

DANCING BUTTERFLIES OF THE EAST HIMALAYAS – NEW *MECONOPSIS* SPECIES FROM EAST BHUTAN, ARUNACHAL PRADESH AND SOUTH TIBET

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ABSTRACT

The region from eastern Bhutan to Arunachal Pradesh of India and the adjacent south-eastern Tibet and northern Myanmar seems to be one of the last frontiers not only for *Meconopsis* hunting but also for other botanical exploration. Although there remain political difficulties for foreigners to approach the unsettled border between India and China, including the famous Tsari valley with its prominently rich flora, which was visited by Frank Ludlow, George Sherriff, Frank Kingdon-Ward and a few other plant hunters before 1950, some botanical and horticultural treasures in this region have gradually been revealed to recent travellers. As a result of examining the photographs taken by these travellers and our own botanical field research in eastern Bhutan in 2014, accompanied by subsequent herbarium studies, two species new to science are described. The first, from eastern Bhutan and adjacent Arunachal Pradesh and Tibet, has long been cultivated under the names *M. grandis* or *M. grandis* GS600, and has recently been described as *M. grandis* subsp. *orientalis* (Grey-Wilson, 2010). It is the national flower of Bhutan. However, the type of *M. grandis* from Sikkim belongs to a species quite distinct from the eastern populations and the latter is now described as a new species, *Meconopsis gakyidiana*. The second novelty, *Meconopsis merakensis*, is newly described from eastern Bhutan and adjacent Arunachal Pradesh. In the past this species was confused with the closely allied *M. prainiana*. The two species are isolated geographically, *M. prainiana* being found only much further to the north-east, in south-eastern Tibet, including the Tsari valley. The title of this article is based on a comparison made by Frank Kingdon-Ward of *Meconopsis* flowers with butterflies in Tibet (see below).

INTRODUCTION

In 2004 a botanical tour group led by Peter Cox, the distinguished Scottish horticulturist and plant hunter, visited the western part of Arunachal Pradesh of India just east of the Orka La (correctly Warge La) located on the boundary between Arunachal Pradesh and Sakten (formerly Sakden) region of Bhutan. Since that year, many botanical groups from the UK and other countries have travelled there and photographed some interesting plants of *Meconopsis*, as well as a species of *Roscoea* (Zingiberaceae) that was recently described as a new species, *R. megalantha* T. Yoshida & R. Yangzom (Yoshida *et al.*,

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in press), based on a specimen collected on the collaborative field project in Bhutan mentioned below.

Among the plants of *Meconopsis* observed in that area, the most interesting one is a tall perennial blue poppy similar to the specimen *Kingdon-Ward* 13711, collected in 1938 on the Indian side of Orka La, and also similar to the so-called 'Sherriff 600'. The latter number refers to a collection with ample seeds from the Nyuksang La (Nyakchung La in Bhutanese official maps), in the Sakten region of eastern Bhutan, made by George Sherriff in 1934, and also applied to the cultivated plants later grown from those seeds. Although 'Sherriff 600' and the Kingdon-Ward specimen have long been referred to as *Meconopsis grandis* by many horticulturists and botanists, the plants differ from the typical plant of the latter species in many aspects.

A second interesting plant of *Meconopsis* photographed by the recent travellers is a prickly poppy with four yellow or white petals resembling *M. prainiana*, but differing from the typical plant of the latter species in its larger fruit capsules as well as petal colour (usually pale blue in the latter).

Another small scapose blue poppy with pinnately lobed leaves was also photographed by the travellers in this region near the Orka La and this plant was recently described as a new species, *M. ludlowii*, by Christopher Grey-Wilson in his monumental monograph of the genus published at the end of 2014 (Grey-Wilson, 2014), based on the specimen *Ludlow & Sherriff* 642 (BM), collected by George Sherriff on the Bhutan side of the Orka La four days after the collection of 'Sherriff 600'.

To study more closely these interesting plants of *Meconopsis*, in the summer of 2014 we visited the Tashigang district of Bhutan bordering Arunachal Pradesh, as one of the main collaborative projects between the Blue Poppy Society, Japan, and the National Biodiversity Center, Bhutan.

A NEW SPECIES FORMERLY INCLUDED IN *MECONOPSIS GRANDIS*

First we planned to visit the Nyuksang La, where George Sherriff collected a beautiful plant of *Meconopsis*, 'Sherriff 600' or more correctly *Ludlow & Sherriff* 600. The plant was included in *M. grandis* Prain by George Taylor (Taylor, 1934) and, since then, has been called *Meconopsis grandis* 'Sherriff 600' or merely 'GS 600', among blue poppy enthusiasts. This blue poppy has also been adopted as the national flower of Bhutan. In 2010, 'Sherriff 600' was included in the new subspecies *M. grandis* subsp. *orientalis* by Grey-Wilson, and this taxon was re-described with a similar circumscription to that in the above-mentioned monograph of the genus. This subspecies is based on the type specimen *Ludlow, Sherriff & Hicks* 20801, collected not on the Nyuksang La in the Sakten region of Bhutan bordering Arunachal Pradesh but on the Cho La at the north-eastern corner of Bhutan bordering Tibet.

The plant introduced by George Sherriff is beloved by gardeners in the UK and other countries, and many garden forms have been produced from the plant; these garden forms were recently classified as the 'George Sherriff Group' by the *Meconopsis* Group,

an organisation of *Meconopsis* enthusiasts specialising in cultivation, supported by the Royal Botanic Garden Edinburgh (RBGE) (The Meconopsis Group, 2004–2014).

Harold R. Fletcher (Regius Keeper of RBGE 1958–1970 and author of *A Quest of Flowers – The Plant Explorations of Frank Ludlow and George Sherriff*) described Sherriff's discovery (Fletcher, 1975) as follows:

“On the Nyuksang La Sherriff found a plant which surpassed in beauty all the primulas and every other plant on the pass – a most magnificent form of Meconopsis grandis (600), which he and Ludlow had recorded from Bhutan for the first time in 1933. It was occupying open stony ground beside Primula waltonii. Well might Sherriff have echoed the remarks of Kingdon-Ward when he collected Bailey’s Blue poppy, Meconopsis betonicifolia [= M. baileyi], near Tumbatse in SE Tibet in 1924; ‘Among a paradise of primulas the flowers flutter out from amongst the sea-green leaves like blue and golden butterflies.’ Perhaps the collection of M. betonicifolia is the achievement best associated with Ward’s name, for it is now firmly established in cultivation both in Britain and overseas. And it could well be that the discovery, and the introduction to cultivation, of ‘Sherriff 600’, as this marvelous plant is now known in horticulture, will be ranked as Sherriff’s greatest achievement. It is a finer plant by far than M. betonicifolia; and it is a finer plant by far than the form M. grandis from Sikkim which grew for many years in the Rock Garden at the Botanic Garden, Edinburgh, and which carried only a solitary nodding flower on a 12 or 18-inch flower stem. ‘Sherriff 600’ grows to twice that height, sometimes higher, and bears several glorious deep blue flowers often as much as 6 inches across.”

