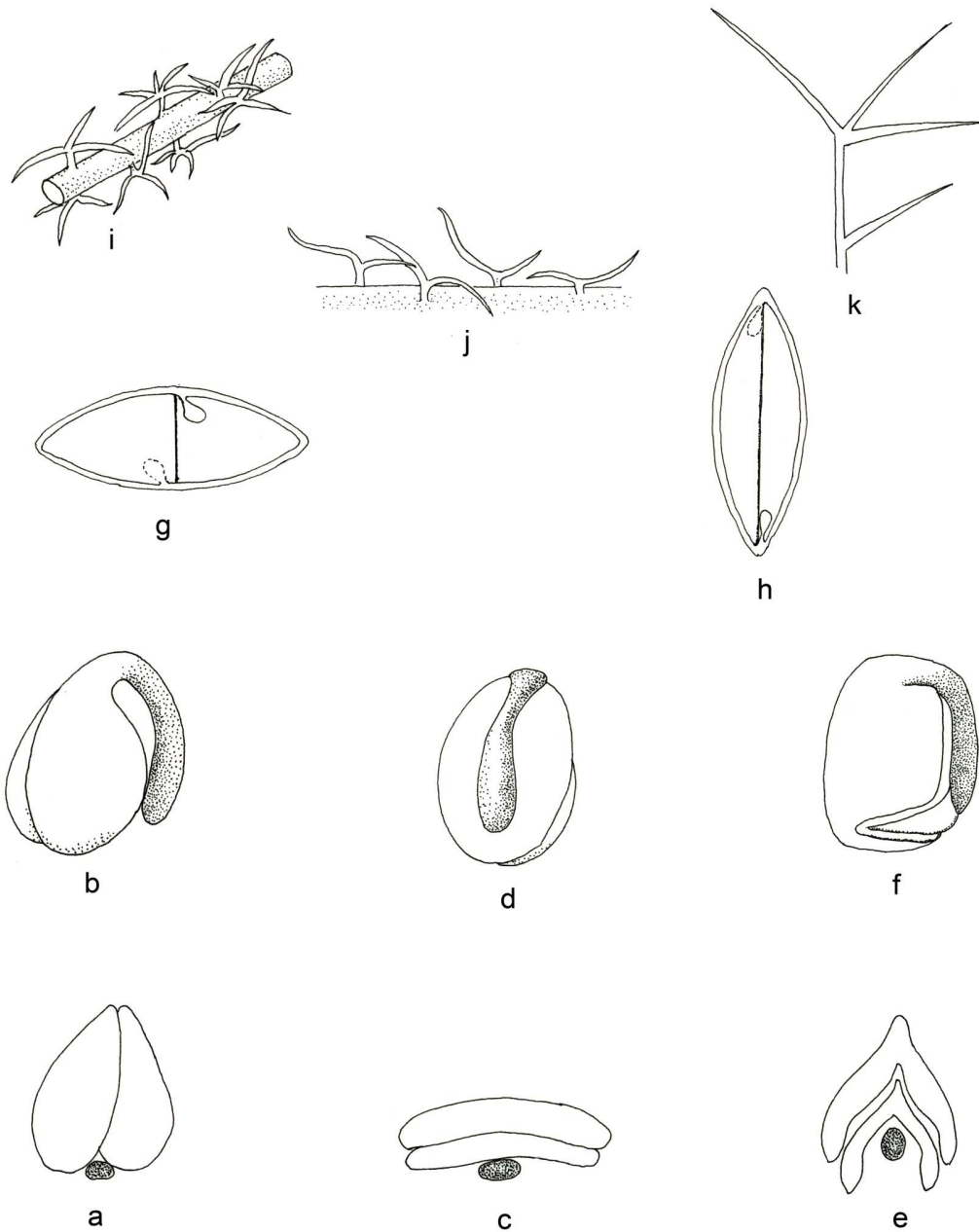


Fig. 1.
CRUCIFERAE. Cotyledon types: a, accumbent (vertical view); b, accumbent (side view); c, incumbent (vertical view); d, incumbent (side view); e, conduplicate (vertical view); f, conduplicate (side view). silicula types: g, angustiseptate; h, latiseptate. Hair types: i, stellate; j, forked; k, branched.

