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Author: Perth, Uotila

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PERTTI UOTILA[1]

Dysphania sect. *Botryoides* (*Amaranthaceae* s.lat.) in Asia

Abstract

Uotila P.: *Dysphania* sect. *Botryoides* (*Amaranthaceae* s.lat.) in Asia. – Willdenowia 43: 65–80. June 2013. – Online ISSN 1868-6397; © 2013 BGBM Berlin-Dahlem.
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Of the seven species of *Dysphania* sect. *Botryoides* recognized from Asia, the Mediterranean and Central Asian *D. botrys* is widespread in the area and *D. nepalensis* is widespread in the Hindu Kush, Himalaya and China. They are sympatric only from the E Hindu Kush and Pamir to NW Himalaya. *Dysphania schraderiana* from East Africa and the Arabian Peninsula has a restricted area in NW Pakistan, and the recently described *D. bhutanica* is known from Bhutan and China (Xizang). Two species are described here as new to science and illustrated: *D. kitiae* from China (Gansu) and *D. himalaica* from high altitudes in N India, Nepal and China (Xizang). *Dysphania tibetica*, also from high altitudes in N India to China (Xizang), is transferred from *Chenopodium* to *Dysphania*. *Dysphania kitiae* has narrowly lobed leaves, the back of the perianth lobes with a forward-projecting tooth near the apex and seeds with an undulate testa; *D. himalaica* is characterized by vertical seeds, previously almost unknown in this section; and *D. tibetica* has a very dense indumentum and the ultimate branchlets of its inflorescence are sterile. Descriptions for all recorded species are provided, a key to them is presented and distribution maps for *D. botrys*, *D. himalaica*, *D. nepalensis* and *D. tibetica* are given. A lectotype for *C. foetidum* (≡ *C. schraderianum*, *D. schraderiana*) is designated.

Additional key words: *Chenopodiaceae*, *Chenopodium*, *Dysphania himalaica*, *Dysphania kitiae*, *Dysphania tibetica*, distribution, taxonomy, China, India, Nepal, Pakistan

Introduction

The genus *Chenopodium* L. (*Chenopodiaceae* or *Amaranthaceae* s.lat.) is very heterogeneous, and several species had already been transferred to *Suaeda* Forssk. ex J. F. Gmel. and *Bassia* All. in the 1700s and early 1800s. The remaining major part of the genus has been under active research during the last few years, and it was divided into seven different genera, four of them belonging to the tribe *Atripliceae* Duby (*Chenopodiastrum* S. Fuentes & al., *Chenopodium* s.str., *Lipandra* Moq. and *Oxybasis* Kar. & Kir.), one to *Anserineae* Dumort. (*Blitum* L.) and two to *Dysphanieae* R. Br. (*Dysphania* R. Br. and *Teloxys* L.) (Fuentes-Bazan & al. 2012b). Transferring of the aromatic species of *Chenopodium* to the genus *Dysphania* took place in the 2000s, and to the present knowledge, the genus includes ten original Australian *Dysphania* species (Wilson 1983) and 33 species later transferred from *Chenopodium* by Mosyakin & Clemants (2002, 2008) and Verloove & Lambinon (2006). Taking in consideration the new species from Sukhorukov (2012) and three additional species described and combined here, the number of known *Dysphania* species is now 47.

No further phylogenetic division of *Dysphania* has been proposed so far. However, on a morphological basis, the aromatic *Chenopodium* species, now belonging to *Dysphania*, have been divided into several sections (e.g. Aellen 1960; Mosyakin 1996). The native Asiatic species belong to *D.* sect. *Botryoides* (C. A. Mey.) Mosyakin & Clemants; excluded are *D. ambrosioides* (L.) Mosyakin & Clemants (*D.* sect. *Adenois* (Moq.) Mosyakin & Clemants), originally an American species but naturalized and

1 Botany Unit, Finnish Museum of Natural History, University of Helsinki, P.O. Box 7, FI-00014 University of Helsinki, Finland; e-mail: pertti.uotila@helsinki.fi

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widespread in southern parts of Asia, and members of the Australian *D.* sect. *Orthosporum* (R. Br.) Mosyakin & Clemants: *D. pumilio* (R. Br.) Mosyakin & Clemants (Ramayya & Rajagopal 1969, as *C. pumilio* R. Br.) and *D. truncata* (Paul G. Wilson) Mosyakin & Clemants (Ravi & Anilkumar 1990, as *C. truncatum* Paul G. Wilson), found as aliens in India. *Dysphania* sect. *Botryoides* includes one widespread species from the western half of Asia to Europe and North Africa and naturalized in North America (*D. botrys* (L.) Mosyakin & Clemants), two species from the Himalaya and China (*D. nepalensis* (Colla) Mosyakin & Clemants, *D. bhutanica* Sukhor.), two from East Africa and the Arabian Peninsula (*D. schraderiana* (Schult.) Mosyakin & Clemants, *D. procera* (Hochst. ex Moq.) Mosyakin & Clemants), one from South Africa (*D. pseudomultiflora* (Murr) Verloove & Lambinon), two from North America (*D. dissecta* (Moq.) Mosyakin & Clemants, *D. graveolens* (Willd.) Mosyakin & Clemants) and one from South America (*D. mandonii* (S. Watson) Mosyakin & Clemants). However, the group is more diverse in Asia than earlier known and altogether seven species are treated here. *Dysphania procera* from the S Arabian Peninsula to East Africa is excluded.

The taxonomic treatment of the group under *Chenopodium* has been uncritical in earlier Floras of Asia. In Central Asia in the former U.S.S.R., only *C. botrys* was recognized (e.g. Iljin & Aellen 1936; Pratov 1972). Also in the Himalaya in the past generally only one taxon was accepted and named *C. botrys* (Hooker 1890; Bamber 1916; Pampanini 1930; Stewart 1972; Bhopal & Chaudhri 1977; Mullin 1982; Long 1984; Ahmad & al. 1995; Press & al. 2000). However, already in the first half of the 1800s, two further names, *C. nepalense* and *C. multiflorum*, were used for the Himalayan member of the group, but these names were soon after their description reduced to synonomy under *C. botrys* and totally forgotten for more than a hundred years.

Difficulties in determining Himalayan plants as either *Chenopodium botrys* or *C. schraderianum* (also as *C. foetidum*) have been noted on some labels and determination slips of herbarium sheets. The late *Chenopodium* specialist Paul Aellen (1896–1973) determined in 1964 much Asiatic material in various herbaria and assigned Himalayan plants to *C. botrys*, but some of them with hesitation. Only Gupta (1989) recognized two taxa (*C. botrys* and *C. multiflorum*) from the Himalaya. Uotila revised the group for Flora Iranica (Uotila 1997) and Flora of Pakistan (Uotila 2001) and divided it into *C. botrys, C. nepalense* and *C. schraderianum*. Recently, Yonekura (2008) accepted *C. botrys* and *C. nepalense* for Nepal.

As to China, Grubov (1966), Kung & Chu (1979), Li & Ma (1983), Mao (1994), Huang (1997) and Zhu & al. (2003) were aware of two taxa. They were named as *Chenopodium botrys* and *C. foetidum*, except in the new edition of Flora of China (Zhu & al. 2003), where the names *Dysphania botrys* and *D. schraderiana* were used, although the re-establishing of *C. nepalense* by Uotila (1997, 2001) led to a comment in the Flora that actually most of the material of *D. schraderiana* might belong to *D. nepalensis*.

Chenopodium tibeticum, described in Flora Xizangica already 20 years earlier (Li & Ma 1983) and accepted by Grubov (2000), was synonymized with *Dysphania aristata* (L.) Mosyakin & Clemants (= *Teloxys aristata* L.) by Zhu & al. (2003). *Teloxys* was recently proved to be a monotypic genus in the tribe *Dysphanieae* (Kadereit & al. 2010; Fuentes-Bazan & al. 2012a; Sukhorukov & Zhang 2013), widespread in Central Asia and China, and it is not treated here.

Material

When preparing the accounts of *Chenopodium* for Flora Iranica (Uotila 1997) and Flora of Pakistan (Uotila 2001), specimens from SW Asia, Central Asia, the Himalaya and China were revised from the following herbaria: B, BM, C, E, FI, G, G-BOISS, G-DC, H, K, KUH, LD, LE, LG, M, NEU, OXF, PI, S, W and WU; later also specimens from BP, FRU, KAS, MHA, MW, PR, herb. Klimeš (PRA) and herb. Miehe (Marburg) were studied. Early in 2000 Leos Klimeš from Třeboň (Czech Republic) sent several tiny plants for identification, and two unknown species, considerably different from each other and from all *Chenopodium* (s.lat.), were recognized from them. In 2012 the rich material collected by Klimeš in 1999–2005 from Ladakh Province in Jammu and Kashmir, India, was studied. His specimens of *Chenopodium* (s.lat.) were very well determined, and the two unknown taxa were provided with the names *C. himalaicum* ined. and *C. tibeticum* A. J. Li. Sadly, Klimeš disappeared during his excursion to the area in 2007. Until now his material has been kept separate in Třeboň, but in due time it will be incorporated in PRA.

All *Dysphania* specimens seen have been provided with a revision slip (before 2012 as *Chenopodium*). The label information from the specimens was written in an Excel file and geographical coordinates were sought for the collecting localities for mapping the distributions of the species. Images available at the Chinese Virtual Herbarium (Qin & Ma) were checked, but identities often remain uncertain because the perianth characters are not visible, and those images have not been used in preparing the distribution maps.

Key to the Asiatic *Dysphania* sect. *Botryoides*

1. Branches of the inflorescence flat, with narrow opposite wings, ultimate branchlets sterile, forming short tips; flowers solitary in branch axils . 1. ***D. tibetica***
– Branches of the inflorescence ± terete (sometimes narrowly winged near axils), ultimate branchlets ending with flowers; flowers solitary in branch axils and in small fairly compact cymes 2

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2. Seeds vertical; perianth lobes / segments lanceolate; leaves narrowly elliptic to lanceolate, margin entire to sinuous . . . . . 2. ***D. himalaica***
– Seeds almost always horizontal; perianth lobes / segments narrowly ovate to broadly ovate; leaves elliptic-ovate, margin pinnatisect to pinnatifid 3
3. Perianth divided into narrowly ovate segments, back of segments hardly keeled; glandular hairs distinctly stalked with small globular pale yellow heads . . . . . 3. ***D. botrys***
– Perianth divided into ovate to broadly ovate segments or lobes, back of segments and lobes apically swollen or variously keeled; glandular hairs subsessile, heads yellow to orange 4
4. Perianth divided into lobes, with simple eglandular hairs, back of lobes evenly swollen to keeled with long narrow lobes 5
– Perianth divided into lobes or segments, without simple eglandular hairs, back of segments cristate or back of lobes with a prominent projection near apex . 6
5. Leaf blade pinnatifid, lobes ovate to semiorbicular, sinus as broad as or narrower than lobes; glands ± yellow . . . . . 4. ***D. nepalensis***
– Leaf blade pinnatisect to deeply pinnatifid, lobes narrowly oblong to lanceolate, sinus broader than lobes and often containing rounded teeth at centre; glands orange to yellowish orange . . . . . 5. ***D. bhutanica***
6. Leaf blade pinnatisect to deeply pinnatifid, lobes narrowly oblong to lanceolate; perianth divided into lobes, back of lobes with an undivided projection near apex . . . . . 6. ***D. kitiae***
– Leaf blade pinnatifid, lobes broadly entire to dentate; perianth divided into segments, back of segments cristate, with several lobes . . . . 7. ***D. schraderiana***

Taxonomy

All species of *Dysphania* sect. *Botryoides* are annuals. Due to glands they are aromatic, probably of different intensity and even of different tinge of odour, but the odour soon disappears in herbarium material and information of fresh plants is very scant.