As Fletcher misinterpreted, the typical plant of *M. grandis*, first found in western Sikkim, sometimes appears to be scapose, that is, with leaves all basal and with flowers borne on long, thick, erect pedicels (scapes), because of its lower stature with short stems and many basal leaves, but actually the plant usually bears 1–3 flowers on the top of erect, long and thick pedicels borne in the axils of 2–4 pseudo-whorled bracts as they grow larger.

On our summer 2014 expedition we planned to climb north-east from Merak village to cross the Nyuksang La, and then after searching for ‘Sherriff 600’ growing near the pass, descend to Sakten village to visit the Orka La. One of the authors (Yangzom) had observed a small population of ‘Sherriff 600’ still surviving in a limited area on the Sakten side of Nyuksang La (the original locality of Sherriff’s plant), in her previous year’s preliminary exploration.

However, our plan had to be changed at Merak village because we were informed by a local traveller that a bridge on the way to Sakten had collapsed. Another local guide (who wore the curious blackish felt hat with four pigtails of the same texture dangling from each corner typical of the local Brokpa people) on seeing the plants in the photographs we showed him, recommended that we go eastwards and visit the mountains

near the border with Arunachal Pradesh to search for *Meconopsis*. He assured us we would see many more plants of 'Sherriff 600' there than on the Nyuksang La, and this advice was vindicated later. He added that no foreigner had previously entered that mountainous region east of Merak village.

So we departed Merak village walking eastwards, and, after a long and gradual ascent, crossed a pass named Serney La at an elevation of 4,200m. On the way to Serney La, we found the first plant of *Meconopsis paniculata* beside a stream and plants of 'Sherriff 600' growing tall amongst shrubs of a juniper. We were delighted to see more plants of 'Sherriff 600' in flower around our camp on the western slope near the pass. However, these delights were soon diluted by the splendid views of numerous flowers of the plants over the next few days.

On both sides of the Serney La, at 3,900 to 4,100m in elevation, we saw large plants of *Swertia assamica* scattered on stony and mossy slopes. The plants bore many showy flowers coloured pale yellow with purple streaks on a thick stem tinged with dark purple. This species is distributed in the Merak and Sakten regions and adjacent Arunachal Pradesh.

Among the plants of *S. assamica*, on the east side of Serney La, we found the first plant of *Meconopsis sinuata* with a one-sided raceme of the palest blue flowers and the characteristic regularly sinuate narrow leaves. Later we found more plants of this species growing taller, together with other herbs and ferns on the margin of a coniferous forest at a lower elevation on the same slope. On a north-east facing steep rocky slope near the colony of *S. assamica* and *M. sinuata*, we encountered an unfamiliar *Meconopsis* with pale blue flowers resembling *M. prainiana*. This plant is dealt with in detail below.

We descended to the bottom of a valley via a marshy terrace named Bushinaga, and crossed a torrent, which flows down towards Sakten village, by a bridge temporarily constructed with a few logs of *Tsuga dumosa* carried from a nearby forest by our local horsemen, and then ascended a steep zigzag path under a coniferous forest. When we emerged from this forest, all the members of our expedition roared with pleasure at the sight of a panoramic view of blue and yellow flowers of *Meconopsis* 'Sherriff 600' and *M. paniculata*. These plants were growing gregariously over an abandoned pasture at an elevation of 4,000m and on the surrounding mountain slopes. We called this place (located 5km east of Nyuksang La on the same mountain range and close to our Tsejong campsite) 'Tsejong Paradise' in consideration of Kingdon-Ward's words describing the splendid scenery of many primroses.

Because of this, we changed our plan to get to Orka La on the border with Arunachal Pradesh and decided instead to stay at the Tsejong camp for three days from 1 July to explore the surrounding mountains.

After examining in detail numerous living plants of 'Sherriff 600' in the field, we became firmly convinced that these plants should not be included within the circumscription of *M. grandis*. The plants appeared to be specifically distinct from *M. grandis*, and rather more closely related to *M. baileyi* and *M. betonicifolia* in the arrangement,

shape and serration of the leaves, inflorescence, and shape and hairiness of the fruit capsules. The most important difference between 'Sherriff 600' and *M. grandis* is in life form; most of the leaves in a typical plant of *M. grandis* cluster near the base and the plants look semi-scapose with short stems and long flower stalks, whereas the leaves of 'Sherriff 600' are more or less regularly alternate along the elongate stem except for the pseudo-whorled bracts at the top, as are those in *M. baileyi* and *M. betonicifolia*.

The leaves of 'Sherriff 600' have distinctive serration similar to that of *M. baileyi* and *M. betonicifolia*. The leaf margins of these last two species are remotely, regularly and shallowly cut towards the mid-vein near the base of the lamina with obliquely wedged sinuses. Adrian Franchet characterised leaves with this unique serration as 'betonicifolia', betony-like, although the leaf margins of our plants are more remotely cut with straighter, or less curved, segments of margin between the cuts than in the betony, *Stachys officinalis*. Leaves of a typical plant of *M. grandis* are, however, usually sub-entire or coarsely and somewhat irregularly toothed.

The flower colour of 'Sherriff 600' in the photo published in *A Quest of Flowers* (Fletcher, 1975, facing p. 50 and dust jacket) is deep blue and described as 'glorious deep blue' in the text. However, those we observed in the Merak region ranged from purple to blue, often pale blue tinged with purple, occasionally deep reddish-purple, rarely bicoloured with bluish flowers and reddish flowers mixed on the same plant. The changing nature of flower colour has also been reported from the plants growing on Nyuksang La and in western Arunachal Pradesh near the Orka La. Such a changing flower colour is considered to be one of the characteristics of this plant.

The fruit capsules of 'Sherriff 600' we observed in Merak, although not fully mature, looked shorter, thicker and much hairier with bristles than those of the true *M. grandis*, and rather similar to those of *M. baileyi*.

The living plant habit of 'Sherriff 600' also looked different from that of typical plants of *M. grandis*. Plants of 'Sherriff 600' often form a loose tuft with taller stature and grow gregariously together with shrubs and tall herbs unlike typical plants of *M. grandis*, which usually grow alone and often form substantial clumps with compact bases and with a shorter stature.

The nodding flowers of 'Sherriff 600' are bowl-shaped, often hemispherical, with round petals distinctly concave in fine weather, whereas those of *M. grandis*, *M. baileyi* and *M. betonicifolia* are more widely open with petals less concave in fine weather. The unique flower shape of 'Sherriff 600' could be considered to be an adaptation to a wetter climate, or to a more foggy and rainy climate than is normal in the habitats of the related species.