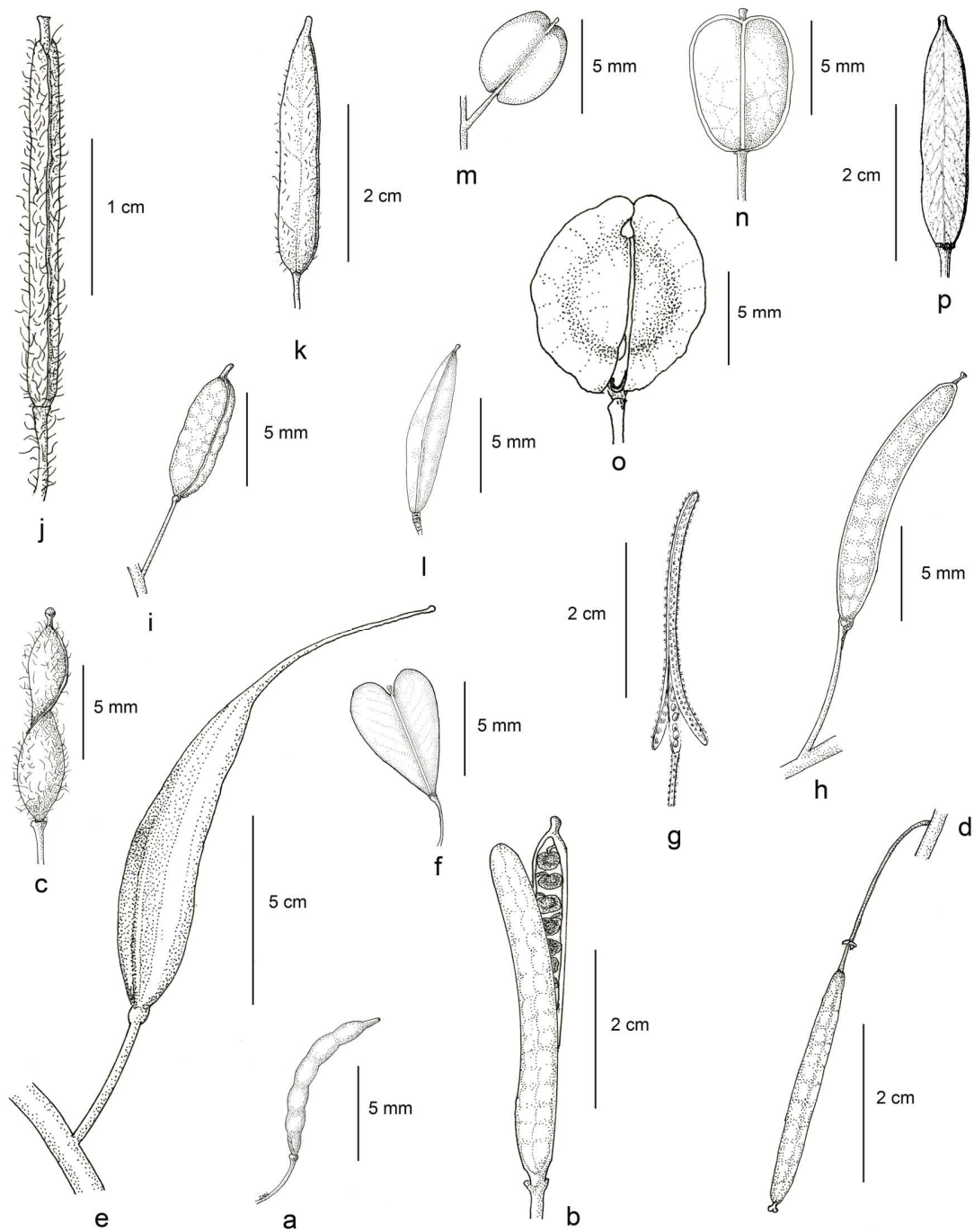


Fig. 2.

CRUCIFERAE. Fruit diversity. a, *Aphragmus ohbana*; b, *Arabis pterosperma*; c, *Draba sikkimensis*; d, *Diplotaxis harra*; e, *Raphanus sativus*; f, *Capsella bursa-pastoris*; g, *Crucihimalaya lasiocarpa*; h, *Nasturtium officinale*; i, *Rorippa palustris*; j, *Braya humilis*; k, *Solms-laubachia himalayensis*; l, *Eutrema heterophyllum*; m, *Lepidium sativum*; n, *Smelowskia tibetica*; o, *Thlaspi arvense*; p, *Christolea crassifolia*.

Cruciferae

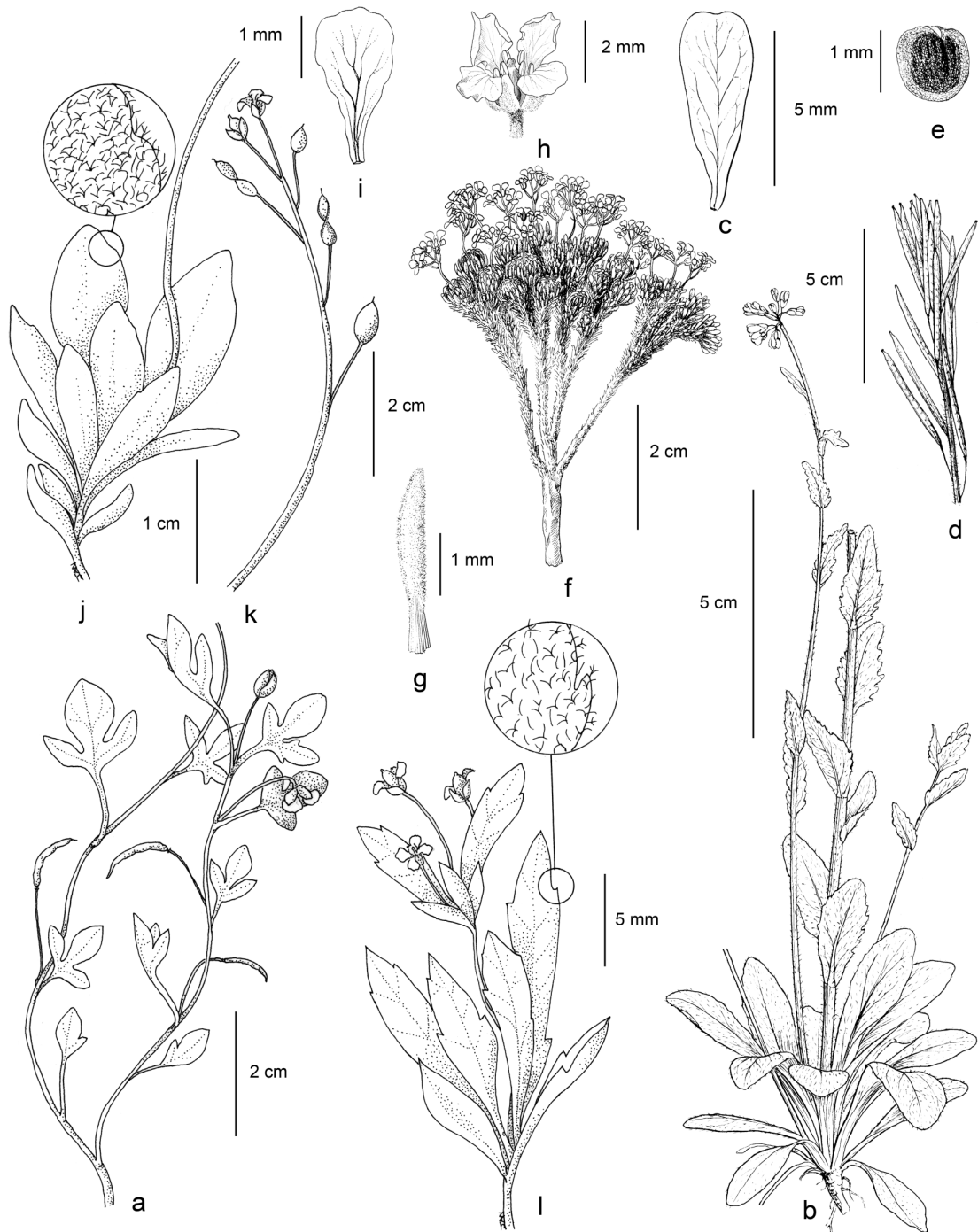


Fig. 3.
CRUCIFERAE. **Aphragmus ohbana**: a, shoot with flowers and fruits. **Arabis pterosperma**: b, flowering plant; c, petal; d, fruits; e, seed. **Draba glomerata**: f, flowering plant; g, leaf; h, flower; i, petal. **Draba sikkimensis**: j, lower part of plant; k, inflorescence with fruits. **Draba macbeathiana**: l, inflorescence and leaves.

