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Four Himalayan *Umbelliferae* new to the flora of China, with critical notes on *Tordyliopsis* DC. and *Keraymonia* Farille

Abstract

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Two genera of the *Umbelliferae*, *Tordyliopsis* and *Keraymonia*, previously not known from China, have been revealed on the basis of original collections made by German-Chinese expeditions to Xizang (Tibet) Autonomous Region and adjacent areas. *Tordyliopsis brunonis*, gathered on the Tibetan side of the Mt Everest massif, was known only from India and Nepal. The mature fruit of *Tordyliopsis* is described from Nepalese material. *Keraymonia cortiformis*, found in the Tibetan part of Mt Xixabangma, belongs to a genus with its previously known distribution limited to the Nepalese Himalaya. Findings of two additional species from other genera, *Chamaesium mallaeanum*, from Xizang (Xixabangma), and *Aulacospermum stylosum* from Xinjiang (Karakorum, K2 North slope), are also new to the Chinese flora.

Introduction

Representatives of two genera new to the flora of China, *Tordyliopsis* and *Keraymonia*, and two additional species of *Aulacospermum* and *Chamaesium* turned up among large and well-documented new collections of *Umbelliferae* from the Xizang Autonomous Region, Xinjiang, Qinghai, adjacent Chinese provinces and neighbouring Himalayan countries. The specimens were collected by joint expeditions of the Lanzhou Geographical Institute, the Xining North West Plateau Institute of Botany (HNWP), the Chengdu Institute of Mountain Disaster and Environment, the Kunming Institute of Botany (KUN), the Institute of Taxonomic Botany Göttingen (GOET) and the Institute of Geography Marburg. *Tordyliopsis brunonis* DC., *Keraymonia cortiformis* Cauwet-Marc & Farille and *Chamaesium mallaeanum* Farille, previously known only from the Nepalese and, in case of *Tordyliopsis*, the Indian Himalayas, were found in the southern part of the Tibetan Autonomous Region (Xizang) of China. *Aulacospermum stylosum* (C. B. Clarke) Rech. f. & Riedl was collected in the Karakorum Mountains of the SW Xinjiang Autonomous Region.

All new records are not surprising, as they were made close to the political boundaries, in the same floristic regions where the gatherings of the species were known in adjacent Nepal, India and Pakistan. It seems to be very probable that further findings of high-mountain Nepalese species will be made in adjacent Chinese territory and vice versa.

Genera new to the flora of China

Tordyliopsis

Tordyliopsis, which is sometimes included into *Heracleum* L., is a monotypic genus of the tribe *Tordylieae* W. D. J. Koch. It was described by A.-P. De Candolle (1830) with the type species *T. brunonis* DC. on the basis of Wallich's collections from Kamaon [Kumaon], now in the Indian state Uttar Pradesh. The sheets of Wallich were without mature fruits, and De Candolle had some doubts about the generic independence from *Heracleum* ("genus dubium et provisorium donec fructus notis sit"). He indicated the well-developed bracts and bracteoles as differential characters of *Tordyliopsis* and *Heracleum*. *Tordyliopsis* was accepted by Endlicher (1839) and Meisner (1843) but rejected by Bentham (Bentham & Hooker 1867) and C. B. Clarke (1879). Bentham stated that, in its fruit structure, *Tordyliopsis* is a typical *Heracleum*. Baillon (1879), with his general concept of very broad genera, and Drude (1898) also rejected *Tordyliopsis*. Among more recent authors Hiroe (1958, 1979) and Cannon (1979) regarded *T. brunonis* as a member of *Heracleum*.