1. *Dysphania tibetica* (A. J. Li) Uotila, **comb. nov.** ≡ *Chenopodium tibeticum* A. J. Li, Fl. Xizang. 1: 638. 1983. – Holotype: China, Xizang, Gyangze, prope vicum, 3960 m, *Qinghai-Xizang Complex Exp. 74-2077* (PE).

Illustrations — Fig. 1; Li & Ma (1983: 639, as *Chenopodium tibeticum*).

Description — *Herbs* (2–)5–10(–22) cm tall, with simple, long and curly hairs and shortly stipitate glands; *glands* pale yellow, obovate, c. 0.04 mm in diam. *Stems* erect or ascending, often red, densely hairy and with glands, only basally branched and lowermost branches subopposite (sometimes with several main stems). *Leaves* brownish; *blade* elliptic-trullate, 0.5–2 cm, as long as or longer than petiole, hairy on both surfaces, glandular only below, margin almost entire to sinuate with 1–3 shallow ± obtuse lobes on both sides, apex ± obtuse. *Bracts* smaller than leaves, narrowly obovate to spatulate, margin entire. *Inflorescence* elongate; *partial inflorescences* 0.5–1.5(–3.5) cm, slightly falcate 1-sided dichasia and monochasia; *branches* fairy stiff, flat, with 2 opposite wings, abaxial side greenish, rounded, with some hairs and glands, adaxial side with strong, elevated and whitish midrib, glabrous, margin hairy; *ultimate branchlets* dichasial, forming sterile short often somewhat hooked tips. *Flowers* solitary in axils of branches on adaxial side, sessile (without swollen receptacle). *Perianth segments* 5, free to near base but not spreading in fruit, broadly ovate, c. 0.8 × 0.6 mm, herbaceous with very narrow membranous margin widening towards apex, midrib visible on both surfaces but not prominent, back almost flat, somewhat swollen near apex, densely pubescent and with glands, apex deep red (sometimes apical part of segment deep red), obtuse to acute, hardly acuminate, often strongly backward curved at least after flowering. *Stamens* 1–5. *Stigmas* 2, c. 0.2 mm. *Fruits*

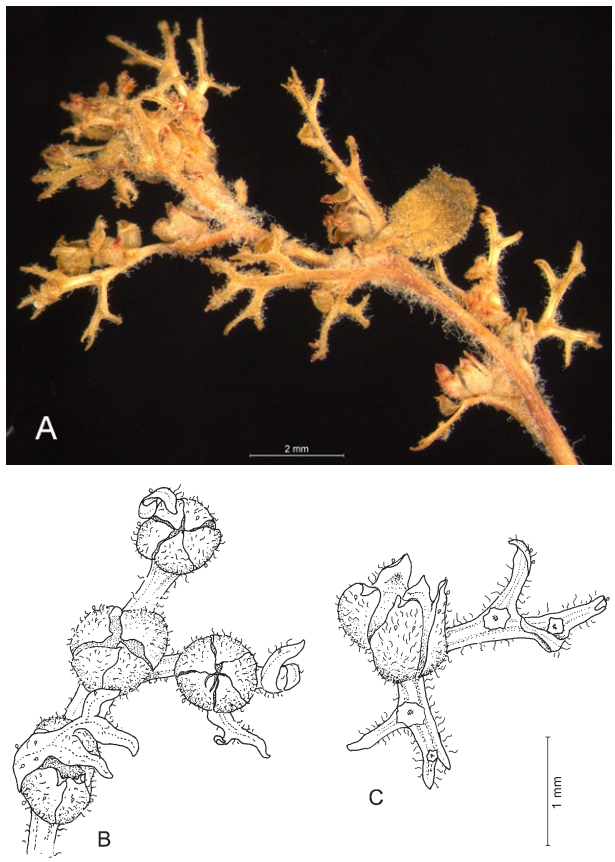


Fig. 1. *Dysphania tibetica* – A–C: parts of an inflorescence from *L. Klimeš 1741* (PRA). Note scars of fallen flowers at branch axils (C). – Photo and drawings by M. Koistinen.

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falling without perianth; *pericarp* white, thickish, fairly easily scratched from seed, papillae low. *Seeds* horizontal, rarely vertical in lowermost narrow axils, brownish black, orbicular to ovate in outline, 0.7–1.2 × 0.6–0.9 × 0.4–0.6 mm, margin obtuse to truncate, irregularly notched or keeled; *testa* lustrous, faintly pitted.

Distribution and habitats — *Dysphania tibetica* is known from three areas in Xizang, China: Gyangze Xian and Cuoqin Xian at 3900–4600 m (Li & Ma 1983) and the Upper Arun Valley, and from Ladakh in Jammu and Kashmir, India (Fig. 2). The altitude given for the specimens seen is 4020–4810 m. Further, three images (PE 00235089, PE 00235090, PE00235091) in the Chinese Virtual Herbarium (Qin & Ma) represent *D. tibetica*. The specimens were collected from sandy ground and grassland near (salty) lakes and from subalpine grassland. According to Li & Ma (1983), *D. tibetica* is known near villages and on roadsides. No ecology was given by Klimeš on his labels.

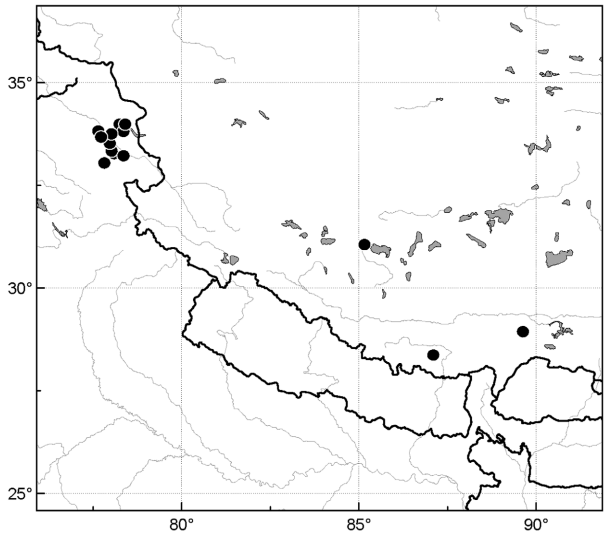


Fig. 2. Distribution of *Dysphania tibetica* based on the specimens seen and Li & Ma (1983).

Taxonomic remarks — Klimeš regarded *Chenopodium tibeticum* as a good species, despite it being synonymized with *Teloxys aristata* in Flora of China (Zhu & al. 2003). Both the description and good drawing in Li & Ma (1983) show that the species is remarkably different from *T. aristata* and also indicate that the species belongs to *Dysphania*.

Dysphania tibetica is densely hairy, with simple curly hairs. Further, it has subsessile pale yellow glandular hairs. The number of glands seems to be less than usual in *D. botrys* and *D. nepalensis*, and this is obviously the reason for its not-so-strong odour, as observed by Li & Ma (1983). On the contrary, *Teloxys aristata* bears neither glands nor simple long hairs. It is only slightly vesicular hairy, especially in basal parts of the stem and sporadically on the leaves; the vesicular hairs are tiny, shortly stipitate, and the head is membranous, without colour, elongated and collapsing early similarly to the vesicular hairs of *Chenopodium* s.str. Such hairs are absent in *Dysphania*.

The presence of sterile spinose ultimate branchlets in the inflorescence is one of the most important characters separating *Teloxys* from *Dysphania*, even though such branchlets may sometimes be absent in *Teloxys*. However, *D. tibetica* also has sterile ultimate branchlets in the inflorescence, but they differ much from those in *Teloxys*. In *D. tibetica* they are very short, of ± equal length in a dichotome, flat and sharply narrowing to the tip, which sometimes seems to end with a minute flower bud. On the contrary, the sterile ultimate branchlets in *T. aristata* are up to 5 mm long, often of markedly unequal length in a dichotome and sometimes forked, very gradually narrowing to stiff spines and terete for most of their length. They are not flat, but branches of *T. aristata* and other *Dysphania* have narrow wing-like extensions on the axis of the inflorescence near the branch axils. Also the American *D. graveolens* has sterile ultimate branchlets in the inflorescence. They are almost terete, longer than the branchlets of *D. tibetica* and end with a knot-like rudimentary flower.

Dysphania tibetica has slightly elongated seeds commonly with a truncate margin and a faintly pitted black testa; these seeds match well with other Asiatic *Dysphania* species. *Teloxys aristata* has rounded relatively flat seeds usually with an acute or even winged margin, and the testa is smooth (Sukhorukov & Zhang 2013).

The peculiarities of the inflorescence as a whole, together with dense long hairs, make *Dysphania tibetica* morphologically a quite unique member of the genus.

Specimens seen – India: Jammu and Kashmir: Ladakh: Region Indus Valley: Zhung, Chukirmo, 33°49.5'N, 77°39.1'E, 4150 m, 8 Sep 2001, *L. Klimeš 1657* (PRA); Zhung, Lato, 33°40.7'N, 77°43.8'E, 4020 m, 5 Sep 2001, *L. Klimeš 1545* (PRA); Zhung, Stagar (Sakti) to Wari La, 34°2.8'N, 77°49.3'E, 4240–4270 m, 12 Sep 2001, *L. Klimeš 1741* (PRA); Stot (E), above the Tiri village, 33°31.5'N, 77°58.6'E, 4330–4460 m, 1 Aug 2001, *L. Klimeš 1190* (PRA). Region Rupshu: Rupshu, 32°58.5'N, 77°24'E, c. 4600 m, 11 Jul 2000, code 00-10-4, *L. Klimeš* (H 1757589); Samand Rockhen, Thukje village to Nyamur, 33°20.13'N, 78°1.67'E, 4560 m, 9 Sep 2005, *L. Klimeš 6268* (PRA); Tso Moriri, Karzok to Peldo, 32°59.5'N, 78°15'E, 4550 m, 13 Sep 2005, *L. Klimeš 6309* (PRA); Tso Moriri, Lapgo River Valley, 32°58.7'N, 78°21.3'E, 4810 m, 11 Jul 2000, *L. Klimeš 6268* (PRA). China: Xizang: Tibetan Himalaya, Upper Arun Valley, N of Xegar (Tingri), 28°37'N, 87°10'E, 4400 m, 5 Oct 1989, *B. Dickoré 5919* (KAS).