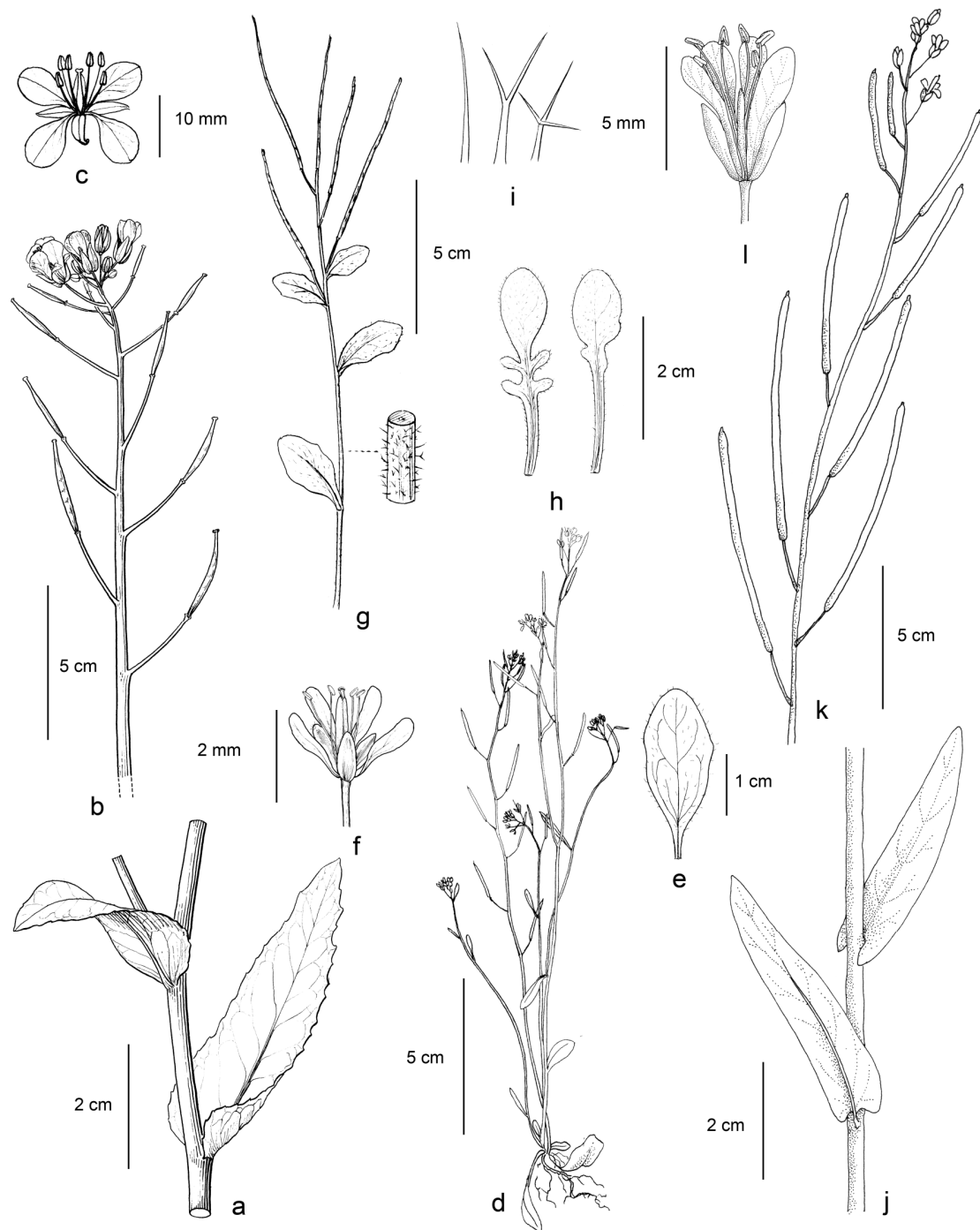


Fig. 4.
 CRUCIFERAE. ***Brassica rapa* var. *oleifera***: a, stem with leaves; b, inflorescence with fruits; c, flower. ***Arabidopsis thaliana***: d, plant with flowers and fruits; e, basal leaf; f, flower. ***Crucihimalaya wallichii***: g, infructescence; h, basal leaves; i, hairs. ***Turritis glabra***: j, stem with leaves; k, inflorescence with fruits; l, flower.