Tordyliopsis was resurrected by I. P. Mandenova (1950, 1959, Mandenova & al. 1978), first in an enlarged circumscription (including the species of *Platytaenia* Nevski & Vved. = *Semenovia* Regel & Herder), later in the original circumscription as a monotypic genus. She analysed the diagnostic characters of *Tordyliopsis* and compared it with the closely related genera *Heracleum*, *Tetrataenium* and *Semenovia*. According to Mandenova (1959), *Tordyliopsis* differs from *Heracleum* by the presence of well-developed keeled dorsal mericarp ribs, septated vallecular oil ducts (vittae), and in petal shape. It is closer to *Tetrataenium*, another not generally accepted generic segregate of *Heracleum*, and *Semenovia* than to *Heracleum*. *Tetrataenium* differs from *Tordyliopsis* in having larger marginal ribs with a thin translucent proximal part ("wing neck" in the terminology by Al-Eisawi & Jury 1988) and in non-radiant marginal petals. *Semenovia* is distinguished by narrow vittae and low-conical stylopods. At the same time, Mandenova did not emphasise that *Tordyliopsis* has, unique in the *Tordylieae*, well-developed bracts and bracteoles, resembling those of some *Hymenidium* (*Pleurospermum* s. ampl.) species. Further studies on a multi-character basis, including comparative investigation of stomata, pollen grains, phytochemistry (coumarins), etc. (Mandenova & al. 1978) corroborated the generic status of *Tordyliopsis*, in spite of its similarity in many characters with the widely variable genus *Heracleum*. Modern students of the Himalayan *Umbelliferae* support the separation of *Tordyliopsis* from *Heracleum* (Mukherjee & Constance 1993, Watson 1998b, 1999). Bracts are regarded by Mukherjee & Constance (1993) as the main diagnostic character of *Tordyliopsis*. They also noted differences in pericarp sclerification between *Tordyliopsis* and *Heracleum*. Although some carpoanatomical characters were noted by Mandenova and Mukherjee & Constance either, their descriptions of *Tordyliopsis* fruits are incomplete and partly contradictory, probably due to the absence of mature fruits.

The following fruit description (see also Fig. 1) has been compiled on the basis of completely mature material, collected in central Nepal ("Annapurna mountain massif, NE slopes of Hiunchili Mt, between Machhapuchhare Base Camp and Annapurna Base Camp, *Rhododendron* scrub, 28°30' N, 83°51' E, 4100 m, 23.10.1999, *M. G. Pimenov & E. V. Kljuykov* 23", MW):

Fruit elliptic, flattened dorsally, with 2-cleft carpophore. *Calyx* teeth triangular, subequal to stylopodium. *Stylopodium* short-conical, *styles* 2-3.5 mm long, slender, erect or recurved. *Mericarps* strongly flattened dorsally, elliptic in outline, 6.5-10 mm long, 4.4-7 mm wide, on dorsal surface sparsely covered by thin hairs. *Dorsal ribs* low-keeled, marginal ribs wider, winged,