2. *Dysphania himalaica* Uotila, **sp. nov.**

Holotype: India, Jammu and Kashmir, Ladakh, Region Indus Valley, Stot (E), Nyi [Nior Nis; Njurnis] to

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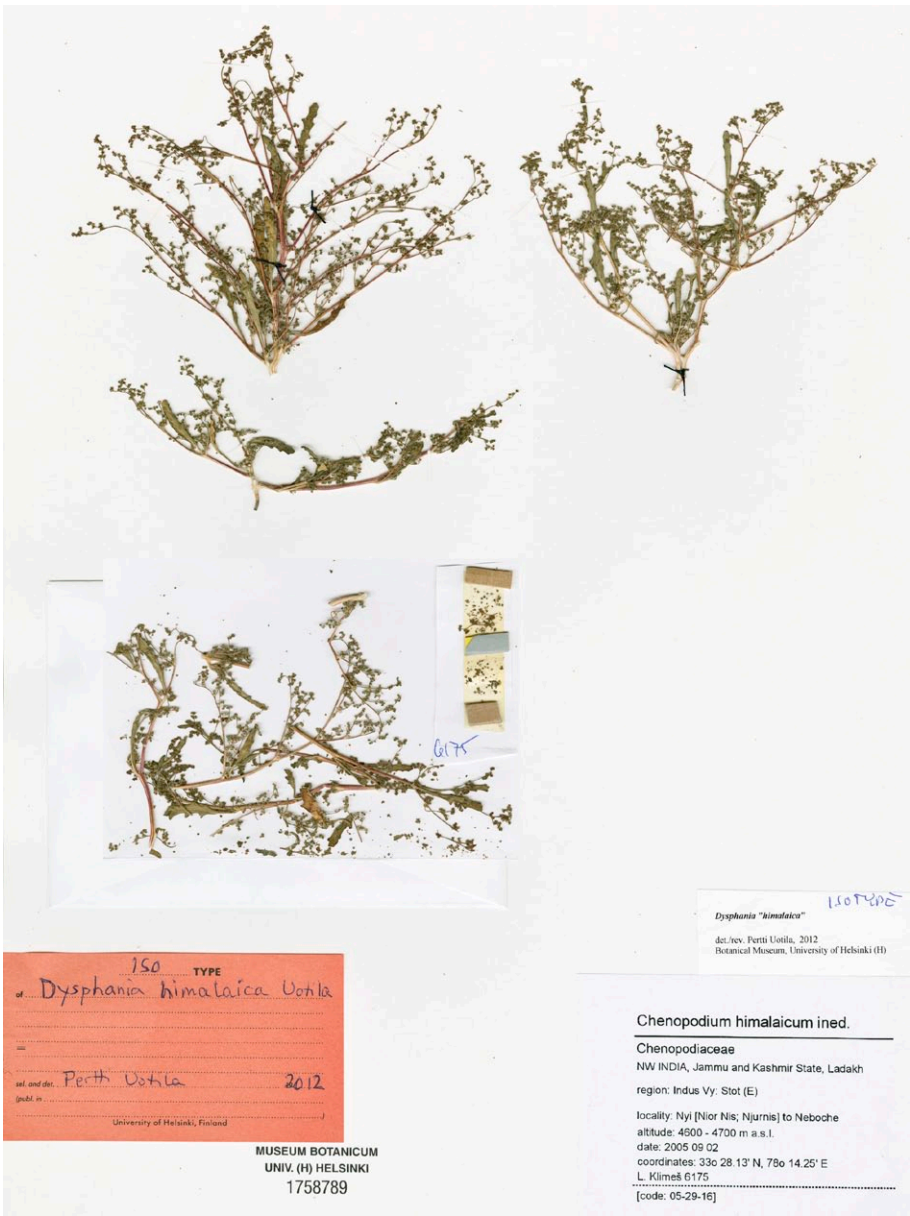


Fig. 3. Isotype of *Dysphania himalaica* – *L. Klimeš 6175* (H 1758789). – Photo by A. Taponen.

Neboche, 33°28.13'N, 78°14.25'E, 4600–4700 m, 2 Sep 2005, code 05-29-16, *L. Klimeš 6175* (PRA; isotypes: H 1758789, PRA).
– *Chenopodium himalaicum* Klimeš, in schedis.

Illustrations — Fig. 3 and 4 (illustrated here for the first time).

Description — *Herbs* (2–)5–10(–14) cm tall, sometimes turning red in fruiting stage, with long simple curly hairs and subsessile glands; *glands* pale yellow, obovate, c. 0.05 mm in diam. *Stems* erect, often red or red-striped, hairy and with few glands, much branched basally (sometimes with several main stems). *Leaves* green on both surfaces; *blade* gradually tapering into a short petiole, to 2 × 0.8 cm, narrowly elliptic to lanceolate, with glands and hairs on both surfaces, especially along midvein abaxially, margin sinuate with 2–5 shallow lobes on both sides, lobes and apex obtuse. *Inflorescence* ebracteate, elongate to length of most or whole of stem, diffuse, broad, ± thyrsoid, lax, with all branches fertile, composed of solitary flowers in branch axils, even in lowermost ones, and of more condensed groups of few flowers in ultimate parts of inflorescence. *Flowers* with 0.1–0.3 mm long stipe; *receptacle* strongly swollen. *Perianth segments* 4 or 5, persistent, at first united above middle but during maturity splitting to base, lanceolate, 1–1.2 × 0.35–0.4 mm, herbaceous, margin narrowly membranous, at maturity broadly membranous apically and basally so that only strong midrib connects segment to receptacle, back of segment swollen to somewhat keeled near apex, ± hairy and with glands especially near margin, apex long acuminate, usually strongly red and recurved at least in seed stage (sometimes major part of segment red). *Stamens* 0–5. *Stigmas* 2, 0.2–0.5 mm. *Fruits* falling without perianth; *pericarp* whitish, fairly thick, soft, easily scratched from seed, papillae low. *Seeds* vertical, brownish black, somewhat elongate in outline, 0.75–0.9 × 0.65–0.8 × 0.4–0.45 mm; margin rounded to truncate; *testa* almost smooth, faintly reticulate.

Distribution and habitats — *Dysphania himalaica* is known from India (Ladakh in Jammu and Kashmir), Nepal and China (Xizang) (Fig. 5) and is reported at altitudes of 3410–4765 m. Also two images (PE 00235087 and PE 00235088) in the Chinese Virtual Herbarium (Qin & Ma) represent *D. himalaica*. The species has been collected from various grassy habitats, pastures on lakeshore terraces, slopes with relict juniper and in groves on limestone rock. The Indian specimens bear no information on habitats.

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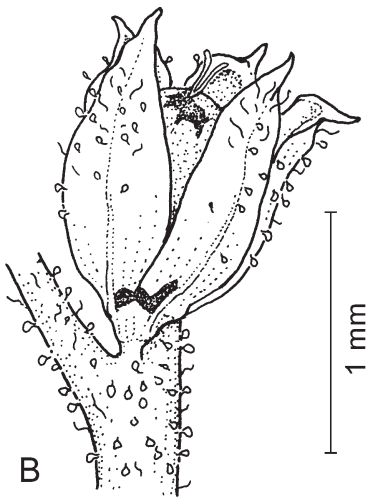


Fig. 4. *Dysphania himalaica* – A, B: parts of an inflorescence from *L. Klimeš 6175* (H 1758789). – Photo and drawing by M. Koistinen.

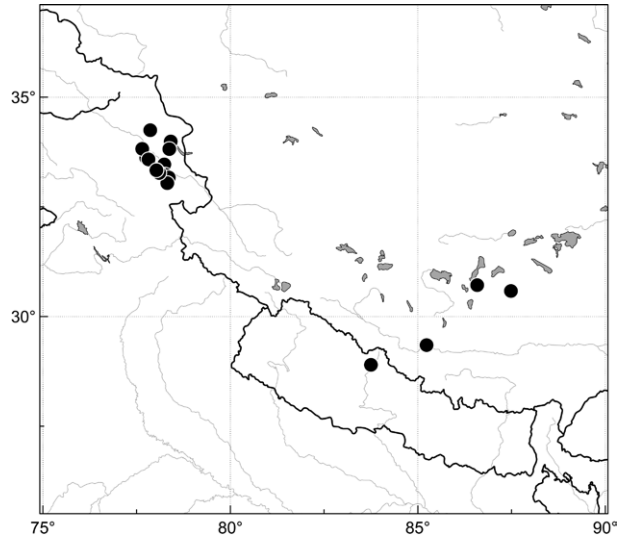


Fig. 5. Distribution of *Dysphania himalaica* based on the specimens seen.

Dysphania himalaica is the most infrequent taxon in Klimeš's material of *Dysphania*. It is often collected from the same localities as *D. nepalensis* and *D. tibetica*, but mostly from higher altitudes than those of *D. nepalensis* and especially *D. botrys*. However, they all grow more or less sympatrically in Ladakh.

Taxonomic remarks — The species does not match well with the current concept of *Dysphania* sect. *Botryodes* (see, e.g., Aellen 1960; Clemants & Mosyakin 2003). It has four or five perianth segments and vertical seeds, which are more or less unknown in the species so far included in the section. However, at least in *D. botrys* and *D. tibetica* there are sporadically vertical seeds. In other sections fewer than five perianth segments or lobes and vertical seeds are not uncommon and they seem to correlate with each other. Also in other characters (swollen receptacle, narrow perianth segments with low keel, relatively long stigma) *D. himalaica* resembles *D. botrys* more than other *Dysphania* species.

Additional specimens seen (paratypes) — India: Jammu and Kashmir: Ladakh: Region Pangong: Lukung, 33°59.5'N, 78°24.6'E, 4300 m, 9 Sep 2002, code 02-39-10, *L. Klimeš 6627* (PRA). Region Indus Valley: Zhung (Leh), Chogdo to Chukirmo, 33°49.4'N, 77°38.9'E, 4180–4310 m, 8 Sep 2001, code 01-41-10, *L. Klimeš 1627* (PRA); Zhung (Leh), Gya to Lato, 33°40.2'N, 77°43.9'E, 4060–4070 m, 5 Sep 2001, code 01-38-12, *L. Klimeš 1539* (PRA); Zhung (Leh), Kiameri La to Rumtse village along the Kyammar Lungpa, 33°35'N, 77°49'E, 4350 m, 15 Sep 1999, code 99-34-3, *L. Klimeš 830* (H, PRA); Stot (E), Angkhung village to Puga, 33°14'N, 78°16'E, 4550 m, 8 Sep 1999, code 99-27-9, *L. Klimeš 6627* (H, PRA); Stot (E), Sumdu Gonma to Kiagar La, 33°10.2'N, 78°21.5'E, 4690 m, 7 Sep 2003, code 03-26-3, *L. Klimeš 3461* (PRA). Region Shyok: W & C, Wari La to confluence of Lurten Lungpa and Lazun Lungpa, 34°14.9'N, 77°51.8'E, 3840 m, 15 Sep 2001, code 01-47-40, *L. Klimeš 1868* (PRA). Region Rupshu: Samad Rockhen, Polokongka Valley, 33°16.4'N, 78°6.1'E, 4660–4750 m, 5 Aug 2002, code 01-8-11, *L. Klimeš 1255* (PRA); Tso Moriri, Lunglung valley, 33°2.5'N, 78°18.0'E, 4700 m, 8 Sep 2003, code 03-27-5a, *L. Klimeš 3476* (PRA); Samad Rockhen, Thukje village to Nyamur, 33°20.13'N, 78°1.67'E, 4560 m, 9 Sep 2005, code 05-36-2, *L. Klimeš 6270* (PRA); Samad Rockhen, Thangmar, 33°20.4'N, 78°1.8'E, 4590 m, 5 Aug 2001, code 01-8-8, *L. Klimeš 1271* (PRA).