Cruciferae

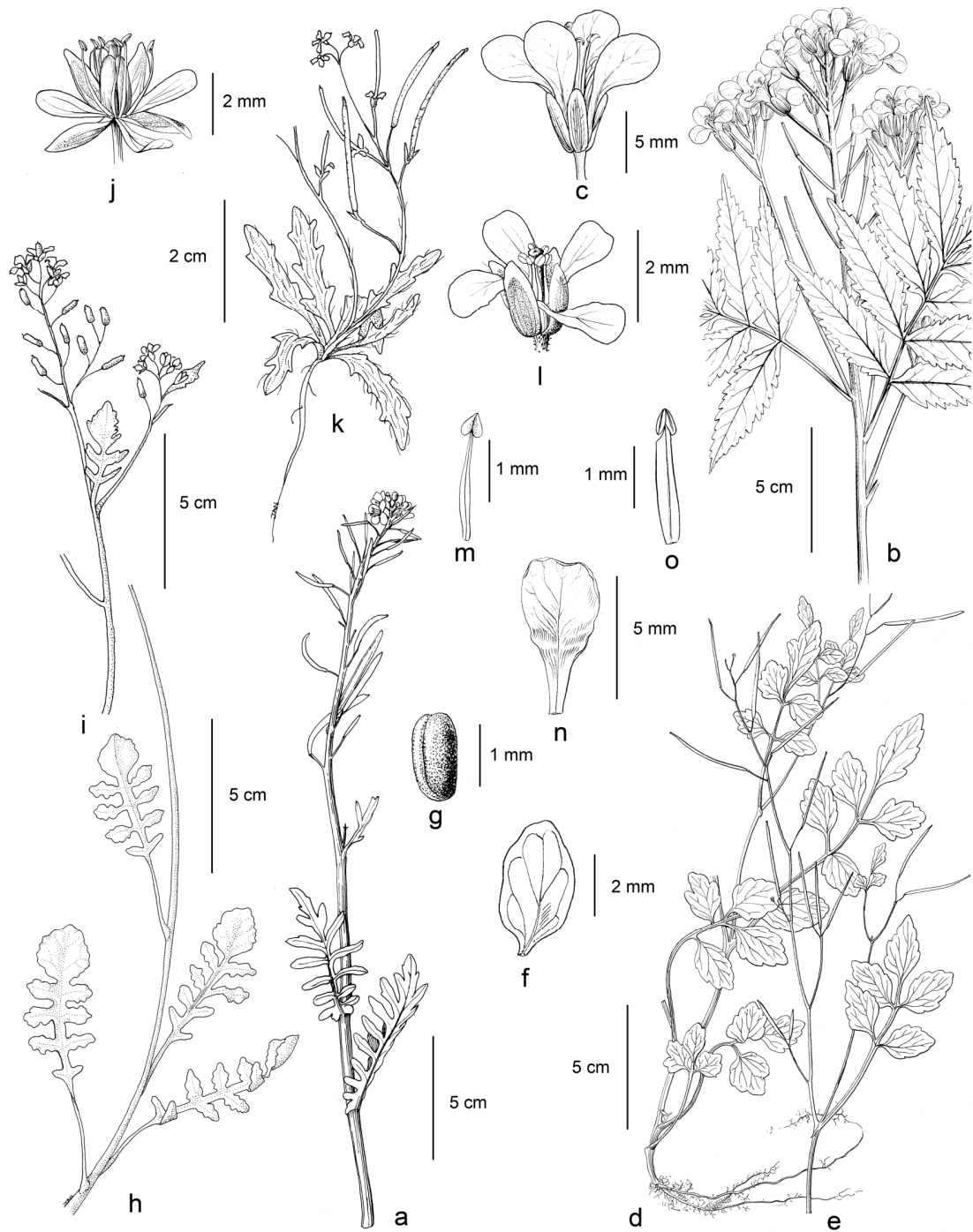


Fig. 5.
CRUCIFERAE. **Barbarea intermedia**: a, shoot with flowers and fruits. **Cardamine macrophylla**: b, leaves and inflorescence; c, flower. **Cardamine yunnanensis**: d, lower part of plant with leaves; e, inflorescence with leaves; f, petal; g, seed. **Rorippa palustris**: h, lower part of plant with leaves; i, inflorescence with fruits; j, flower. **Dontostemon glandulosus**: k, plant with flowers and fruits; l, flower; m, stamen. **Dontostemon pinnatifidus**: n, petal; o, stamen.