Meconopsis 'Sherriff 600' growing on the mountain range which includes Nyuksang La and the nearby Tsejong is considered by us to be identical to the typical plant of *M. grandis* subsp. *orientalis* Grey-Wilson growing on the Cho La in every key character, from our study of living plants and herbarium specimens. We therefore elevate the status of the subspecies to species rank, distinct from *M. grandis*, and rename it here *Meconopsis gakyidiana* (Figs 1–3). As this plant is the worthy national flower of Bhutan,



Fig. 1 *Meconopsis gakyidiana* at Tsejong, Merak, east Bhutan, alt. 4,000m. Photo: T. Yoshida (2014), 4, vii.



Fig. 2 Colony of *Meconopsis gakyidiana*, surrounded by yellow-flowered *M. paniculata*, at Tsejong, Merak, east Bhutan, alt. 4,000m. Photo: T. Yoshida (2014), 1, vii.



Fig. 3 *Meconopsis gakyidiana* with dark red flowers at Tsejong, Merak, east Bhutan, alt. 4,000m. Photo: T. Yoshida (2014), 2, vii.

we have chosen an epithet based on the Dzongkha word for happiness, *gakyid*, to reflect Bhutan's important cultural aspiration of 'gross national happiness'.

M. gakyidiana grows on both the Bhutanese and Tibetan sides of the type locality Cho La and the nearby Me La and Po La passes in the mountain range located on the boundary between the two countries, and the Merak and Sakten regions of easternmost Bhutan and the adjacent western Arunachal Pradesh of India. According to recent travellers, *M. gakyidiana* grows around Bhangajang, located 6km north of Orka La in western Arunachal Pradesh. Shun Umezawa, a botanical photographer and a member of the Blue Poppy Society, Japan, visited Orka La from Sakten in the summer of 2015 as a follow-up to our collaborative field research, the first visit by foreigners since George Sherriff visited there from Sakten in 1934, and observed *M. gakyidiana* growing in abundance on the Bhutanese side of the Orka La. Some photographs taken by Chinese travellers have proved that *M. gakyidiana* grows in Tsona (*cuona* in pinyin), in southern Tibet, some 40km north-east of the type locality at Cho La.

George Taylor included within *M. grandis* the plants collected in southern Tibet at an elevation of 16,000ft (4,877 m) by the famous Second Mount Everest Expedition of 1922 (Taylor, 1934), although the elevation seems to be too high for this species and its close relatives. Examination of photographs of the plants taken recently by travellers between Shau La (4,900m) and Zokshyam (4,000m) on the Kangshung Trek, on the route of the Second Mount Everest Expedition, located north-east of Mount Everest

and in the catchment of an upper tributary of the Arun River that flows southwards into eastern Nepal through the Great Himalaya, shows that many plants similar to the typical plant of *M. grandis* grow in that area, with widely open bluish flowers and pseudo-whorled bracts with narrowed bases. There are also plants that look similar to *M. gakyidiana* with bowl-shaped reddish flowers and bracts with rounded and half-clasping bases at lower altitudes of the same valley. There seem to be various hybrids between the two species.

THE TYPICAL PLANT OF *M. GRANDIS*

The original discovery of *M. grandis* Prain is somewhat mysterious. G. Taylor wrote in *The Genus Meconopsis* (Taylor, 1934):

“The original description was based by Prain on specimens obtained by native collectors (1887) and also by Watt (1881) and Gammie (1892), all from Jongri district of Sikkim where, apparently, the species occurs in some abundance between the altitudes of 10,000 and 12,000ft. According to Gammie, M. grandis is found in this area only as a cultivated plant about the dwellings used in summer by shepherds. They are not primarily concerned with the aesthetic qualities of the plant, but grow it rather for the extraction of oil from the seeds, although the properties of this oil are not recorded. It has also been stated that the species is not truly native in Sikkim, but was originally introduced there from Nepal”.

Because Jongri (Dzongri) is located close to the Nepalese border, it may be possible that the typical plants of *M. grandis* were once introduced there by herders who came from eastern Nepal crossing over the high passes on the border in Kangchenjunga Himal with their livestock. Even if not brought by herders themselves, small seeds of *M. grandis* could easily have been carried by the long and tangled hairs of yaks and sheep crossing the high passes open to local herders in the old days, although specimens of the typical plant of *M. grandis* collected on the Nepalese side of Kangchenjunga Himal have originated from the region west of Ghunsa, not from near the border with Sikkim.

One of the authors (Long) observed and collected the typical plant of *M. grandis* from Western Sikkim, between Chamathang and Goecha La, at 4,570m in elevation, located in the type locality of ‘Jongri district’ in 1992, 71 years after George H. Cave collected a specimen there in 1922. This specimen was collection no. 615 on the expedition with acronym ESIK and is stored in the herbarium at Edinburgh (E). This proves that the plant was still surviving there in the wild with at least a small population.

The specimens collected from the type locality of *M. grandis* show that the plants have many leaves near the base with or without a few remotely alternate leaves and with pseudo-whorled bracts, and have 1–3 flowers born on long, erect pedicels above the bracts. They differ from those of *M. gakyidiana* which have leaves more or less regularly

alternate along the long stem and have flowers borne on much shorter pedicels above pseudo-whorled bracts as already mentioned.

Most of the cultivated plants appearing in Plate XVI of Taylor's *The Genus Meconopsis* (Taylor, 1934) bearing the caption *M. grandis* Prain are, however, scapose, despite having been cultivated in a mild climate. They are suspected to have been the progeny of past hybridisation with a polycarpic and large-flowered form of *M. simplicifolia*, which was recently described as *M. simplicifolia* subsp. *grandiflora* by Grey-Wilson (Grey-Wilson, 2014), in the wild or in RBGE's rock garden.

In eastern Nepal, *M. grandis* subsp. *grandis* (Fig. 4) is now known to grow in the western Kangchenjunga Himal, Jaljale Himal and the neighbouring Lumbasumba Himal to the north, southern Makalu Himal and Solu Himal. The Lumbasumba Himal, located on the boundary between Nepal and Tibet, connects the Jaljale Himal and Kangchenjunga Himal without a deep intervening valley blocking migration of alpine plants. The population of the species in these regions is concentrated in the northern Jaljale Himal including Lumbasumba Himal. The flower colour of the plants in these regions is usually pale sky-blue to purplish-blue except in those from Solu Himal.

The plants from Solu Himal are somewhat different from the typical plant of the species in their larger flowers, wine-red flower colour, narrow leaves and narrow bracts only occasionally pseudo-whorled. In the southern Makalu Himal, located north-east of the Solu Himal, intermediate forms between the typical plant of *M. grandis* and the Solu population grow. Solu and Makalu Himal are located on the west of the large subtropical valley of the Arun River which divides these ranges from the other Himalas where the typical plant of the species grows. More studies are needed to consider the infraspecific status of the Solu and the Makalu populations.

There is no record of *M. grandis* from other parts of Nepal except the northern periphery of the Jumla district in western Nepal. The Jumla plants were rightly classified as a distinct subspecies, *M. grandis* subsp. *jumlaensis*, by Grey-Wilson (Grey-Wilson, 2010); its distinguishing characters are the small stature, the narrow oblanceolate leaves, the deep flower colour and the semi-scapose inflorescence with a single flower.