China: Xizang: Changthang S shore of Dangra Yum Tso, 30°43'N 86°35'E, 4590 m, 9 Sep 2003, *G. & S. Miehe 03-081-05* (KAS); Changthang S of Dangra Yum Tso, Targo River S of Targo Shang, 30°35'N, 86°89'E, 4765 m, 10 Sep 2003, *G. & S. Miehe 03-089-01* (KAS); Saga Dzong, Upper Yarlug Tsangpo, 29°21'N, 85°14'E, 28 Aug 2003, *G. & S. Miehe 03-043-23* (KAS); Tibetan Himalaya, Upper Arun Valley, N of Xegar (Tingri),

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28°37'N, 87°10'E, 5 Oct 1989, *B. Dickoré 5919* (KAS). Nepal: Mustang Province: Chalungpa, Lower Jeula Forest, 28°54'N, 83°45'E, 3410 m, 8 Sep 2001, *G. Miehe & al. 01-119-03* (KAS).

3. *Dysphania botrys* (L.) Mosyakin & Clemants in Ukrayins'k. Bot. Zhurn. 59: 383. 2002 ≡ *Chenopodium botrys* L., Sp. Pl.: 219. 1753. ≡ *Teloxys botrys* (L.) W. A. Weber in Phytologia 58: 477. 1985. – Lectotype (designated by Jafri & Rateeb in Jafri & El Gadi, Fl. Libya 58: 13. 1978): Herb. Linn. No. 313.12 (LINN!).

Illustrations — Mao (1995: t. 8, fig. 3–5); Uotila (1997: t. 23); Zhu & al. (2003: fig. 307, 4–5).

Description — *Herbs* 5–40(–80) cm tall, somewhat sticky, densely hairy, some hairs simple and eglandular, most hairs glandular, stalked; *glands* pale yellow, often obovoid, as long as stalk, 0.02–0.04 mm in diam., early collapsing. *Stems* erect, green-striped to yellow, with simple and glandular hairs, usually with several ascending branches, mainly at middle of stem, sometimes longer than main axis. *Leaves* dull green, somewhat glaucous, rarely reddish, usually densely pubescent on both surfaces; *blade* elliptic to ovate in outline, 1–7 cm, longer than petiole, base shortly attenuate to subcordate, margin pinnatifid with 2–5 broad lobes and several teeth on each side, apex obtuse; *lower leaves* sometimes repand. *Bracts* small, margin pinnatifid to dentate. *Inflorescence* mostly terminal and ebracteate, elongate, composed of solitary flowers in branch axils of dichotomies and of more dense small dichasial cymes; *main axis* to 5 cm wide. *Flowers* with c. 0.1 mm long stipe; *receptacle* somewhat swollen. *Perianth segments* 5, free to and often not contiguous at base, fairly persistent, often whitish in fruit, elliptic to ovate, c. 1 × 0.5 mm, herbaceous, midrib strong, back rounded to weakly keeled, densely covered with stalked glandular hairs, margin membranous, apex acuminate. *Stamens* 1–5. *Stigmas* 2, 0.5–0.7 mm. *Fruit* falling without perianth; *pericarp* fairly thin, easily scratched from seed, papillae low. *Seeds* horizontal, some vertical especially in lower parts, black, orbicular in outline, 0.6–0.8 × c. 0.5 mm, margin rounded, often truncate in part; *testa* almost smooth.

Distribution and habitats — *Dysphania botrys* is a Mediterranean and Irano-Turanian species, spread over a wide area from Mediterranean Europe to Ukraine and S Russia, Anatolia, the Near East and the Caucasus (Uotila 2011), and to W and N Iran, Afghanistan, W and N mountainous Pakistan and NW India (Jammu and Kashmir and Himachal Pradesh) and, according to Li & Ma (1983), to SW China (Zanda County, the southwesternmost part of Xizang). In Central Asia its area consists of Turkmenistan (Kopet Dagh), E Uzbekistan, Tajikistan, Kyrgyzstan, and E Kazakhstan, and continues to NW China (Xinjiang, mostly the foothills and mountains of the Tian Shan; Grubov 1966; Mao 1994), and the southwesternmost parts of Mongolia (Mongolian Altai s.lat.; Grubov 1966; Gubanov 1996); Fig. 6. In Central Asia the growing altitude is mostly between 700 m and 2500 m. The patchy distribution in Fig. 6 is in part due to uneven collecting, but also shows that the species avoids all the driest regions of the area. *Dysphania botrys* is introduced and naturalized in most of C Europe and Mediterranean Africa (Uotila 2011), North America and S Africa. It is mentioned as alien from one locality in S Siberia (Lomonosova 1992, 2012) and from a few localities in the Vladivostok Region (Ignatov 1988); and as cultivated it is collected from E China (Shanghai, Gardens of Zi-ka-Wei, 1861, herb. Léveillé, E). Probably part of the northern finds in Central Asia also represent originally introduced occurrences.

Dysphania botrys is sympatric with *D. nepalensis* in a fairly limited area in the W Pamir, Karakoram and W Himalaya, in NE Afghanistan, Tajikistan, N Pakistan, N India and probably in SW China. In the Himalaya and adjacent areas it grows at altitudes between 1200 m and 4000 m, and in the sympatric area often at lower altitudes than *D. nepalense*. Kilmeš's specimens from Ladakh are from 3010–4000 m (*D. botrys*) and 2780–4700 m (*D. nepalensis*). Klimeš (Klimeš & Dickoré 2005) studied the flora of Lower Ladakh (c. 3000–3500 m) and found *D. botrys* in 24 of the 43 studied localities and *D. nepalensis* in only seven of the localities (in part the same localities as *D. botrys*). This also reflects difference in their altitudinal preferences.

The habitats of the two species are also different according to Klimeš & Dickoré (2005). *Dysphania botrys* was mentioned as a weed from fields, roadsides and river sands, and from more natural habitats, such as sandy grasslands, dry river-bed gravels and (as rare) deserts; whereas *D. nepalensis* was found as a weed in potato fields and along irrigation canals. In general, *D. botrys* grows in many kinds of disturbed habitats, usually open, gravelly and dry, either natural habitats such as semideserts, salt-lake shores, dry riverbeds, rock screes, grassland vegetation and sparse shrubberies, or man-made habitats such as roadsides, villages, field margins and waste lands.

Taxonomic remarks — *Dysphania botrys* is morphologically fairly uniform in its area. All of the chromosome counts (see Grozeva & Cvetanova 2013), including those from from Afghanistan (Podlech & Dieterle 1969; Uotila 1973) and Mongolia (Lomonosova & al. 2003), give a diploid number, $2n = 18$ (as *Chenopodium botrys*). The identity of "*C. botrys*" from Kashmir, Pahalgam, reported to have $2n = 18$ by Mehra & Malik (1963), has not been checked.

Selected specimens seen — Iran, Afghanistan: see Uotila (1997).
Pakistan: see Uotila (2001).

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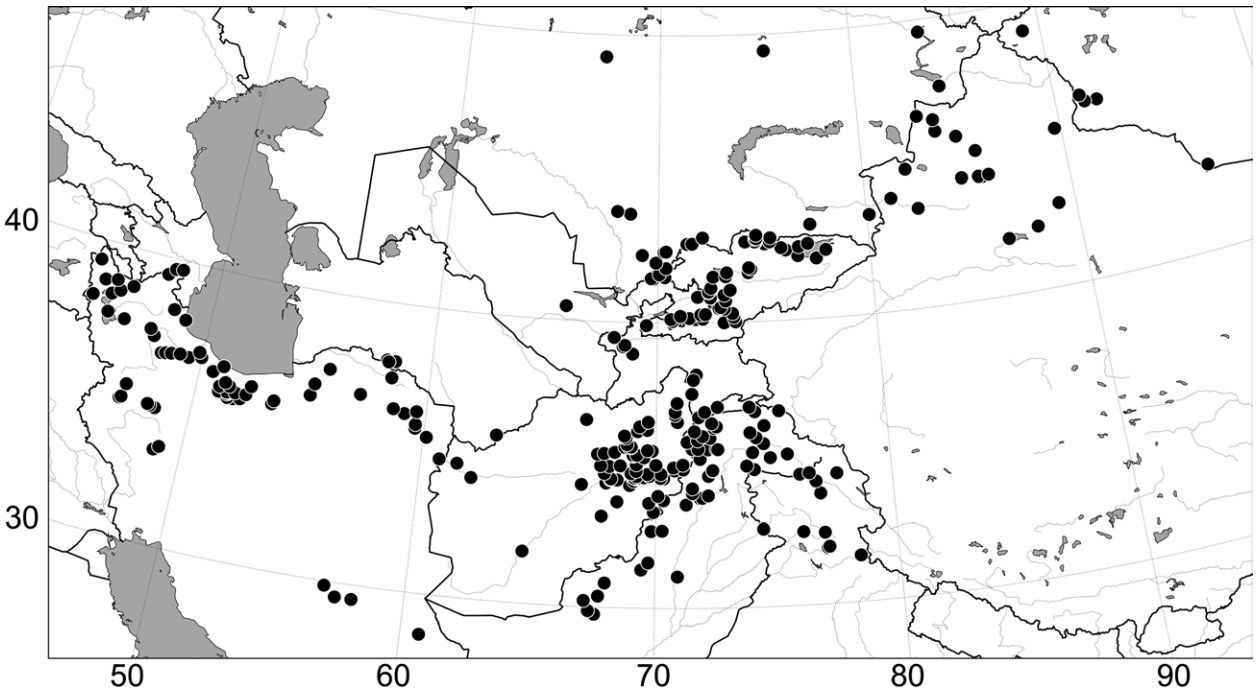


Fig. 6. Distribution of *Dysphania botrys* in Asia (excluding the territories south and west of the Flora Iranica area) based on the specimens seen.