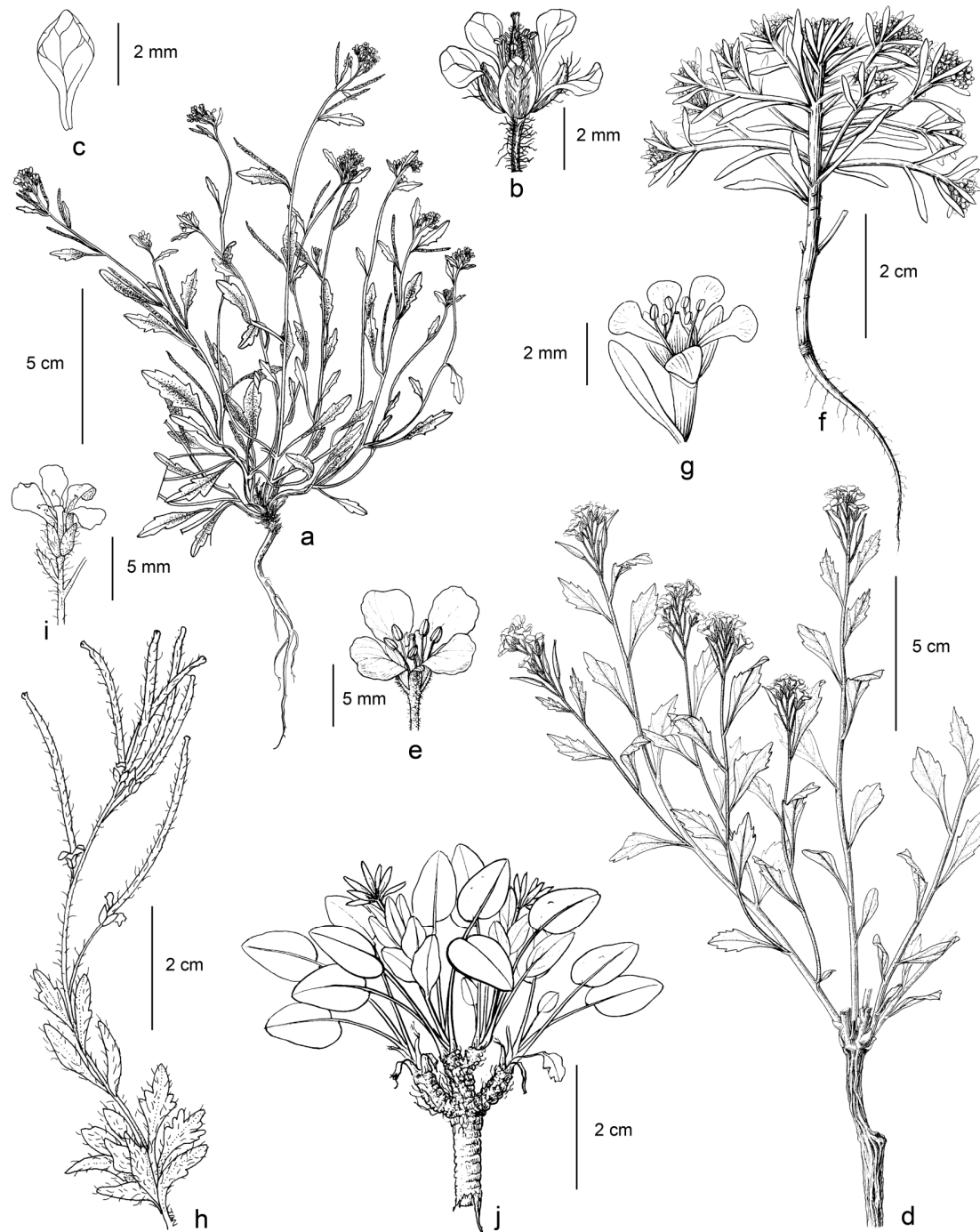


Fig. 6.
 CRUCIFERAE. ***Braya humilis***: a, plant with flowers and fruits; b, flower; c, petal. ***Christolea crassifolia***: d, plant with flowers and fruits; e, flower. ***Dilophia salsa***: f, flowering plant; g, flower. ***Solms-laubachia linearis***: h, fruiting plant; i, flower. ***Eutrema heterophyllum***: j, flowering plant.

Cruciferae

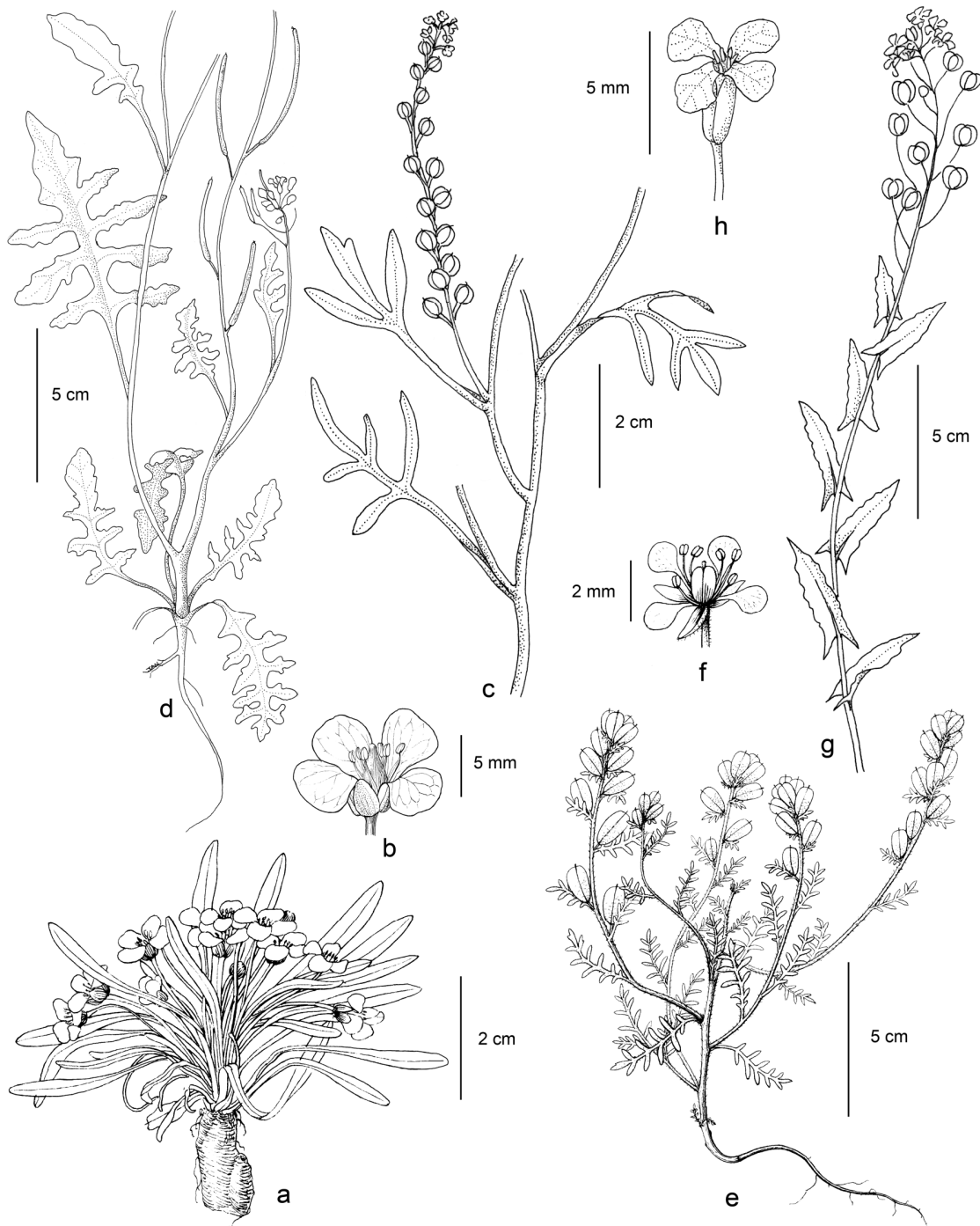


Fig. 7.
CRUCIFERAE. *Pegaeophyton scapiflorum*: a, flowering plant; b, flower. *Lepidium sativum*: c, inflorescence with leaves. *Sisymbrium irio*: d, plant with flowers and fruits. *Smelowskia tibetica*: e, fruiting plant; f, flower. *Thlaspi arvense*: g, stem with inflorescence and fruits; h, flower.