The typical plant of *M. grandis* subsp. *grandis* was first photographed in the field by Sasuke Nakao, a Japanese botanist who has explored Himalayan countries widely, in 1962 at Nango La, western Kangchenjunga Himal, at 4,300m elevation, and his photographs appeared in colour in his *Living Himalayan Flowers* (Nakao, 1964, pp. 15–16). One of the authors (Yoshida) observed the plant in many places in the western Kangchenjunga Himal, Lumbasumba Himal and Jaljale Himal from 1987 to 1990 and photographs of the plant appeared in his books (Yoshida, 2002; 2005) and also in Grey-Wilson's monograph of the genus.

In eastern Nepal, *M. grandis* subsp. *grandis* often forms substantial clumps scattered around the temporary houses of herders in open, stony grazing grounds, where cattle and yaks manure the plants and graze 'weedy' grasses among them and, as a result, this encourages the growth of *M. grandis*. The animals never eat the leaves or flower buds of *M. grandis* which are densely covered with long bristles. The plants



Fig. 4 *Meconopsis grandis* subsp. *grandis* in northern Jaljale Himal, east Nepal, alt. 4,450m. Photo: T. Yoshida (1990), 11, vii.

tolerate cattle trampling by forming substantial clumps with compact bases along with their hard and short rootstock. The sight of many plants with showy flowers scattered around the temporary houses could easily appear to foreigners as though the plants were cultivated.

The semi-scapose life form of *M. grandis* is considered to be an adaptation to the more exposed and severe conditions of its habitats than in the related species, *M. gakyidiana*, *M. baileyi* (Fig. 5) and *M. betonicifolia*. The last three species usually grow amongst shrubs or tall herbs, beside trees or rocks, or on the sunnier margins of subalpine forests, and these habitats are not exposed to strong winds. *M. grandis* bears its flower buds close to the ground in order to escape strong winds, and just after the buds are ready to open, the flower stalks develop with enough height and thickness to keep the flowers and fruits high in the air.

M. grandis usually has pseudo-whorled bracts around the middle of the plant. However, smaller plants growing on exposed stony slopes occasionally appear to be scapose, because the plants bear the bracts so close to ground level that they look similar to the basal leaves. Such a semi-scapose habit with an occasional scapose-looking inflorescence is observed also in *M. sherriffii*, although the latter species usually bears



Fig. 5 *Meconopsis baileyi*, east of Tong La, Milin county, south-east Tibet, alt. 3,650m. Photo: T. Yoshida (1997), 26, vi.

pseudo-whorled bracts lower than the middle of the plant and often becomes completely scapose. The scapose-looking plants of *M. grandis* have sometimes been misidentified as a polycarpic form of *M. simplicifolia* with purple or deep-blue lateral-facing large flowers, or, as *M. simplicifolia* subsp. *grandiflora* Grey-Wilson, and vice versa; the last plant, growing in northern Bhutan and other regions, has been misidentified as *M. grandis* by some botanists.

M. grandis has narrower leaves than the three related species, *M. gakyidiana*, *M. baileyi* and *M. betonicifolia*, and the bracts are narrowed at the base, occasionally shortly stalked, whereas those of the related species are usually rounded at the base and half clasping. Such leaf shapes of *M. grandis* are also considered to be a result of an adaptation to strong winds. However, *M. grandis* occasionally grows in milder conditions beside tall shrubs, and such plants approach life forms of the related species with wider leaves.

M. betonicifolia, *M. baileyi*, *M. gakyidiana* and *M. grandis* are closely related but each shows geographical isolation; *M. betonicifolia* occurs in north-western Yunnan, *M. baileyi* occurs in south-eastern Tibet and adjacent regions of Myanmar and Arunachal Pradesh, *M. gakyidiana* occurs in the area around the adjoining point of three countries,

Bhutan, Arunachal Pradesh of India and southern Tibet, and *M. grandis* occurs in Nepal and adjacent regions of Sikkim and southern Tibet. The species can be distinguished using the key below and characters given in Table 1.

Key to *Meconopsis gakyidiana* and related species

- 1a. Plant often forming a loose tuft with short or long rhizomes, taller in stature (to 120cm tall), with long stems; stem leaves more or less regularly alternate along long stems; lamina wider, with betony-like serration (remotely and regularly toothed with obliquely wedge-shaped sinus); bracts and upper leaves half clasping; fruit capsules shorter and thicker, to 5cm long, glabrescent or densely hairy
..... 2
- 2a. Rhizomes occasionally elongate in marshy habitats. Fruit capsules glabrescent; style longer, 5–10mm long; bracts only occasionally pseudo-whorled
.....*M. betonicifolia*
- 2b. Rhizomes usually short. Fruit capsules densely hairy; style shorter, less than 5mm long; bracts usually pseudo-whorled
..... 3
- 3a. Flowers widely open during fine weather, petals slightly concave, flower colour not changing, pale to deep blue, thecae yellow to dull orange, style often obsolete, less than 4mm long; leaves bluish-green
.....*M. baileyi*
- 3b. Flowers bowl-shaped or hemispherical even during fine weather, petals distinctly concave, flower colour usually changing from purple to blue, often pale blue tinged with purple, rarely dark red, thecae bright orange, style 1–5mm long; leaves yellowish-green
.....*M. gakyidiana*
- 1b. Plant often forming a substantial clump with a compact base, lower in stature (to 70cm tall), semi-scapose with short stems and erect, long and thick pedicels; leaves usually clustered near the base, occasionally regularly alternate along stem and in this case leaves are usually narrow and erect along the stem; lamina narrower, sub-entire or coarsely toothed; bracts not clasping; fruit capsules longer and narrower, to 7cm long, glabrescent
.....*M. grandis*

Meconopsis gakyidiana T. Yoshida, R. Yangzom & D. G. Long, *nom. et stat. nov.*; *nom. nov.* for *Meconopsis grandis* Prain subsp. *orientalis* Grey-Wilson, *Sibbaldia* 8, 81 (2010). Type: NE Bhutan, Cho La, Ludlow, Sherriff & Hicks 20801 (BM, holotype). *Meconopsis grandis* auct. non Prain, G. Taylor, *The Genus Meconopsis* 68 (1934), pro parte.