India: Himachal Pradesh: Simla distr., Urni-Chim, 9 Jul 1940, *M. R. Abbi 2849* (G); Lahul, Gondla, 10 300 ft, 2/8 Jul 1938, *N. L. Bor 12439* (E, K); British Lahul, Chandrabhaga Valley, 10 000–11 000 ft, 30 Mar 1920, *L. Shiv Ram Kashyap 67* (K). — Jammu and Kashmir: Kargil, Ladakh, 27 Jul 1933, *W. Koelz 6133* (G, S); Kuri and Changrezing, 11 000–12 000 ft, 1884, *Stoliczka* (K); Region Indus Valley, Zhung (Leh), Ganglas – upper part, springs, 34°12.3'N, 77°36.8'E, 3880–4000 m, 30 Jun 2001, *L. Klimeš 1160* (PRA); Region Zanskar, S of Padum, Pibiting to Karsha, 33°30.3'N, 76°54.0'E, 3530 m, 2 Sep 2003, *L. Klimeš 3442* (PRA).

Tajikistan: Pamir, Hissar Range, Ravine of Varzob River 30 km N of Dushanbe, 12 Aug 1982, *I. A. Gubanov 571* (MW); Pamir, 10 km situ australi ab oppido Dushanbe, apud flumen Kafirnigan, 38°26'N, 68°46'E, 800 m, 25 May 1974, *V. Vašák* (PR 374433); West Pamir, Bartand River near Shujand Village, 2000 m, 5 Jul 1983, *G. M. Poskuariakova & al.* (MHA); West Pamir, vicinity of Horog Town, 2300 m, 18 Jul 1992, *T. Konovalova & N. Shevyreva* (MHA); Vakhan – Ishkishimskii distr., Shitkhar, 36°51'N, 72°6.4'E, Aug 1935, *P. N. Ovczinnikov & K. S. Afanassjev 1650* (LE).

Turkmenistan: Ashabad, ad Mekrowa, 12 May 1900, *P. Sintenis 285* (B, LD, S); Firuza, Firunzinka River, 22 Jun 1942, *V. Alekhin* (MW).

Uzbekistan: Nurata, Chiya village, 15 Jul 1932, *O. Knorring & L. Emme* (MW); Balykchi, 28 Apr 1878, *A. Kuschakewitsch* (LE); Tian-shan, apud flumen Akhangaran in vicinitate pagi Karakhtai, 40°53'N, 69°43'E, 600 m, 6 Jul 1973, *V. Vašák* (PR 374427I); Tian-shan, montes Keksuiski khrebet, in vicinitate pagi Brichmulla, 41°36'N, 70°6'E, 1600–1900 m, 11 Jul 1973, *V. Vašák* (PR 374430); Tian-shan, montes Ugamski khrebet, in vicinitate pagi Khumsan, in valle fluminis Ugam, 41°49'N, 69°56'E, 1000–1200 m, 10 Jul 1973, *V. Vašák* (PR 374437, PR 374438).

Kyrgyzstan: Alay Range, left side of Taldyk River between Mady and Langar, 9 Jul 1930, *S. V. Juzepczuk 141* (LE); Prope Gulcza, ad fl. Gulcza, 1 Jun 1900, *W. Tranzschel* (LE); Toktogul Distr., northernmost end of Fergana Ala-Too, roadside along Kara-Suu River, 1050 m, 41.656°N, 72.833°E, 28 Jul 2009, *P. Uotila 47502* (H 1746707); Ala-Buka Distr., Chatkal Range (S slope), Kasan-Say River, west side of a nameless north-side tributary, 600 m from the main river, 1750 m, 41.4979°N, 71.0434°E, 3 Aug 2009, *P. Uotila 47700* (H 1747544); Teskey Ala-Too, Tosor, shore of Ysyk-Köl Lake, 27 Aug 1969, *Z. Arbaeva & al*. (FRU, H).

Kazakhstan: Promontorii Alatau austro-occidentalis in jugi Alatau Transiliensis, in fluxu inferiore fl. Kyzyl-Saj (systema fl. Czu), 11 Jun 1963, *V. Goloskokov 1480* (BP 497406, H, LE, S); Distr. Chimkent, in vicinitate pagi Saryagach, apud rivum Keles, 49°32'N, 69°17'E, 450 m, 4 Jul 1973, *V. Vašák* (PR 374425); Karatau, Uch-Uzen, 1 Jun 1930, *S. Lipschitz 396* (MW); Taldy-Kurgan distr., 4 km W Basshiy, plains S of Altyn Emel' Range, 44°10'N, 78°44'E, 1000 m, 7 Sep 1992 *H. Freitag & S. Rilke 26151* (KAS); Songaria, Lacum Saisang-Nor [c. 47°37'N, 84°21'E, no date or collector given] (E, UPS); Ketmen Range, between Dardamty and Shunkar, 18 Sep 1931, *L. Rodin* (MW): Semipalatinsk distr., S part, near

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the village Taubinka by the river Tchar-Gurban, May 1914, *N. Schipczinsky 1069* (S).
China: Xinjiang: Kashgar, SE Tien Shan in Karashar, near Chokur village, 28 Aug 1929, *M. G. Popov 620* (LE); Barotala, 2000–3000 ft, 21 Aug 1878, *A. Regel* (LE); Kuldscha, 15 Jul 1877, *A. Regel* (LE); Balkh.-Alak, Emel River, S of Chuguchak town, 10 Jul 1947, *E. M. Shumakov* (LE); Chuguchak, 10 Aug [1840], *Schrenk* (LE).
Mongolia: Mongolian Altay: Khara-Dzarga Range, valley of Shutyn Gol River, 28 Aug 1939, *E. G. Pobedimova 442* (LE); Bulugun River, at mouth of Ulyaste-Gol, 20 Jul 1947, *A. A. Yunatov 13055* (LE); Bodochin Gol, 25 Sep 1948, *V. I. Grubov 5141* (LE).

4. *Dysphania nepalensis* (Colla) Mosyakin & Clemants in J. Bot. Res. Inst. Texas 2: 428. 2008 ≡ *Chenopodium nepalense* Colla, Herb. Pedemont. 5: 25. 1836. – Holotype: "Ex Hb. Berol." [ex herbario berolinensi] in herb. Colla (TO 5972, photo in Sukhorukov 2012: fig. 2).
= *Chenopodium multiflorum* Moq. in Candolle, Prodr. 13(2): 75. 1849. – Lectotype (designated by Sukhorukov 2012): Garhwal, Jun 1845, *I. Thomson 1324* (K!; isolectotypes: BM!, G [herb. Aellen 10324, fragment!]).
= *Chenopodium foetidum* subsp. *tibetanum* Murr in Bull. Herb. Boiss., ser. 2, 4: 990. 1904, nom. inval. (Art. 38.1(a), no description, only an illustration of a leaf).
– *Chenopodium foetidum* auct. [non Lam. 1779 nec Schrad. 1808].
– *Dysphania schraderiana* sensu Zhu & al. (2003: 377) [non (Schult.) Mosyakin & Clemants 2002: 383].
– *Teloxys foetida* sensu Kitag., Rep. First Sci. Exp. Manchoukuo 4(4): 80. 1936.

Illustrations — Gupta (1989: cxliii, as *Chenopodium botrys*); Kung & Chu (1979: t. 15, fig. 1–3, as *C. foetidum*); Huang (1997: t. 49, fig. 9–13, as *C. foetidum*); Uotila (1997: t. 23, 24); Zhu & al. (2003: fig. 307, 1–3, as *Dysphania schraderiana*).

Description — *Herbs* 3–70 cm tall, with simple hairs and subsessile glands; *glands* yellow, ± globose, 0.04–0.07 mm in diam. *Stems* erect, green-striped to yellow, densely hairy, with few glands in younger parts; *branches* numerous, mainly at middle of stem, usually shorter than main axis, diffusely spreading to erect-spreading. *Leaves* yellowish to pure green, sometimes slightly glaucous, with hairs and glands on both surfaces; *blade* (narrowly)elliptic to ovate, 1–7 cm, longer than petiole, margin pinnatifid with 2–5 lobes on each side; *lobes* broad, margin entire or with few rounded teeth, sinus as broad as or narrower than lobes, apex fairly obtuse. *Bracts* narrowly elliptic to narrowly obovate, margin less lobed to entire in sequence up stem. *Inflorescence* mostly terminal, elongate to diffuse thyrsoid, to 10(–20) cm wide, with slightly falcate main branches, lax, composed of solitary flowers in axils and of small compound dichasial to monochasial cymes. *Flowers* sessile; *receptacle* not distinctly swollen. *Perianth lobes* 5, free usually to halfway, sometimes more, fairly persistent, broadly ovate, 0.8–1 mm, herbaceous with ± narrow membranous margin, midvein fairly strong, back swollen in apical part, often with several c. 0.2 mm long narrow lobes, ± pubescent but glands absent or sparse, margin glandular, apex acute to acuminate. *Stamens* 1–5. *Stigmas* 2, 0.2–0.5 mm. *Fruits* mostly falling without perianth; *pericarp* thin, fairly easily removable from seed, papillae often fairly high. *Seeds* horizontal, brownish black, orbicular in outline, 0.6–0.8 × c. 0.5 mm; margin obtuse to truncate, irregularly notched or keeled; *testa* almost smooth.

Distribution and habitats — *Dysphania nepalensis* is widely distributed in the Himalaya and highland China. The western limit of its area is in the Pamir (Wakhan area in Afghanistan and Tajikistan) and in the NE Hindu Kush (Konar in Afghanistan). It seems to be common in N Pakistan, NW India (Himachal Pradesh, Uttarkhand and Jammu and Kashmir), Nepal and Bhutan. From China much material has been seen from Xizang and Yunnan; many specimens are also from Gansu, Shanxi and Hebei, and several from Xinjiang, Qinghai, Shaanxi and Sichuan (Fig. 7). Judging from the images in the Chinese Virtual Herbarium (Qin & Ma) it is more common and widespread in China. Herbarium specimens have been commonly collected from 2500–3300 m, in some cases down to at least 1200 m (India) and up to 4660 (Xizang) and 4700 m (Ladakh); also Klimeš collected specimens at 2780–4700 m. In Ladakh it grows with *D. himalaica* and *D. tibetica*, and less often with *D. botrys*. In India it seems to be more common than *D. botrys*. The specimen *Lung Hua* 789 (G-PAE!), cited as *Chenopodium botrys* by Walker (1941), belongs to *D. nepalensis*.

Habitats include subalpine juniper scrub, grasslands, river banks, canal sides, pastures, fields, ruderal places, waste places, roadsides and paths, often on loamy or alluvial soil. In general, the ecology is fairly similar to that of *Dysphania botrys*. Perhaps *D. nepalensis* prefers somewhat moister and more nutrient-rich places, but the information on labels is too scarce and superficial for proper conclusions.