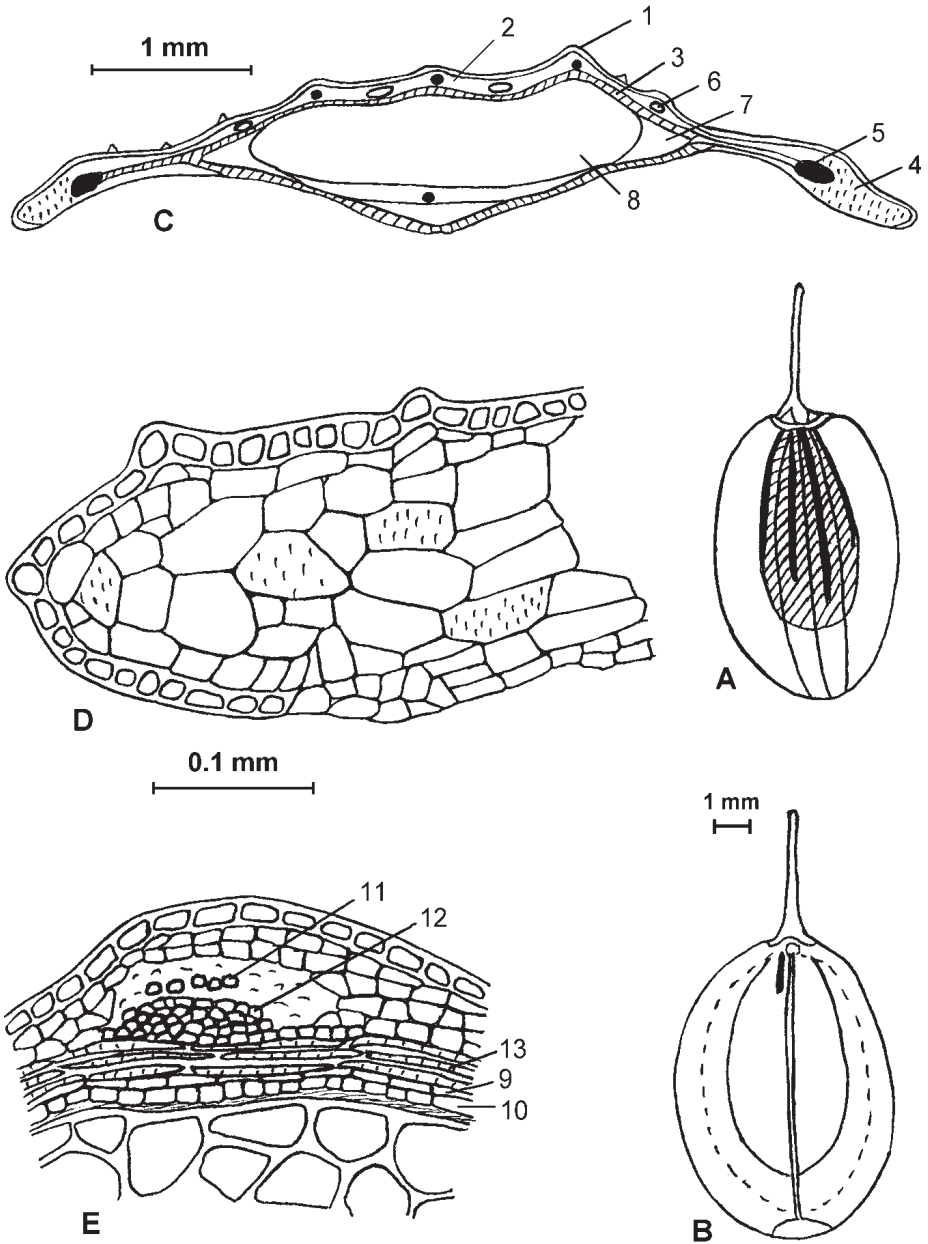


Fig. 1. A-B: mericarp, dorsal face (A) and ventral (commissural) face (B); C: mericarp, transverse section; D: lateral rib, transverse section of distal part; E: dorsal rib. – Abbreviations: 1 = exocarp; 2 = mesocarp; 3 = mesocarp fibres (hypendocarp); 4 = parenchyme of lateral rib; 5 = wing vascular bundle; 6 = oil duct; 7 = seed cavity; 8 = endosperm; 9 = endocarp; 10 = spermoderm; 11 = xylem; 12 = sclerenchyma of vascular bundle; 13 = horizontal fibres of hypendocarp; specimen: Central Nepal, *Pimenov & Kljuykov 23* (MW).

slightly inflated in distal parts; commissure wide. *Exocarp* consisting of one layer of small cells. Outer *mesocarp* layer of thin-walled parenchyma cells; inner mesocarp (hypendocarp) composed of thick-walled horizontal lignified fibrous cells, in marginal ribs and on commissural side partly of similar vertical fibres. *Vascular bundles* in dorsal ribs thin, in marginal ribs/wings more massive; thin-walled, slightly lignified parenchymatous cells with pitted walls present in distal part of marginal ribs. Dorsal *vittae* solitary in furrows, thin, extending for half or 2/3 of mericarp length, frequently unequal, commissural *vittae* absent or 1-2, short. *Endocarp* and *spermoderm* of hardly distinguishable cells. *Endosperm* plane on the commissural side.