Cruciferae

Illustration Accreditation

The editors are pleased to credit the artwork from the following artists and sources used by Bhaskar Adhikari when composing the illustrations used in this volume. 'FOB' refers to *Flora of Bhutan* (Grierson, Long & Noltie, 1983–2002. Royal Botanic Garden Edinburgh); 'FOCI' refers to *Flora of China Illustrations* (Wu, Raven & Hong, 1998–ongoing. Science Press (Beijing) & Missouri Botanical Garden Press); and 'FRPS' refers to *Flora Reipublicae Popularis Sinicae* (1959–2004. Science Press (Beijing)). The copyright holders of these three publications, Science Press (Beijing), Missouri Botanical Garden Press, and Royal Botanic Garden Edinburgh, are thanked for permission to reproduce these illustrations, and for their generosity in making the images available in digital format

Fig. 1

a-k Jane Nyberg

Fig. 2

a Jane Nyberg

b FOCI 8: 77. Redrawn by Jane Nyberg (FRPS 33: 275 pl. 76. 1987.- Wei Lisheng)

c-f Jane Nyberg

g FOCI 8: 81. FRPS 33: 282, pl. 78. 1987.- Chen Rongdao

h-o Jane Nyberg

p FOCI 8: 85. FRPS 33: 293, pl. 81. 1987.- Zhang Taili

Fig. 3

a Jane Nyberg

b,c FOCI 8: 76. FRPS 33: 284, pl. 79. 1987.- Shi Weiqing

d,e FRPS 33: 275, pl. 76. 1987.- Wei Lisheng

f-i FOCI 8: 32. FRPS 33: 162, pl. 39. 1987.- Chen Rongdao

j-l Jane Nyberg

Fig. 4

a-c FOCI 8: 3. FRPS 33: 24, pl. 4. 1987.- Zhang Chunfang

d-f FOCI 8: 81. FRPS 33: 282, pl. 78. 1987.- Chen Rongdao

g-i FOCI 8: 76. FRPS 33: 284, pl. 79. 1987.- Shi Weiqing

Fig. 5

a FOCI 8: 70. FRPS 33: 252, pl 66. 1987.-Wei Lisheng

b,c FOCI 8: 44. FRPS 33: 190, pl 44. 1987.-Shi Weiqing

d-g FOCI 8: 62. FRPS 33: 230, pl 57. 1987.-Chen Rongdao

h-i Jane Nyberg

j FOCI 8: 89. FRPS 33: 310, pl 86. 1987.-Shi Weiqing

k Jane Nyberg

l-o FOCI 8: 96. FRPS 33: 324, pl 92. 1987.-Shi Weiqing

Fig. 6

a-c FOCI 8: 127. FRPS 33: 429, pl 123. 1987.-Wei Guangzhou, redrawn by Li Aili

d,e FOCI 8: 85. FRPS 33: 293, pl 81. 1987.-Zhang Taili

f,g FOCI 8: 120. FRPS 33: 93, pl 19. 1987.-Wu Zhanghua

h, i Jane Nyberg

j FOCI 8: 129. FRPS 33: 433, pl 124. 1987.-Zhang Chunfang

Fig. 7

a, b FOCI 8: 66. FRPS 33: 245, pl 63. 1987.-Chen Rongdao

c, d Jane Nyberg

e, f FOCI 8: 18. FRPS 33: 87, pl 18. 1987.-Wu Zhanghua

g, h Jane Nyberg

How to use this pdf web edition

This Web-edition pdf document forms part of a set of Flora accounts for families and genera that have been finalized, including those in volumes yet to be printed. These pdf documents are made accessible via the *Flora of Nepal* website (www.floraofnepal.org) and will be periodically updated in numbered versions, permanently available and citable.

Flora of Nepal takes an innovative approach to Flora writing, with an underlying data base system managing the *Flora of Nepal Knowledge Base* from which the printed volumes and the 'online Flora' (www.floraofnepal.org) are generated. The Internet-accessible dataset augments the printed Flora by presenting all herbarium specimen data, detailed taxonomic information (such as full nomenclatural references and typification), distribution maps with point occurrences and images used when preparing the Flora. Much of this information is accumulated as a normal part of taxonomic working practices when undertaking a floristic revision, but it is usually lost to a wider audience as it is rarely included in the traditional printed Flora.

Flora of Nepal includes all native and fully naturalized vascular plants recorded within the political borders of Nepal, including brief references to agricultural and horticultural plants as appropriate. For pragmatic reasons the arrangement of families in the printed *Flora of Nepal* follows a modified Englerian sequence, closely following that of the *Flora of China* and, to a lesser extent, the *Flora of Bhutan*.^{1,2} In recent years the world view on the arrangement of families has radically changed following overwhelming phylogenetic evidence. The emergent family-level classification, now in its third iteration as APG III, is reasonably stable and widely accepted.³ It has not been possible to alter the family sequence in *Flora of Nepal* printed volumes midway through the project, but as the data are stored separately in a database, the families can be reorganized electronically at a later date to reflect alternative classifications. Circumscription of families and genera, however, generally does follow a contemporary understanding of their relationships, except where group experts advise otherwise. Genera and species are treated in taxonomic order, or if there is disagreement then morphologically similar species are usually grouped together or occasionally listed alphabetically. Intraspecific taxa are always presented in alphabetical order. Intermediate ranks, such as subfamily, tribe, subgenus, section and series, are only used when they are useful in the treatment of large families or genera.