There are at least two old specimens of introduced *Dysphania nepalensis* from Europe: Austria, Wien, Tivoligasse, edge of pavement, 1937, *E. Korb* (W; as *Chenopodium botrys*), and Germany, Mannheim, harbour, no date, *R. Baschant* (W; as *C. foetidum*). No recent collections of *D. nepalensis* from Europaean botanical gardens have been seen, but in the 1820s plants with the same Berlin origin as the holotype specimen were apparently cultivated in several botanic gardens; specimens referring to this are at least in G-DC, H (from Nikita Botanical Garden, Crimea, Ukraine), LE (from Tartu Botanical Garden, Estonia), NEU, OXF and PI.

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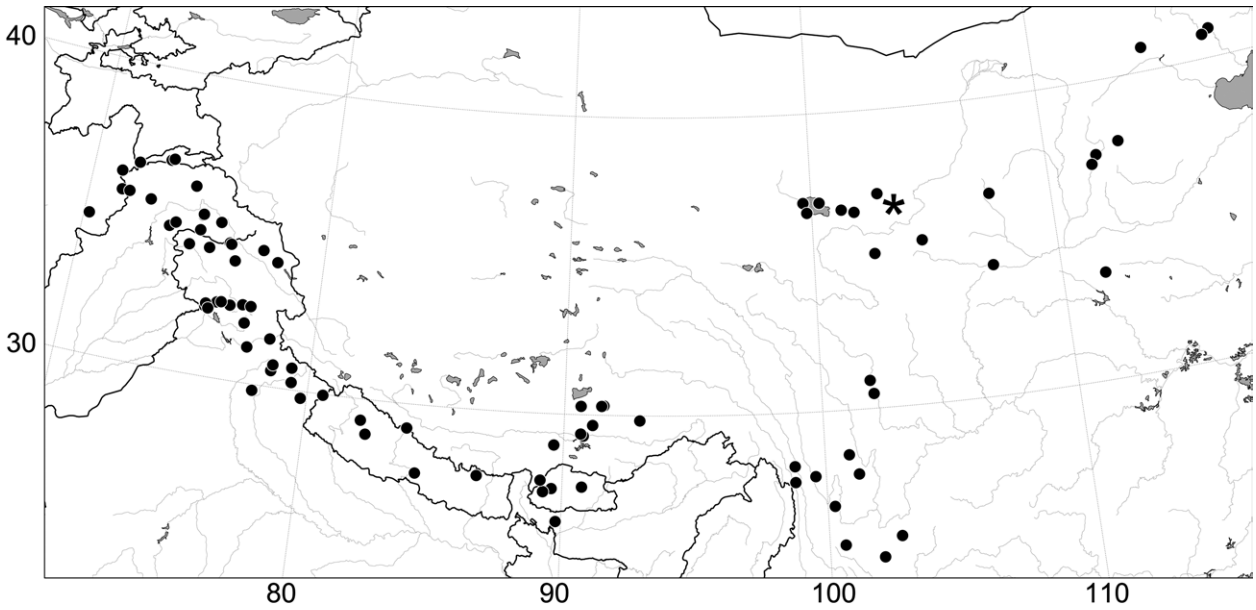


Fig. 7. Distribution of *Dysphania nepalensis* based on the specimens seen (dots). Location of the holotype specimen of *Dysphania kitiae* (asterisk).

Taxonomic remarks — High mountain plants, for instance the material collected by Klimeš and Miehe from 2230–4530 m, are very small in size, only 1–3 cm and with one or few flowers, and without checking flower characters easily confused with *Dysphania himalaica* or *D. tibetica*. Sometimes, in particular in Qinghai and Gansu, leaves of *D. nepalensis* have numerous quite regular and entire lobes. The inflorescence varies from relatively narrow and spiciform to more than 15 cm broad dichasial panicles. Diffuse inflorescences are to some extent correlated with relatively shallowly lobed leaves and they are fairly common, especially in higher areas. Such variation exists also in *D. botrys*, and its taxonomic importance is limited. Variation in perianth characters involves both hairiness and the shape of the keel, which may be narrow with several prominent hairs, or broader with only few weak hairs. The pericarp is sometimes densely glandular. The great variation in leaf shape and inflorescence – even after *D. bhutanica* was separated – and in shape and hairiness of perianth lobes in *D. nepalensis* may indicate its heterogeneity.

The chromosome number of *Dysphania nepalensis* is not known.

Selected specimens seen — Afghanistan: see Uotila (1997). — Pakistan: see Uotila (2001).

Tajikistan: Buchara Province, Wakhan, in valle fl. Pamir pr. castellum Langar-gischt, 9900 ft, 27 Jul 1901, *Alexeenko* (LE).

India: Jammu and Kashmir: Region Indus Valley: Zhung (Leh), Sasoma, 33°38.3'N, 77°44.6'E, 4130–4150 m, 5 Sep 2001, *L. Klimeš 1580* (PRA); Domkhar – Dha, 34°36'N, 76°31'E, 2780 m, 31 Aug 2002, *L. Klimeš 2561* (PRA; Klimeš & Dickoré 2005); Stot (E), Tugla, 33°44.8'N, 77°59.8'E, 3900 m, 27 Sep 2003, *L. Klimeš 3630* (PRA). Region Zanskar: Zara, Sorra village, 33°35'N, 77°29'E, 4310 m, 22 Aug 1998, *L. Klimeš 123* (PRA). Region Rupshu: Tso Moriri, Lunglung valley, 33°2.5'N, 78°19.0'E, 4700 m, 8 Sep 2003, *L. Klimeš 3477* (PRA); Tso Moriri, Karzok, NE, 32°58.23'N, 78°16.05'E, 4550 m, 14 Sep 2005, *L. Klimeš 6334* (PRA). Region Shyok: central part, Diskit, 34°32.77'N, 77°33.47'E, 3170 m, 27 Sep 2004, *L. Klimeš 5077* (PRA); upper Shyok, V4, 1000–1300 ft, *T. Thomson* (E). Kashmir, Ladakh, Marsho, 10–11 Aug 1933, *W. Koelz 6374* (G, S); Kashmir, Dalhousie, 5000 ft, 20 Sep 1874, *C. B. Clarke 22776* (FI), *22781A* (BM) & *22850A* (LE); Kashmir, drained lake basin of Kashmir, environs of Srinagger, in a circle 8 miles radius, Aug–Sep 1856, *Schlagintweit 4413* (BM, E); Kashmir, Kargil, *Stoliczka* (K). — Himachal Pradesh: Lahul, Kyelang, 10 200 ft, 12 Jul 1941, *N. L. Bor 15206* & *15208* (K); Simla, 6000–7000 ft, 1844, *M. P. Edgeworth 57* (K, OXF); Simla, Ushan valley, 6900 ft, 9 Sep 1888, *G. Watt 9376* (E); near Sinjoli, Mahasu Rd, Simla, 7300 ft, 1877, *Gamble 4631A* (G, K). — Punjab: Matiana, 1885, *J. R. Drummond 26474* (E, G, K); Kilar Pangi, Chamba State, 8300 ft, 13 Sep 1898, *J. J. Lace 1860* (B, E). — Punjab/Himachal Pradesh: Pentapotamiea, Gurdaspur versus Dunera, 1880, *J. R. Drummond 1420* (G, K). — Uttarkhand: Tehri-Garhwal, Jairglo in Ganges Valley [Janglot], 8000–9000 ft, 1 Aug 1883, *J. F. Duthie 352* (BM); Tehri-Garhwal, near Maneri, 26 Aug 1952, *P. P. Huggins A6* (BM); Garhwal, Badhrinath, 10 000 ft, *R. Strachey & J. E. Winterbottom 1* (BR, K, LE); Manglaur, Seorai, 5000 ft, 30 Oct 1916, *R. E. Cooper 5912* (E); Kumaun, Dhauli valley, 11 000 ft, 4 Aug 1886, *J. F. Duthie 5915* (K); Almora Distr., 9 Oct 1950, *D. D. Arasthi 1902* (B).