It may well be concluded that the carpological structure in *Tordyliopsis* is typical for the representatives of the *Tordylieae*. Some fruit anatomical characters, proposed to distinguish *Tordyliopsis* from related genera, in particular from *Heracleum* s.l. (including *Tetrataenium*), are not indeed suitable for this purpose. For instance, the sclerification of the inner layer of the mesocarp in *Tordyliopsis* is quite similar to that of *Heracleum* species. This layer, sometimes called “hypendocarpium”, in both cases consists of horizontally and partly vertically oriented prosenchyma cells with lignified walls. These cells are not only situated “beneath inner margin of lateral wings”, as Mukherjee & Constance (1993) described, but form a continuous layer around the seed. Middle dorsal ribs are only slightly developed, being hardly distinguishable from filiform ribs in *Heracleum*. The secretory system (*vittae* arrangement) is also similar in both genera. It should be noted, however, that the fruit model in some other genera of *Tordylieae*, if not in the majority of them, is very similar too, and intergeneric differences could nevertheless be found among non-carpological characters. In the case of the *Tordyliopsis*-*Heracleum* dichotomy, such diagnostic characters are the bracts and bracteoles, which are leafy in *Tordyliopsis* and usually absent (bracts) or small and linear or filiform (bracteoles) in *Heracleum*. The treatment of *Tordyliopsis* as part of *Heracleum* s. ampl. is possible, but we prefer to regard it as an independent monotypic genus, according to the current standards of generic delimitation in this group.

Below a summing up of nomenclature and distribution of *T. brunonis* is presented:

Tordyliopsis brunonis DC., Prodr. 4: 199. 1830 ≡ *Heracleum brunonis* (DC.) C. B. Clarke in Hooker, Fl. Brit. Ind. 2: 713. 1879. – Lectotypus: India, “in Kamaon Nepaliae versus Emodum, *R. Blinkworth* [590]” (G-DC; isolectotypi: BM, CAL, E, K).

References: As *T. brunonis*: Mandenova 1959: 18; Mukherjee & Constance 1993: 245; Watson 1998: 383, 1999: 503; Hiroe 1958: 190, 1979: 1736; as *Heracleum brunonis*: Cannon 1979: 186; Miehe 1987: 246.

Distribution: China (Tibet: Xizang A.R.), Nepal, India (W Himalaya: Himachal Pradesh, Uttar Pradesh; E Himalaya: Sikkim).

Collection from China: Xizang, S Tibet, Tibetan Himalaya, Everest E, Kama Chu, head of valley N of Sakyatang (Camp Ev3-4), 27°59'N, 87°14'E, 4250 m, subalp. moist scrub (*Rhododendron*, *Juniperus*), forbs and ferns among large gneiss boulders, 10.10.1989, B. Dickoré 6188 (B, MW).

The collecting site is situated less than 20 km from the Nepalese boundary, in a tributary of the Arun valley E of Mt Everest and NE of Makalu. The Kama valley [Karma Chhu] is relatively moist and exposed to monsoonal disturbances from the Himalaya S slopes. Several other Himalayan species collected in this area (*Juniperus indica* Bertol., *Astragalus donianus* DC., *Leontopodium jacotianum* Beauverd) are apparently also confined to the immediate vicinity of the Himalayan main ridge, and accordingly are rare and local on the Tibetan side.

Keraymonia

Keraymonia is a recently described genus (Farille & al. 1985), originally containing three species (*K. nipaulensis* (type), *K. cortiformis* and *K. triradiata*), all being described from and distributed in Nepal. Watson (1998a) described a fourth species from Bhutan, *K. pinnatifolia* M. F. Watson, referred to the genus with some hesitation. All Nepalese species are ultimately high-mountainous plants, described from border regions of the country, situated in the rain

shadow of the main Himalayan range with vegetation of the Tibetan type. Thus, it is not surprising that one of them has now been found in the adjacent part of Xizang.

All species of *Keraymonia*, and *K. cortiformis* in particular, are stemless or short stemmed, dwarf alpine perennials. Similar life-forms occur in some other *Umbelliferae* of High Asia, which, however, belong to different, sometimes taxonomically distant genera. The fruit structure is useful to distinguish related and distant alpine Asiatic *Umbelliferae*. The carpoanatomy of *Keraymonia* was correctly described in detail by Farille & al. (1985), demonstrating campylosporous fruits, numerous vittae and well-developed, approximately equal ribs in all Nepalese species. In these characters *Keraymonia* differs considerably from *Cortia* and its segregates, *Pachypleurum* and its segregates, as well as from *Schulzia*, *Keraymonia* being closer to *Pleurospermum* s. ampl. Our special analysis of a large set of taxa from the *Pleurospermum* group, distributed mainly in Asia, confirmed the generic status of *Keraymonia*.