Diagnosis: *M. baileyi* Prain affinis, sed flore crateriformi, petalis manifeste concavis, thecis aurantiacis, atque stylo longiore difert. *M. gakyidiana* is similar to *M. baileyi*, but

| | <i>M. grandis</i> | <i>M. gakyidiana</i> | <i>M. baileyi</i> | <i>M. betonicifolia</i> |
|------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Life form | Often forming a substantial clump with a compact base, lower in stature, semi-scapose with short stems and long pedicels | Forming a loose tuft with short rhizomes, taller in stature with long stems | Usually forming a loose tuft with short rhizomes, taller in stature with long stems, occasionally forming a clump | Usually forming a loose tuft with short or elongate rhizomes, taller in stature with long stems |
| Leaf arrangement | Usually clustered near the base, occasionally regularly alternate along stem with narrow and erect leaves | More or less regularly alternate along long stem | More or less regularly alternate along long stem | More or less regularly alternate along long stem |
| Lamina | Narrower, sub-entire or coarsely toothed | Wider, with betony-like serration | Wider, with betony-like serration | Wider, with betony-like serration |
| Leaf colour | Green | Yellowish-green | Bluish-green | Bluish-green |
| Base of bracts | Not clasping | Half clasping | Half clasping | Half clasping |
| Flower number | 1–3 | (1)2–4 | (1)2–6 | (2)3–7 |
| Flower shape | Usually widely open in fine weather, with slightly concave petals | Bowl-shaped or hemispherical even in fine weather, with distinctly concave petals | Usually widely open in fine weather, with slightly concave petals | Usually widely open in fine weather, with slightly concave petals |
| Petal colour | Not changing, pale to deep blue, blue-purple or wine-red (in Solu Himal) | Usually changing from purple to blue, often pale blue tinged with purple, rarely dark red | Not changing, pale to deep blue | Not changing, pale blue to pale purple |
| Theca colour | Orange | Bright orange | Yellow to dull orange | Orange |
| Fruit capsule | Longer and narrower, glabrescent | Shorter and thicker, densely hairy | Shorter and thicker, densely hairy | Somewhat longer, both ends narrowed, glabrescent |
| Style | 4–8mm long | 1–5mm long | Often obsolete, less than 4mm long | 5–10mm long |

Table 1 Comparison of major features separating *M. gakyidiana* from *M. baileyi*, *M. betonicifolia* and *M. grandis*.

differs from the latter in the bowl-shaped flower with distinctly concave petals, orange-coloured thecae and longer style.

Description: Herb, polycarpic, 45–120cm tall, forming a tuft with short rhizomes; rhizomes to 15mm across, bearing many dark-coloured firm, fibrous roots. Stem simple, 5–15mm across near base. Entire plant densely covered with pale yellow-green bristles; bristles to 6mm long. Leaves yellowish-green. Basal leaves many; petiole broadly linear, membranous, 5–17cm long, 3–7mm wide; lamina oblong or oblanceolate, 8–24cm long, 2.3–9cm wide, base attenuate, margin sub-entire or remotely and regularly toothed with obliquely wedge-shaped sinus, apex obtuse or acute. Stem leaves and bracts 5–8, ascending, more or less regularly alternate except pseudo-whorled bracts; lower stem leaves petiolate, lamina similar to basal ones; upper stem leaves and bracts sessile, lamina lanceolate or ovate, 4–12cm long, 1.5–5cm wide, base rounded and half clasping, margin remotely and regularly toothed with obliquely wedge-shaped sinus, rarely entire, apex acute or acuminate; bracts (1)2–4, usually pseudo-whorled. Flowers (1)2–4, born in axil of bracts, nodding or half-nodding, bowl-shaped or hemispherical, rarely dish-shaped, 6–15cm across. Pedicels 8–25cm long. Calyx 2–2.5cm long. Petals 4, broadly ovate or broadly obovate, rounded, 4.5–8cm long, 3–7cm wide, distinctly concave, margin sub-entire, rarely erose, pale blue, sky blue, blue-purple, purple, reddish-purple or rarely dark red, usually changing from purple to blue; rarely some flowers with reddish petals and others with bluish petals borne on same plant. Stamens numerous; filaments white, filiform, 8–13mm long; anthers 1.2–2mm long, thecae bright orange. Ovary ellipsoid, 10–15mm long, 4–6 ridged, densely covered with ascending bristles; style thick, 1–5mm long, 1.5–2mm across; stigma obovoid, 4–7mm long, 3–5mm across, divided into 4–6 lobes. Fruit capsules narrowly obovoid or ellipsoid, 2.5–4.3cm long, 10–17mm across, densely covered with patent or retrorse bristles.

Distribution: Eastern Bhutan, western Arunachal Pradesh of India, southern Xizang (Tibet) of China; 3,700–4,300m in elevation.

Habitat: Open shrubberies, lush pastures, beside rubble walls in grazing grounds, rarely on the sunny edge of sub-alpine forests; often forming a loose tuft with short rhizomes and gregariously growing together with shrubs and other tall herbs.

Specimens examined: Bhutan: *Ludlow & Sherriff* 387 (BM, E), 600 (BM, E), 1021 (BM); *Ludlow, Sherriff & Hicks* 20671 (BM, E), 20801 (BM), 21069 (BM), 21431 (BM); *R. Yangzom & C. Wangmo* 632 (THIM), 633 (THIM), 634 (THIM), 635 (THIM); *T. Yoshida* 4443 (TI). India (Arunachal Pradesh): *Kingdon-Ward* 13711 (BM); *Ludlow & Sherriff* 1315 (BM); *Ludlow, Sherriff & Taylor* 6416 (BM). China (Xizang [Tibet]): *Ludlow & Sherriff* 875 (BM).

TAXA RELATED TO *MECONOPSIS PRAINIANA*

On the descending route from Serney La to Bushinaga, in the Merak region of easternmost Bhutan, during the collaborative field research in 2014, we first encountered some plants of an unfamiliar prickly poppy with four petals, resembling *M. prainiana* (*M. aff. prainiana*) growing on a north-east facing steep stony slope, at 4,200m elevation.

Contrary to our expectations, these plants of *M. aff. prainiana* have watery blue flowers, somewhat paler than those of the typical plant of the species. We expected the plants to have yellowish flowers, because plants of another *M. aff. prainiana* with yellow or white flowers have recently been reported from many photographs taken by travellers in western Arunachal Pradesh of India. Some of these photographs show that those plants have larger, somewhat cylindrical fruit capsules differing from those of the typical plant of the species, where capsules proved to be shorter and more or less ellipsoid from the specimen Ludlow, Sherriff & Taylor 6236 (BM, E), collected at the type locality of Temo La in 1938 and also by some photographs taken by travellers at Serkyim La, close to the type locality of the species.

M. prainiana was first found on the Temo La, south-eastern Tibet, by Frank Kingdon-Ward, and published as a new species by him (Kingdon-Ward, 1926). Flower colour of the typical plant of the species is pale blue or sky-blue. G. Taylor included this species within a conglomerate species of *M. horridula*. Later, yellow-flowered plants resembling this were found in more western regions of south-east Tibet, and Taylor described a new variety, *M. horridula* var. *lutea*, for those plants (Taylor, 1937).