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Nepal: Khumbu, Paugroche, 3900–4000 m, 9 Oct 1962, *J. Poelt* (M); Uthu, E of Jumla, 8000 ft, 31 Jul 1952, *O. Polunin & al. 4970* (BM, E, LE); Mustang, 13 000 ft, 3 Aug 1954, *Stainton & al. 2165* (BM); Tegar (N of Mustang), 13 000 ft, 6 Aug 1954, *Stainton & al. 2248* (BM, G, LE); Tingri, Jul 1921, *A. F. R. Wollaston 266* (K); Marsyandi valley, the way between Pisang and Ongre, 3200 m, 25 Sep 1969, *T. Wraber 399* (BM, LJU 36508). Bhutan: above Umtsako/Masakang Chu, 28°5'N, 89°44'E, 4000 m, 14 Aug 2000, *G. & S. Miehe 00-283-35* (KAS); Haa distr., Ha, 2700 m, 26 Jul 1991, *C. Parker 7066* (E); Ha, 2797 m, 18 Jun 1971, *R. Bedi 162* (K); Bumthang distr., Bumthang, 2600 m, 9 Aug 1991, *C. Parker 7118* (E); Upper Mo chu distr., Gangyvel Chu below Gangyvel, 3820 m, 27 Sep 1984, *I. W. J. Sinclair & D. G. Long 5364* (E). China: Xizang: Tsang, Plaine of Gyangtse and surrounding mounts, 4000–5100 m, Jul–Aug 1937, *F. Marainі 247* (FI); Gyangtse, Phari, 4 Jul 1905, *H. J. Walton 117* (K); Thibet Oriental, Tongolo (Principauté de Kiala), 1893, *J.-A. Soulié 671* (G, K, L 73173); Docken, 14 000 ft, 7 Aug 1936, *F. Spencer Chapman 890* (K); Chusul, 11 500 ft, 21 Aug 1936, *F. Spencer Chapman 105* (K); 3/4 miles W of Polata, 11 800 ft, 29 Sep 1936, *F. Spencer Chapman 105* (K); Lhasa, 12 000 ft, 20 Sep 1904, *L. A. Waddell* (K); Vicinity of Lhasa, Jul 1839, *H. E. Richardson 288* (BM); E of Reting Monastery, 30°19'N, 91°31'E, 4270 m, 2 Sep 2010, *G. & S. Miehe 10-27-03* (herb. Miehe); side valley of S Nyalam below Koya, 28°22'N, 86°2'E, 4460 m, 24 Aug 1999, *G. Miehe & al. 99-150-28* (KAS); Tibetan Himalaya, Upper Arun Valley, N of Xegar (Tingri), 38°37'N, 87°10'E, 4400 m, 5 Oct 1989, *B. Dickoré 5922* (KAS); SE Tibet, upper Kyi Chu basin, S of Damxung, 30°22'N, 90°54'E, 4350 m, 7 Sep 1995, *G. & S. Miehe 95-39-12* (KAS). — Yunnan: NW Yunnan, Deqin County; W of Deqin near Marbating, 28°33'N, 98°47'E, 2230 m, 16 Sep 1995, *D. Chamberlain & al. FED 275*) (H); near hot springs Nada village, NE of Zhongdian, 2260 m, 27 Sep 1990, *CLD-90 324* (K); NW Yunnan, 27°20'[N], along base of E flank of the Lijiang Range, 9000–10 000 ft, Oct 1906, *G. Forrest 3090* (E); Mekong valley, 27°40'[N], 7000 ft, Aug 1914, *G. Forrest 13097* (E); Mekong valley, 28°12'[N], 6000 ft, Sep 1917, *G. Forrest 14875* (E); Plaine de Tong tchouan, 2500 m, Sep 1912, *E. E. Maire* (E, G); Prope Lijiang, 2800 m, Sep 1914, *C. Schneider 2904* (G, K); Chungtien, Haba, 2500 m, 25 Nov 1937, *T. T. Yü 14976* (BM, E). — Sichuan: Muli, Wachan, near Lamasery, 3100 m, 3 Oct 1937, *T. T. Yü 14419* (BM); Muli, Guhtzun, 3100 m, 4 Oct 1937, *T. T. Yü 14827* (BM, E); Muli, Wachan, Shawan, 3000 m, 11 Oct 1937, *T. T. Yü 14469* (BM); Inter flumina Yalimg et Ngannging-ho, 1500–2500 m, 15 Oct 1914, *Handel-Mazzetti* (G); Hsii-Tsing, 6900 ft, 10 Oct 1922, *H. Smith 4754* (UPS); Rumich'ango, 6500 ft, 29 Oct 1922, *H. Smith 4872* (LD, UPS). — Hebei: Chark'ar, Hsiaowutaishan [39.5111°N, 114.5910°E] to T'angchihsze [41°N, 115°E], 1550 m, 8 Sep 1930, *H. W. Kung* (K); Chili, Hsiao-wu-tai-shan, Yang-kia-ping [40°N, 115°E], 3300 ft, 12 Sep 1921, *H. Smith 691* (UPS); Po-Hua-Shan, 6 Sep 1936, *T. F. King 579* (S). — Qinghai: Xining, 2300 m, 30 Aug 1985, *Y. H. Wu 1966* (B); Xinghai, 15 Jul 2011, *G. Miehe 11-002-08* (herb. Miehe); Koko Nor near Hema He, 36°41'N, 99°48'E, 3291 m, 24 Jul 2011, *G. Miehe 11-041-20* (herb. Miehe); 4024 m, 24 Jul 2011, *G. Miehe 11-043-18* (herb. Miehe). — Gansu: vicinity of Labrang, 3000–4000 m, 1923, *Ching 789* (E, G, W); W Kansou, Sie Kia tái, 11 Aug 1918, *E. Licent 4576* (BM, K); Kansu oriental, Sikhe, 29 Sep 1885, *G. N. Potanin* (LE); Tianzhu, 37°11'N, 102°47'E, 2875 m, 4 Aug 2011, *G. Miehe, 11-076-16*, (herb. Miehe). — Shaanxi: Moai-non-san presso la citta di Pao-ki-seen, Shen-si settentr., 1899, *G. Giraldi 2858* (FI, G); Shensi, Fu-Kio, Oct 1892, *G. Giraldi 2827* (FI). — Shanxi, Shou-Yang [38°N, 113°E], 25 Aug 1929, *anon. A444* (UPS); Jiaocheng distr.: Pa-shui-ko, 5600 ft, 18 Aug 1924, *H. Smith 6915* (S, UPS); Jiexiu distr., Sunglin-miao, 2600 ft, 3 Oct 1924, *H. Smith 7899* (UPS); Sih-sien, Shik'owtze, 3 Sep 1935, *T. P. Wang 3449* (K).

5. *Dysphania bhutanica* Sukhor. in Willdenowia 42: 171. 2012. – Holotype: Bhutan, Thimphu distr., Lango, near Paro, frequent weed in apple and other crops, 2300 m, 29 Jun 1992, *C. Parker 7263* (E 00051983).

Illustrations — Sukhorukov (2012: fig. 3, 4A).

Description — *Dysphania bhutanica* is closely related to *D. nepalensis*, but differs from the latter in having narrowly and deeply lobed or dissected leaves and subsessile glands, which are intermixed orange to orange-yellow (vs. yellow in *D. nepalensis*), and papillae on the pericarp surface, which are low (vs. high in *D. nepalensis*). For further description see Sukhorukov (2012).

Distribution — Bhutan and China (E Xizang), at altitudes of 2000–3500 m (Sukhorukov 2012).

Taxonomic remarks — The specimen "*Chenopodium foetidum* f. *spicatum* f. nov." from Xizang (PE 0957618), available through the Chinese Virtual Herbarium (Qin & Ma), belongs to *Dysphania bhutanica*. *Dysphania botrys*, *D. bhutanica* and *D. nepalensis* sometimes produce more or less entire leaves especially in the upper part of the plant. In *D. bhutanica*, such leaves are longer and narrower than in other species. As to the seed anatomy, the papillae on the pericarp surface of *D. bhutanica* are low and resemble those of *D. botrys*, whereas *D. nepalensis* has longer papillae than the others (Sukhorukov 2012).

6. *Dysphania kitiae* Uotila, **sp. nov.**

Holotype: China, Gansu, Monastery Chortentan [c. 36°46'N, 103°27'E; see Fig. 7], on sunny slopes of

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mountains on clay and rich soil, 7000 ft, 1 Sep 1901, *V. F. Ladygin 596* (LE).

Illustrations — Figs. 8–10 (illustrated here for the first time).

Description — *Herbs* to 40 cm tall, with simple hairs and very shortly stipitate glands; *glands* intermixed yellowish orange and orange, globose, c. 0.1 mm in diam. *Stems* erect, green-striped to red, with narrow wings and ridges and fairly sparse hairs and glands; *branches* erect-spreading, ascending at base. *Leaves* shortly petiolate; *blade* pinnatisect to deeply interruptedly pinnatifid, to 5 × 2.5 cm; *leaflets and lobes* narrow, abaxially lighter green, later whitish, without hairs but often fairly richly with glands (Fig. 10B), adaxially dull green, sparsely hairy and at most with a few glands, margin pinnatifid to entire with a few teeth. *Bracts* smaller than leaves, lobed. *Inflorescence* elongate, of lax, terminal and axillary dichasial and monochasial cymes. *Flowers* solitary, shortly stipitate in axils of branches and at ends of ultimate branchlets; *receptacle* not swollen. *Perianth lobes* 5, free to middle, persistent, whitish inside in fruit, 1.1–1.3 × 0.5–0.6 mm, back green-purplish, glabrous, with a slightly forward-projecting triangular tooth near apex and a narrow, gradually lowering keel toward base, margin broadly membranous, without hairs but with glands, apex acute or acuminate, membranous. *Stamens* 5. *Stigmas* 2, 0.1–0.2 mm. *Fruit* falling without perianth; *pericarp* fairly thick, firmly adherent to seed, papillae very low. *Seeds* horizontal, reddish black, orbicular but somewhat irregular in outline, 0.85–1 × c. 0.6 mm, margin rounded to slightly acute; *testa* undulate, radially furrowed and irregularly pitted.

Distribution — *Dysphania kitiae* is known from Gansu, China, in two fairly nearby localities, and probably also from W Sichuan. The location of the holotype specimen is marked in Fig. 7.

Taxonomic remarks — The Wilson gathering of *D. kitiae* at BM and K was seen by P. Aellen and labelled by him "*Chenopodium hillcoatiae Aellen*; *typus*", and the fragment at G (herb. P. Aellen no. 19628) includes some sketch drawings and a very provisional description, but a formal description was never published. Aellen probably hesitated because he had not seen any other material, and Wilson's gathering was without seeds. Two more specimens, one with seeds, have since been located at LE.

The American *Dysphania graveolens* has a tooth-like projection on the apical part of the perianth segments, as in *D. kitiae*, but in other characters the two species differ much from each other. As to the seeds, *D. kitiae* deviates much from *D. botrys* and *D. nepalensis* in having seeds black and apparently harder, more like the seeds of *D. schraderiana*. *Dysphania bhutanica* and *D. kitiae* have quite similar leaf shapes and both have intermixed orange and yellow subsessile glands, but in other characters they are not similar.

Etymology — *Dysphania kitiae* is named in honour of Dr Kit Tan of Copenhagen.

Additional specimens seen (paratypes) — China: Western China [probably W Sichuan], 8500 ft, roadsides, flowers yellow, fragrant, Aug 1903, *E. H. Wilson 3711* (BM, K). — Gansu: Regio Tangut, Regio inferior sylvarum jugi a fl. Tetung versus in rupes frequens, 7500 ft, 25 Jul 1880, *N. M. Przewalski 704* (LE).

7. *Dysphania schraderiana* (Schult.) Mosyakin & Clemants in Ukrayins'k. Bot. Zhurn. 29: 383. 2002 ≡ *Chenopodium schraderianum* Schult., Syst. Veg. 6: 260. 1820 ≡ *Teloxys schraderiana* (Schult.) W. A. Weber in Phytologia 58: 478. 1985 ≡ *Chenopodium foetidum* Schrad. in Mag. Gesellsch. Naturf. Freunde Berlin 2: 79. 1808 [non Lam. 1779] ≡ *Teloxys foetida* Kitag., Rep. First Sci. Exp. Manchoukuo 4(4): 80. 1936, nom. illeg. superfl. – **Lectotype (designated here):** "*Chenopodium foetidum* Cav. (teste Bunge). Spec. culta. Herb. Schrader" [label written by a curator; plant of unknown origin, cultivated by Schrader] (LE!).

Illustrations — Uotila (1997: t. 23, 24).

Description — *Herbs* 5–50 cm tall, with simple hairs and almost sessile glands; *glands* yellow, ± globose, 0.04–0.05 mm in diam. *Stems* erect, green-striped to yellow, with sparse or dense short hairs and glands, sparingly branched at middle; *main axis* longer than branches, sometimes without branches. *Leaves* green to yellowish green; *blade* elliptic-ovate, to 8.5 cm, pinnatifid with 3–5 lobes on each side; *lobes* fairly narrow, abaxially hairy and glandular, adaxially glabrous, margin with few or no teeth. *Bracts* small, with few lobes. *Inflorescence* axillary and terminal, elongate, not more than 5 cm wide, composed of dichasial cymes, with solitary flowers in branch axils and ending in denser small cymes; *rachis* slightly winged. *Flowers* sessile; *receptacle* swollen, hard. *Perianth segments* 5, free to base, often not contiguous at base, sometimes purple, elliptic to ovate, c. 1 × 0.5 mm, herbaceous with membranous margin, back cristate, without hairs and glands, margin glandular, apex acuminate. *Stamens* 1–5. *Stigmas* 2, 0.2–0.4 mm. *Fruits* mostly falling without perianth; *pericarp* very thin, easily scratched from seed. *Seeds* horizontal, reddish black, orbicular in outline, 0.6–0.8 × c. 0.5 mm, margin rounded to slightly acute; *testa* somewhat undulate, shallowly radially striated and minutely pitted.