Taxonomic and other information about *K. cortiformis* is very scanty:

Keraymonia cortiformis Cauwet-Marc & Farille in Candollea 40: 531, fig. 6(6-9). 1985. – Holotypus: Nepal, “C. Népal: haute Kali Gandaki, entre Muktinath et Thorung-la, vers 4900-5000 m, 19.9.1981, M. A. Farille 81456B” (KATH).

References: Mukherjee & Constance 1993: 103; Watson 1999: 460.

Distribution: China (Tibet: Xizang A.R.), Nepal.

Collection from China: Xizang, S Tibet, Central Himalayas: Upper Trisuli gorge W of Mt Xixabangma, 28°33'N, 85°18'E, 4870 m, 30° SW-exp., *Kobresia pygmaea* with cushions, 22.8.1993, G. & S. Miehe 9537/08 (B).

Previously known only from the type.

Species new to the flora of China

Chamaesium malleaeum Farille & S. B. Malla in Candollea 40: 536, fig. 8(1-5). 1985. – Holotypus: Nepal “C. Népal: massif de l'Annapurna, versant nord du col de Namun (Langtang himal) vers 3800 m, 24.09.1981, M. A. Farille 81537” (G; isotypus: JAY).

References: Mukherjee & Constance 1993: 34.

Distribution: China (Tibet: Xizang A.R.), Nepal.

Collection from China: Xizang, S Tibet, Central Himalayas, upper Trisuli gorge W of Mt Xixabangma, 28°33'N, 85°18'E, 4440 m, 35° NNW-exp. *Rhododendron anthopogon* dwarf scrub, 22.8.1993, G. & S. Miehe 9544/05 (B).

Previously known only from the type.

Aulacospermum stylosum (C. B. Clarke) Rech. f. & Riedl in Biol. Skr. 13(4) [Symb. Afghan. 5]: 28. 1963 ≡ *Pleurospermum stylosum* C. B. Clarke in Hooker, Fl. Brit. Ind. 2: 704. 1879. – Lectotypus: “Kashmir, H. Falconer 3150” (K). Paralectotypus: India, “Lahul, 11-12000 ft., H. A. Jaeschke” (K).

= *Pleurospermum pulchrum* Aitch. & Hemsl. in J. Linn. Soc. Bot. 18: 63. 1880 ≡ *Aulacospermum pulchrum* (Aitch. & Hemsl.) Rech. f. & Riedl in Biol. Skr. 13(4) [Symb. Afghan. 5]: 32. 1963. – Holotypus: Afghanistan, “Kurram: Shend Toi, J. E. T. Aitchison 743” (K).

References: As *Aulacospermum stylosum*: Farille & al. 1985: 525; Rechinger 1987: 179, t. 125; as *Pleurospermum stylosum*: Hiroe 1958: 119; Kitamura 1964: 113; Nasir 1972: 147, t. 43(F-H); Mukherjee 1978: 61; Hiroe 1979: 737; Mukherjee & Constance 1993: 193; Aswal & Mehrotra 1994: 292; as *Pleurospermum pulchrum*: Kitamura 1960: 289.

Distribution: China (NW Xinjiang A.R.), India (W Himalaya: Jammu & Kashmir, Himachal Pradesh), Pakistan, Afghanistan.

Collection from China: SW Xinjiang, Karakorum, central northern declivity, K2 area, west of K2-North-glacier, 36°02'N, 76°27'E, 4350 m, stabilized scree (granite), between boulders, 5.9.1986, B. Dickoré 662 (B).

Companion species on the talus slopes of K2-North-glacier were *Carex nivalis* Boott, *Delphinium brunonianum* Royle and *Poa lipskyi* Roshev. *Aulacospermum stylosum* seems to occur more regularly in the inner W Himalayas from E Afghanistan (Kurrām) to Kashmir and occasionally in the S and W Karakorum (Yasin, Ishkoman, Gilgit, Baltistan). The nearest documented stations of the species are approximately more than 100-150 km distant to the W and S in adjacent Pakistan.

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