One of the authors (Yoshida) talked about *M. prainiana* in the 8th International Rock Garden Conference at Nottingham, 2011, and summarised it in *Alpine Gardener*, 79(1), 188, as follows:

“*Meconopsis prainiana*, collected by F. Kingdon-Ward (No. 5909) at Temo La, SE Tibet, and published by him in 1926, is considered a distinct species although it has long been neglected since the revision of the genus by G. Taylor (1934). It differs from closely-related *M. racemosa* (including *M. prattii*) in the flowers with 4 (not 5 or more as in the latter) petals coloured pale blue (never deep blue as in the latter), in the elongate, thick, hollow rachis, in the narrower, broad linear or linear-lanceolate leaves accompanied with many leafy bracts, and in the dense, evenly patent, very hard, glassy, rather short, spiny hairs with fragile, translucent tips. *M. prainiana* grows also on Serkyim La and Nyima La near the type locality. *M. horridula* var. *lutea* was collected by Ludlow & Sherriff (No. 2188) at Shagam La, Tsari, SE Tibet, published by G. Taylor in 1937, and is best considered conspecific with *M. prainiana* as a different variety with pale golden-yellow flowers and with sometimes coarsely toothed or sinuate leaves. Its black-and-white photo can be seen in *A Quest of Flowers*, p.115. The same taxon but with pale sulphur-yellow flowers was collected by Ludlow, Sherriff & Taylor (No. 6062) at Mira, Kongbo, SE Tibet.”

Later in 2014, Christopher Grey-Wilson duly made the new combination, *M. prainiana* Kingdon-Ward var. *lutea* (G. Taylor) Grey-Wilson, for the yellow-flowered plants in his monograph of the genus. Into this taxon, however, he newly included the plants with white or yellow flowers growing in the eastern Bhutan and western Arunachal Pradesh of India.

In our collaborative research in the Merak region, after having observed many plants of *M. gakyidiana* at ‘Tsejong Paradise’, we explored the western mountains of Tsejong and reached the Dantso Tse, a pass on the dividing ridge between the Merak and Sakten regions at an elevation of 4,300m. There is a ruined shrine named Tsholong Gompa to the east of the pass, at the head of the eastern valley that flows east and enters Arunachal Pradesh of India.

Around Dantso Tse, we observed a small colony of the pale blue flowered *M. aff. prainiana* on rocky slopes and a few plants of *M. simplicifolia* growing among dwarf shrubs of junipers, and with some rare alpinists such as *Thylacospermum caespitosum*, *Bhutanthera alpina*, dwarf plants of *Valeriana barbulata* and *Oreosolen wattii* with extraordinarily large orange flowers.

On the return to Tsejong camp on 3 July, following an indistinct trail near the ridge we encountered many more plants of *M. aff. prainiana* growing on north-west facing, steep, partly moss-covered boulder slopes, at around 4,150m elevation. Some plants of the *M. aff. prainiana* grew to 60cm or more and bore many flowers (as many as 15 including flower buds and young fruits) in an elongate raceme; most of the elongate racemes had a narrowed tip of the rachis, which was sometimes curved with many flowers opened; many plants bore pale blue flowers but some bore pale reddish-purple flowers. Fruit capsules on a previous year’s withered plant, which was fallen beside the flowering plants, measured 3.2–3.7cm long – definitely longer than the typical plant of *M. prainiana*, of which fruit capsules are 1.7–2.5cm long in the above-mentioned specimen, *Ludlow, Sherriff & Taylor* 6236.

Although there is no fruiting specimen of the *M. aff. prainiana* with white or yellow flowers which grow in eastern Bhutan and Arunachal Pradesh of India as far as we know, the fruit capsules of these plants are considered to be almost similar in shape and length to those we observed in the withered plant specimen (*R. Yangzom & C. Wangmo* 733) collected in the Merak region together with bluish- and purplish-flowered plants, by comparing photographs and specimens of these plants.

In the herbarium of BM, there are two mysterious specimens (mounted on one sheet) resembling *M. prainiana*, with purplish flowers, both collected on the Orka La, *Ludlow & Sherriff* 639 with ‘grape purple’ flowers and *Kingdon-Ward* 13727 with ‘deep vinous red’ flowers. The latter specimen has fruit capsules which measure 3.2–3.5cm long. In the Grey-Wilson monograph of the genus, these specimens are included in *M. prainiana* var. *prainiana* (Fig. 6), even though Orka La is not included by him in the distribution area of this variety.

As already mentioned, Shun Umezawa visited Orka La from Sakten in the summer of 2015. After observing *Meconopsis gakyidiana*, he photographed *M. aff. prainiana*



Fig. 6 *Meconopsis prainiana* var. *prainiana* at Serkyim La, Linzhi county, south-east Tibet, alt. 4,500m. Photo: T. Yoshida (2006), 9, viii.

with yellow flowers on the Bhutan side of the Orka La just before falling seriously ill. One of his photographs shows somewhat cylindrical young fruits. On the return journey to Saktien, Setsuko Umezawa, accompanying her unconscious husband who was being carried by local Brokpas, photographed *M. aff. prainiana* with purplish flowers, 78 years after Kingdon-Ward collected the specimen of the plant with purplish flowers around Orka La in 1938. The photographs prove that the plants with purplish flowers are still surviving on a slope in a valley at a lower elevation than the habitat of the yellow-flowered plants around Orka La, and that both populations are clearly separate.

After our collaborative field research, we re-examined the specimens of *M. aff. prainiana* collected in the eastern Bhutan and Arunachal Pradesh of India and also those of *M. prainiana* collected in south-eastern Tibet, along with photographs of these taxa and Grey-Wilson's newly published monograph of the genus.

Besides the shape of fruit capsules, the photographs of the living plants have revealed some differences between the *M. aff. prainiana* growing in eastern Bhutan and western Arunachal Pradesh of India and *M. prainiana* growing in south-eastern Tibet; flowers of the *M. aff. prainiana* are always deeply nodding and bowl-shaped, whereas those of *M. prainiana* are usually half-nodding, or lateral-facing, widely opened and dish-shaped under fine weather; stems of *M. aff. prainiana* are less densely covered with spiny hairs

whereas those of *M. prainiana* are quite densely covered with patent spiny hairs; the *M. aff. prainiana* grows under a wetter and cloudier climate than *M. prainiana* does.

As a result of these studies, we conclude that *M. aff. prainiana* growing in eastern Bhutan and western Arunachal Pradesh should be treated as a new species distinct from *M. prainiana*, and we name it *M. merakensis*. The new species consists of two varieties, var. *merakensis* for the plants with bluish or purplish flowers (Figs 7–10), and var. *albolutea* for the plants with white or yellow flowers (Figs 11 & 12).

In var. *albolutea*, the yellow-flowered population is very similar in morphology to the white-flowered population except in its flower colour, and, moreover, some plants with palest yellow or whitish flowers are sometimes seen within the yellow-flowered population; therefore two populations with different flower colour within this variety cannot be distinguished as different taxa.