Distribution — *Dysphania schraderiana* is an East African species with a very limited distribution in Asia. It known from several localities in Pakistan, in Baluchistan

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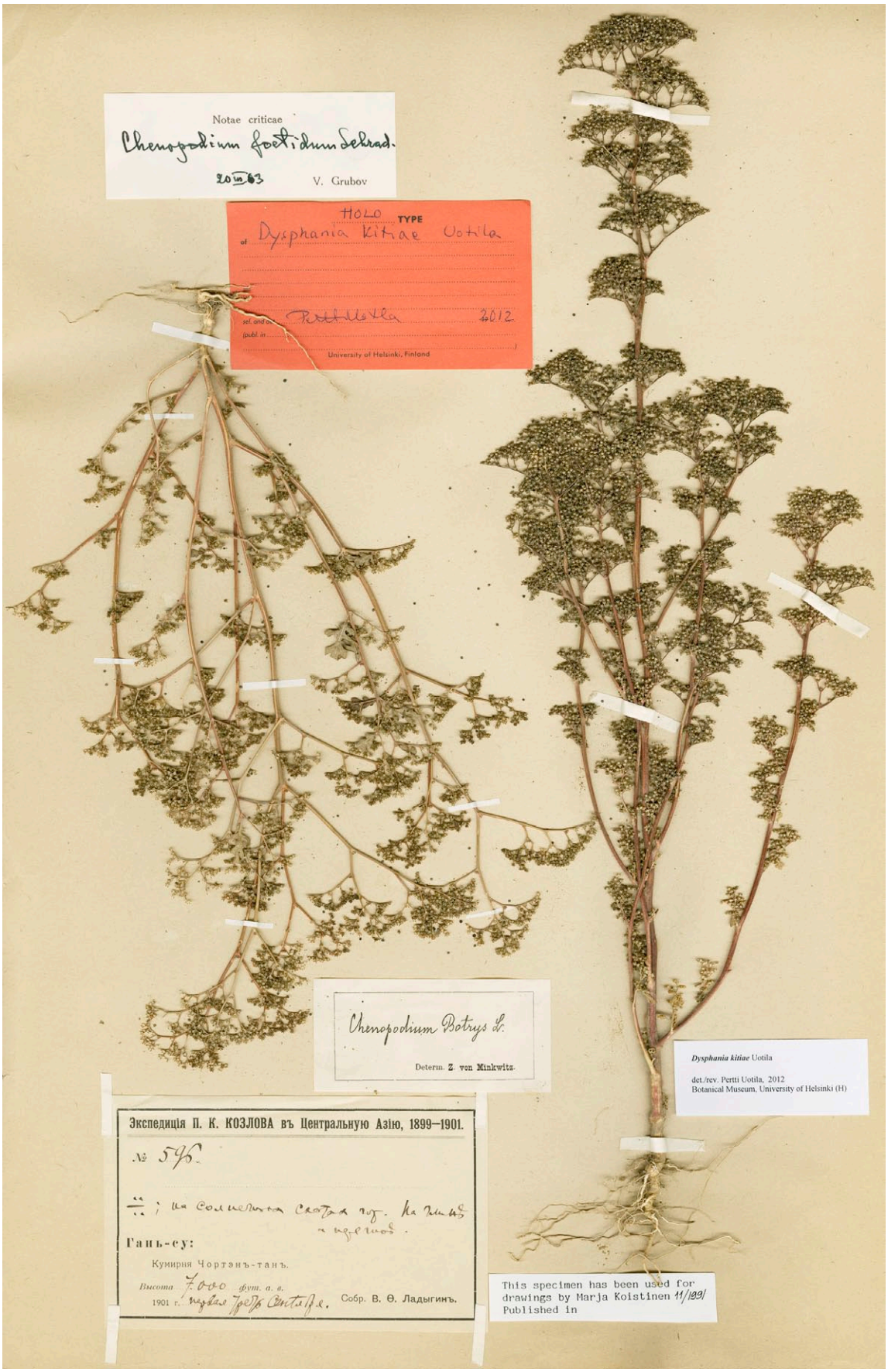


Fig. 8. Holotype of *Dysphania kitiae* – *V. F. Ladygin 596* (LE). – Photo by A. Taponen.

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and Kurram districts (Uotila 2001), but there are also many recent collections from the SW mountainous areas of Saudi Arabia and Yemen, and the species is native there (Boulos1996).

Dysphania schraderiana, earlier commonly grown especially in botanic gardens, has become a weed and has been reported as naturalized in most of the territories in C and E Europe (Uotila 2011). It has been found as alien (probably casual) also in Asia: a specimen has been seen from Russia, Far East, Khabarovsk, 15 Nov 1982, *V. D. Nebalokin* (MHA), as *Chenopodium botrys*; also reported as *C. botrys* by Ignatov (1988).

Taxonomic remarks — As to seed size, shape and surface characters, *Dysphania schraderiana* differs from Asiatic *Dysphania* and resembles more the East African *D. procera.* Leaf shape in *D. schraderiana* is less variable than in *D. botrys* and *D. nepalensis*.

The specimens from Pakistan are old and interpreted as native by Uotila (1997, 2001). However, they may also represent introduced plants even though they are more than hundred years old. Lace, in the field notes of his specimen, mentioned that the plant was eaten as a vegetable by Pathans, and Aitchison added on his specimen No. 750 (*Dysphania schraderiana*) and 899 (*D. botrys*): "A field-weed much collected and eaten as a vegetable, cooked." The strongly aromatic *D. schraderiana*, as well as other members of the group, have long been used as pot herbs, and immigration either by accident or design may have occurred along the ancient trade routes between Africa and China.

Specimens seen — Pakistan: Kurram, *Harsukh 15474* (K); Kurram [Khameyt], Shalozan, c. 2000 m, 1879, *J. E. T. Aitchison 750* (G, LE); [Baluchistan, Sibi distr.] Ziarat, 2440 m, 18 Aug 1887, *Lace 4015* (E); two further specimens from Kurrum cited in Uotila (2001).

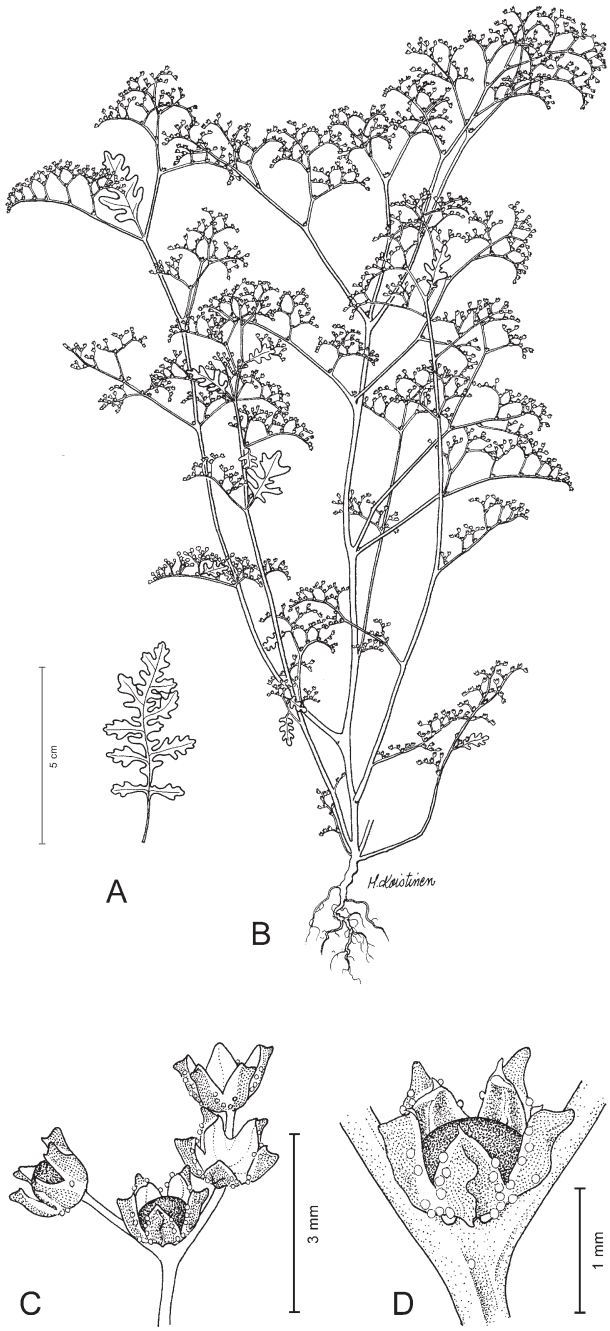


Fig. 9. *Dysphania kitiae* – A: whole plant; B: leaf; C: detail of inflorescence; D: detail of flower. A, C, D from the holotype; B from *N. M. Przewalski 704* (LE). – Drawings by M. Koistinen.

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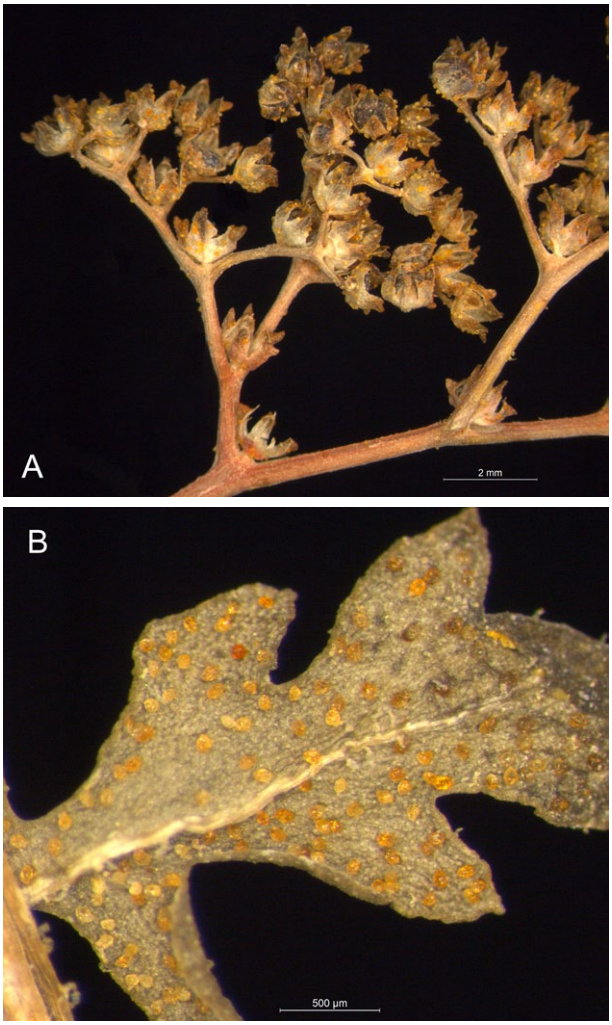


Fig. 10. *Dysphania kitiae* – A: inflorescence from the holotype; B: lower leaf surface from *N. M. Przewalski 704* (LE). – Photos by M. Koistinen.

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