Information on nomenclature and classification is given for all accepted scientific names and synonyms pertaining to Nepal and nearby regions. Emphasis is given to those names listed in the primary checklists for Nepal: *Enumeration of the Flowering Plants of Nepal*,⁴ *Annotated Checklist of the Flowering Plants of Nepal*,⁵ and *Flowering Plants of Nepal (Phanerogams)*.⁶ At the generic level, synonyms widely used in the Asian literature are included. Full bibliographic citation with authorship is given for all accepted names and their basionyms at the rank of genus and below. As far as possible, the bibliographic citations of all accepted names and their basionyms have been verified with the original literature. The basionym precedes all other synonyms, which are listed alphabetically. Misapplied names (misidentifications encountered in the literature) are not included in synonymy, but are discussed in the supporting information at the end of a taxon. Authors of plant names follow the standard forms given in *Authors of Plant Names* and its continuously updated online supplement (www.ipni.org).⁷ Bibliographic references are given using the standard abbreviations in BPH-2 for serial publications (journals and periodicals) and in TL-2 (and its supplements) for books.^{8,9} In some cases books were published in several fascicles on different dates, sometimes over different years, but not indicated as such in the printed work. Date of publication is critical for establishing nomenclatural priority, and so it is important to be precise when citing names published in such works. The fascicle composition and publication dates of these often complex cases are clearly explained in TL-2, but the standard abbreviation does not differentiate between them. In these instances the TL-2 abbreviation has been amended with brackets to clearly indicate which fascicle is being referred to, for example Wallich, N., Pl. As. Rar. 2[8]. 1831. Books and periodicals not included in these two standard references have been abbreviated according to the recommendation in Appendix A of BPH-2.

Cruciferae

Where a taxon has a widely recognized local name this is given in Devanagari script, followed by its transliteration into the Latin alphabet and the language of the vernacular name in parentheses '()'. One local name is given in the printed *Flora*, whereas multiple alternative vernacular names in different languages may be included in the *Flora of Nepal Knowledge Base* and made available online. Separate indexes to vernacular names in Devanagari, their Latin transliterations and scientific names are included at the end of each volume.

Descriptions are given for all taxa (family, genus, species, infraspecies and occasionally intermediate ranks) and wherever possible are based on primary observations and measurements made on specimens from Nepal. If no such material was available to authors, descriptions are taken from specimens from adjacent countries or secondary sources, and annotated as such. Most descriptions are about 150 words long, but exceptionally they are shorter or longer depending on the complexity of the taxon being described. For species with more than one infraspecific taxon, a full description is given for the species and short diagnoses for the lower taxa. Descriptions aim to be consistent and parallel between taxa of the same rank within a higher taxon. Authors were asked to standardize descriptive terms using the definitions given in *Plant Identification Terminology*.¹⁰ If a single measurement is given it refers to length, and if width is also given it is in the format length x width. Ranges are separated by an en-dash (–) and discontinuous states by the word 'or'. Exceptional measurements are given in parentheses '()'. Taxon statistics and short statements on worldwide distribution are provided for families and genera, with summary statistics of lower taxa represented in Nepal.

Identification keys are dichotomous and presented in a bracketed format, with all elements strictly parallel between the two leads of each couplet. Keys are artificial and not intended to reflect any taxonomic classification. There is usually a single key to genera within a family, combining flowering, fruiting and vegetative characters, but where this is unwieldy separate keys are given for flowering and fruiting material (e.g. Cruciferae, Rosaceae). Keys are also given for species within a genus and taxa within a species. Figures are provided to aid identification by illustrating the diagnostic characters of each family and genus, and for large genera variation in major morphological features is represented.

The geographic distribution within Nepal is indicated for each species and infraspecific taxon at the political district level by a shaded distribution map. The distribution maps are evidence-based, produced from the *Flora of Nepal Knowledge Base* using locality information taken from authenticated herbarium specimens and records of plants *in situ* made by credible observers. Ideally all specimens identified by authors should be geo-referenced and databased when they are preparing *Flora of Nepal* accounts, but where this is not possible a minimum of one specimen per district is required. Sometimes the distribution of a species is greater than the sum of the distribution maps of its infraspecific taxa. This is a result of some herbarium specimens only being identifiable to species level. Occasionally species are known only from poorly localised collections, especially those from the early 19th century. For example, Wallich often only gave 'Nepalia' as the locality for many of his 1820–1821 collections. These specimens are most likely to have come from the Kathmandu Valley, known as the 'Nepal Valley' or just 'Nepal' at that time, but they might also have been collected during his inward and outward journeys from India via Hetauda, or by pilgrims going north to 'Gossainthan' (Gossainkund). It is therefore impossible to be sure of the correct district and in such cases this is noted in the supporting information and the map omitted. The *Flora of Nepal* website gives access to the underlying distribution and specimen information through an interactive dot map plotting all geo-referenced occurrence records and a listing of all material recorded.

Distribution for species and infraspecific taxa occurring outside Nepal is indicated by a list of geographical regions, with the resolution becoming coarser with increasing distance from Nepal. In order to utilise information contained within other published Floras these areas are defined according to political borders, with countries or provinces grouped to form regions that have some underlying biogeographic basis. For example, although the Tibetan Plateau extends into parts of Sichuan and Yunnan, we limit it to Xizang and Qinghai. *Flora of Nepal* takes no stance on any politically disputed border areas and is following the current

international mapping convention of using the 'lines of control' to delineate its regions. The names used for the regions are intended to be descriptive and non-political. The regions are:

<i>W Himalaya</i>	India (Jammu & Kashmir, Himachal Pradesh, Uttarakhand), northern Pakistan (Khyber Pakhtunkhwa, previously known as North West Frontier Province).
<i>E Himalaya</i>	Sikkim, Darjeeling, Bhutan, NE India (Arunachal Pradesh).
<i>Tibetan Plateau</i>	China (Xizang, Qinghai).
<i>Assam-Burma</i>	Assam, Nagaland, Manipur, Myanmar.
<i>S Asia</i>	Eastern Pakistan (Punjab, Sind, Islamabad), Peninsular India, Sri Lanka, Bangladesh, Maldives.
<i>E Asia</i>	China (excluding Xizang, Xinjiang, Qinghai), Korea, Japan, Taiwan.
<i>SE Asia</i>	Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, New Guinea.
<i>N Asia</i>	China (Xinjiang), Russia, Mongolia.
<i>C Asia</i>	Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan.
<i>SW Asia</i>	Afghanistan, western Pakistan (Baluchistan, Federally Administered Tribal Areas), Iran, Middle East, Arabian Peninsula, Turkey, Azerbaijan, Armenia, Georgia.
<i>Asia</i>	collective term for all above areas of Asia.
<i>Europe</i>	includes Ukraine, Belarus, Baltic republics.
<i>Africa</i>	includes Madagascar.
<i>N America</i>	includes C America south to Panama.
<i>S America</i>	south of Panama.
<i>Australasia</i>	Australia, New Zealand, Pacific Islands.
<i>Cosmopolitan</i>	collective term for a generally worldwide distribution.