We have selected *Ludlow & Sherriff* 659 as the type specimen of var. *albolutea*, because it is oldest of the available collections of this variety and shows the characters very well. This specimen was collected at Milakatong La located in the northern Tawang district, western Arunachal Pradesh of India, at 14,500ft (4,420m) elevation, and the flower colour is white according to the note on the specimen label. The living state of specimens with white flowers and sub-cylindrical fruit capsules can be visualised with the photos taken by Tim Lever at Pange La (south of Tse La) and Tse La in Mago district, which appeared in the Grey-Wilson monograph of the genus, pp. 263–264. The white-



Fig. 7 *Meconopsis merakensis* var. *merakensis*, north-east of Tsejong, Merak, east Bhutan, alt. 4,350m. Photo: T. Yoshida (2014), 3, vii.



Fig. 8 *Meconopsis merakensis* var. *merakensis* with pale reddish-purple flowers born on curved rachis, north-east of Tsejong, Merak, east Bhutan, alt. 4,350m. Photo: T. Yoshida (2014), 3, vii.



Fig. 9 *Meconopsis merakensis* var. *merakensis*, west of Orka La, Saktien, east Bhutan, alt. 3,950m. Photo: Setsuko Umezawa (2015), 12, vii.



Fig. 10 Previous year's withered fruits of *Meconopsis merakensis* var. *merakensis* from north-east of Tsejong, Merak, east Bhutan, alt. 4,350m. Photo: T. Yoshida.



Fig. 11 *Meconopsis merakensis* var. *albolutea* at Orka La, Saktien, east Bhutan, alt. 4,200m. Photo: Shun Umezawa (2015), 10, vii.

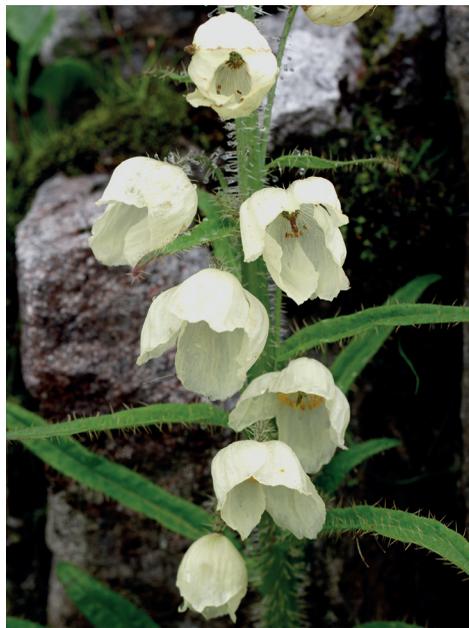


Fig. 12 Palest yellow flowers of *Meconopsis merakensis* var. *albolutea* at Bhangajang near Orka La, west Arunachal Pradesh, east India, alt. 4,100m. Photo: Takeo Morita (2014), 7, vii.

flowered plants of var. *albolutea* have so far been reported only from the Milakatong La in the Tawang district and Chera La, Pange La and Tse La in the Mago district. These regions are located in western Arunachal Pradesh of India and not in eastern Bhutan as stated in footnote 32 (p. 263) of the monograph.

Interestingly, yellow-flowered plants of *M. merakensis* var. *albolutea* grow at a higher elevation around Orka La on the boundary between Bhutan and Arunachal Pradesh, whereas purplish-flowered plants of *M. merakensis* var. *merakensis* grow at a lower elevation in a valley within the same region around Orka La; and, similarly, yellow-flowered plants of *M. prainiana* var. *lutea* grow at a higher elevation around Mira La, Nyang Chu region, whereas bluish-flowered plants of *M. prainiana* var. *prainiana* grow at a lower elevation in a valley along Mira Chu of the same region according to the notes on specimen labels of Ludlow, Sherriff & Taylor 6056 (E) and 6062 (BM, E).

Christopher Grey-Wilson included *Meconopsis prainiana* in the series *Racemosae* of section *Racemosae*, subgenus *Cumminsia*, in his monograph of the genus *M. prainiana*, together with *M. merakensis*, is, however, considered to be better placed within section *Aculeatae* of the same subgenus by its key character of four-petalled flowers.

M. prainiana and the related *M. merakensis* and their varieties are distinguished by the following key and their distribution along with the location of representative specimens is shown in Fig. 13.

Key to *Meconopsis prainiana* and *M. merakensis* and their varieties

- 1a. Fruit capsules ellipsoid, 1.5–2.5cm long; flowers usually half-nodding, widely opened and dish-shaped during fine weather; stems quite densely covered with patent spiny hairs
 2 (*M. prainiana*)
- 2a. Petals pale blue to purple
 *M. prainiana* var. *prainiana*
- 2b. Petals pale yellow
 *M. prainiana* var. *lutea*
- 1b. Fruit capsules sub-cylindrical, 3–3.7cm long; flowers usually deeply nodding, bowl-shaped; stems less densely covered with spiny hairs
 3 (*M. merakensis*)
- 3a. Petals bluish or purplish; plant usually growing larger, tip of elongate rachis often gradually narrowed and curved
 *M. merakensis* var. *merakensis*
- 3b. Petals white or yellow; plant usually growing smaller, tip of rachis rarely curved
 *M. merakensis* var. *albolutea*

Meconopsis prainiana Kingdon-Ward, *Gardeners' Chronicle*, 3(79), 308, Fig. 232 (1926); *Annals of Botany.*, 40, 540, Table 16, Fig. 1 (1926). Type: south-east Tibet, Temo La, Kingdon-Ward 5909 (BM, holotype; E, isotype).

Meconopsis prainiana* var. *prainiana

Description: Stems quite densely covered with patent spiny hairs. Flowers usually half-nodding, widely open and dish-shaped during fine weather; petals usually pale blue (washy pale blue, satiny pale blue or pale Cambridge blue) except those in Tsari, occasionally plum to blue purple or deep purple-violet in Tsari. Fruit capsules ellipsoid, 1.5–2.5cm long.

Distribution: China (Xizang [south-east Tibet]): Temo La, Sang La, Nyima La, Nam La, Pab Ri in Tsela Dzong, Mira in Nyang Chu region, Shoga Dzong in Kongbo, Tsari Sama and Chiniung La in Langong, Bimbi La and Chikchar in Tsari.

Specimens examined: China (Xizang [south-east Tibet]): *Kingdon-Ward* 5717 (K), 5909 (BM, E, K); *Ludlow & Sherriff* 1789 (BM), 2139 (BM); *Ludlow, Sherriff & Elliot* 14173 (E), 14481 (BM); *Ludlow, Sherriff & Taylor* 5061 (BM), 5061a (BM, E), 5550 (BM), 5612 (BM), 6056 (E), 6236 (BM, E). For selected field notes see Appendix.

Meconopsis prainiana* var. *lutea (G. Taylor) Grey-Wilson, *The Genus Meconopsis, Blue Poppies and their Relatives*, p. 263 (2014), description and distribution amended. Type: China (Xizang [south-east Tibet]): Tsari, Shagam La, *Ludlow & Sherriff* 2188 (BM, holotype; E, isotype)
M. horridula var. *lutea* G. Taylor, *New Fl. & Silva*, 9, 158 (1937)

Description: Stems quite densely covered with patent spiny hairs. Flowers usually half-nodding, widely opened and dish-shaped during fine weather; petals pale yellow (pale golden yellow or pale sulphur-yellow). Fruit capsules ellipsoid, 1.5–2.5cm long.