Altitudes (elevation above sea level) are based on herbarium specimen data or records from credible observers. They are given to the nearest 100 m rounded up or down, with exceptional altitudes given in parentheses '()'. Likewise, flowering and fruiting times are based on specimens collected from Nepal, or on material from adjacent regions if these data are lacking and a note is provided to explain this. The short statement on the ecological preference of each species and infraspecific taxon is mostly taken from herbarium specimen data. Currently these often lack detail, a reflection of the shortcomings of poor-quality data recorded by the past collectors of herbarium material, but these will improve with more field studies.

Supplementary information is given at the end of a taxon account discussing taxonomic issues, highlighting spot characters useful for identification, noting similar species that could cause confusion, and detailing the misapplication of names. Summary information is provided for ethnobotanical and other uses, but this is not intended to be exhaustive and is derived from secondary sources, such as *Plants and People of Nepal* and *A Compendium of Medicinal Plants of Nepal*.^{11, 12}

Abbreviations

Standard abbreviations for the International System of Units (SI) are used for measurements. Herbaria are cited using the standard abbreviation in *Index Herbariorum*.¹³ Other abbreviations used in the text include:

C	central.
ca.	<i>circa</i> – about, approximately.
comb. nov.	<i>combinatio nova</i> – new combination of name and epithet.
dbh	diameter at breast height – measured on tree trunks at 1.3 m above the ground.
E	east, eastern.
et al.	<i>et alia</i> – and others.
fig.	figure.
N	north, northern.

Cruciferae

nom. cons.	<i>nomen conservandum</i> – name officially conserved in ICBN. ¹⁴
nom. illegit.	<i>nomen illegitimum</i> – illegitimate name, according to ICBN. ¹⁴
nom. inval.	<i>nomen invalidum</i> – invalid name, according to ICBN. ¹⁴
nom. nud.	<i>nomen nudum</i> – name lacking a description, or reference to an effectively published description, and so invalid according to ICBN. ¹⁴
nom. rej.	<i>nomen rejiciendum</i> – name officially rejected in ICBN. ¹⁴
nom. superfl.	<i>nomen superfluum</i> – name superfluous when published, and so illegitimate according to ICBN. ¹⁴
pl.	plate.
q.v.	<i>quod vide</i> – which see.
S	south, southern.
s.l.	<i>sensu lato</i> – for a taxon treated in a broad sense.
s.s.	<i>sensu stricto</i> – for a taxon treated in a narrow sense.
sect.	section.
subfam.	subfamily.
subgen.	subgenus.
subsp.	subspecies.
subvar.	subvariety.
syn.	synonym
var.	variety.
W	west, western.
>	greater than
<	less than

References

- 1 Wu, Z.Y., Raven, P.H. & Hong, D.Y. (1994–ongoing). *Flora of China*, Science Press (Beijing) & Missouri Botanical Garden Press, St Louis [available online at flora.huh.harvard.edu/china].
- 2 Grierson, A.J.C., Long, D.G. & Noltie, H.J. (1983–2002). *Flora of Bhutan*, Royal Botanic Garden Edinburgh, Edinburgh.
- 3 Angiosperm Phylogeny Group III (2009). 'An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants': APG III. *Bot. J. Linn. Soc.* 161: 105–21.
- 4 Hara, H., Stearn, W.T., Williams, W.T. & Chater, A.O. (1978, 1979, 1982). *An Enumeration of the Flowering Plants of Nepal*, 3 volumes, Trustees of the British Museum (Natural History), London.
- 5 Press, R., Shrestha, K.K. & Sutton, D.A. (2000). *Annotated Checklist of Flowering Plants of Nepal*, Natural History Museum: London & Tribhuvan University, Kathmandu [updated version available online at efloras.org].
- 6 Singh, A.P., Bista, M.S., Adhikari, M.K. & Rajbhandari, K.R. (2001). *Flowering Plants of Nepal (Phanerogams)*, HM Government of Nepal, Ministry of Forests, Department of Medicinal Plants, Kathmandu.
- 7 Brummit, R.K. & Powell, C.E. (1992). *Authors of Plant Names*, Royal Botanic Gardens, Kew, London [available online with revisions at www.ipni.org].
- 8 Bridson, G.D.R. & Smith, E.R. (1991). *Botanico-Periodicum-Huntianum*, ed. 2, Hunt Institute for Botanical Documentation, Pittsburgh.
- 9 Stafleu, F.A., Cowan, R.S. & Mennega, E. (1973–1988). *Taxonomic Literature*, ed. 2 (TL-2), Bonn, Scheltma & Holkema, Utrecht/Antwerpen; dr. W. Junk b.v., The Hague/Boston [available online at tl2.idcpublishers.info].
- 10 Harris, J.G. & Harris, M.W. (2001). *Plant Identification Terminology*, ed. 2, Spring Lake Publishing, Utah.
- 11 Manandhar, N.P. (2002). *Plants and People of Nepal*, Timber Press, Oregon.
- 12 Baral, S.R. & Kurmi, P.P. (2006). *A Compendium of Medicinal Plants in Nepal*, Mass Printing Press, Kathmandu.
- 13 Holmgren, P.K., Holmgren, N.H. & Barnett, L.C. (eds) (1990). *Index Herbariorum. Part 1: The Herbaria of the World*. ed. 8. New York Botanic Garden: New York. [available online with revisions at sweetgum.nybg.org/ih].
- 14 McNeill, J., Barrie, F.R., Burdet, H.M., Demoulin, V., Hawksworth, D.L., Marhold, K., Nicolson, D.H., Prado, J., Silva, P.C., Skog, J.E., Wiersema, J.H. & Turland, N.J. (eds) (2006). *International Code of Botanical Nomenclature (Vienna Code)*, Regnum Vegetabile 146. Gantner, Ruggell.