Distribution: China (Xizang [south-east Tibet]): Shagam La on the south of Tsari, Mira La in Nyang Chu region.

Specimens examined: China (Xizang [south-east Tibet]): *Ludlow & Sherriff* 2188 (BM, E), 6062 (BM); *Ludlow, Sherriff & Taylor* 6062 (BM, E). For selected field notes see Appendix.

***Meconopsis merakensis* T. Yoshida, R. Yangzom & D.G. Long, sp. nov.** Type: East Bhutan: Trashigang district, Merak region, loose rocky area above Tsejong, 4,290m, 27°18'38.3"N, 91°57'37.8"E, 3 July 2014, *R. Yangzom & C. Wangmo* 730 (holotype, THIM); *ibid.*, on the cliff of Dantso Tse, Merak, 4,405m, 27°19'20.4"N, 91°58'09.1"E, 3 July 2014, *R. Yangzom & C. Wangmo* 731 (paratype, TI); *ibid.*, on the cliff near Tsejong, 4,258m, 27°18'30.7"N, 91°57'30.9"E, 3 July 2014, *R. Yangzom & C. Wangmo* 732 (paratype, E); *ibid.*, loose rocky area above Tsejong, 4,290m, 27°18'30.7"N, 91°57'30.9"E, 2 July 2014, *R. Yangzom & C. Wangmo* 733 (paratype, THIM); *ibid.*, on

a north-west facing stable boulder slope partly covered with mosses, above Tsejong, 4,200m, 27°18'32"N, 91°57'32"E, 2 July 2014, *T. Yoshida* 4442 (paratype, TI).

Diagnosis: *M. prainiana* Kingdon-Ward affinis, sed capsulis longioribus et subcylindricis differt.

M. merakensis differs from *M. prainiana* in its longer and sub-cylindrical fruit capsules.

Description: Herb, monocarpic, 35–70cm tall. Taproot elongate, 10–25cm long, 7–18mm broad. Entire plant covered with spine-like hairs; hairs pale straw-coloured or whitish, rather short, to 4(5)mm long; base of hairs thick and often marked with a dark brown spot to an irregular degree. Stem simple, 17–27cm long, 10–20mm broad, covered with patent spine-like hairs. Basal leaves petiolate; petiole broadly linear, 3–9cm long, 2–5mm wide; lamina mostly strap-shaped or linearly oblong, sometimes oblong or lanceolate, 4–12cm long, 10–22mm wide, base attenuate, margin entire or wavy, occasionally coarsely toothed, apex obtuse or acute, both surfaces covered with patent spine-like hairs. Upper leaves and bracts sessile; lamina linearly oblong or lanceolate, 2–8cm long, 4–10mm wide, base cuneate, margin entire or wavy, apex obtuse or acute. Inflorescence racemose; upper one third to two thirds of flowers ebracteate; upper part of rachis gradually narrowed, sometimes curved; pedicels 1–4cm long in flower, to 8cm long in fruit, swollen at base of calyx. Flowers 10–15 per individual, usually deeply nodding, bowl-shaped, 3–5cm across; calyx 1.3–1.7cm long; petals 4(5), pale blue, pale purple, reddish-purple, pale yellow, cream-yellow or white, broadly ovate, rounded or broadly obovate, 2–3.5cm long, 1.7–3cm wide; stamens numerous, filaments filiform, similar to petals in colour, 7–9mm long, anthers 1–1.5mm long, thecae orange or dull orange; ovary ovoid, 5–7mm long, densely covered with ascending spine-like hairs; style 1–3mm long in flower, to 6mm long in fruit; stigma small, 1–1.3mm across. Fruit capsules sub-cylindrical, 2.5–3.5cm long, 7–11mm across. Hairs on calyx and fruit capsules ascending, with prominently thick conical bases.

Distribution: Eastern Bhutan: Merak and Sakten regions of Tashigang district; India: western Arunachal Pradesh, region around Orka La and Bhangajang, Tawang district, Mago district; 3,800–4,500m in elevation.

Habitat: West, north-west or north-east facing steep rocky slopes, partly moss-covered boulder slopes or grassy and rocky slopes above tree-line, exposed to intermittent foggy rains of summer monsoon; rooting deep among rocks with scanty soil.

Meconopsis merakensis* var. *merakensis

Description: Tip of elongate rachis often gradually narrowed and curved. Flowers usually deeply nodding, bowl-shaped; petals bluish or purplish. Fruit capsules sub-cylindrical, 3–3.7cm long.

Distribution: East Bhutan: Merak and Sakten regions of Tashigang district. 3,800–4,500m in elevation.

Specimens examined: Bhutan: *Kingdon-Ward* 13727 (BM); *Ludlow & Sherriff* 639 (BM); *R. Yangzom & C. Wangmo* 730 (THIM), 731 (TI), 732 (E), 733 (THIM); *T. Yoshida* 4442 (TI). For selected field notes see Appendix.

***Meconopsis merakensis* var. *albolutea* T. Yoshida, R. Yangzom & D. G. Long, var. nov.** Type: India, Western Arunachal Pradesh, Tawang district, Milakatong La, 14,500ft., 14 July 1934, *Ludlow & Sherriff* 659 (holotype, BM; isotype, E).

Meconopsis prainiana var. *lutea* (G. Taylor) Grey-Wilson, pro parte, *The Genus Meconopsis, Blue poppies and their relatives* 263 (2014).

Diagnosis: *Meconopsidi merakensidi* T. Yoshida, R. Yangzom & D.G. Long var. *merakensidi* affinis, sed petalis albis vel luteis differt.

Meconopsis merakensis var. *albolutea* differs from the var. *merakensis* in its white or yellow petals.

Description: Tip of rachis rarely curved. Flowers usually deeply nodding, bowl-shaped; petals white or pale yellow. Fruit capsules sub-cylindrical, 3–3.7cm long.

Distribution: India, Western Arunachal Pradesh, region around Orka La and Bhangajang, Milakatong La in Tawang district, Mago district; eastern Bhutan, Sakten region of Tashigang district; 3,800–4,500m in elevation.

Specimens examined: India (Arunachal Pradesh): *Ludlow & Sherriff* 659 (BM, E); *Kingdon-Ward* 11648 (BM), 3727a (BM). For selected field notes see Appendix.

CONCLUSIONS

As stated in the introduction above, parts of the vast mountain ranges between Bhutan, northern Myanmar and south-west China remain very poorly explored botanically, even for such showy plants as *Meconopsis*. The new discoveries reported here demonstrate that diligent field work, using the modern technology of digital photography, can reveal plants new to science and often not brought into cultivation in the past. Sometimes these plants have been collected by early explorers, but those collections were often too limited to allow detailed scientific study without further material. However, when re-examined in conjunction with new specimens and images, proper scientific investigation can reveal new botanical treasures.

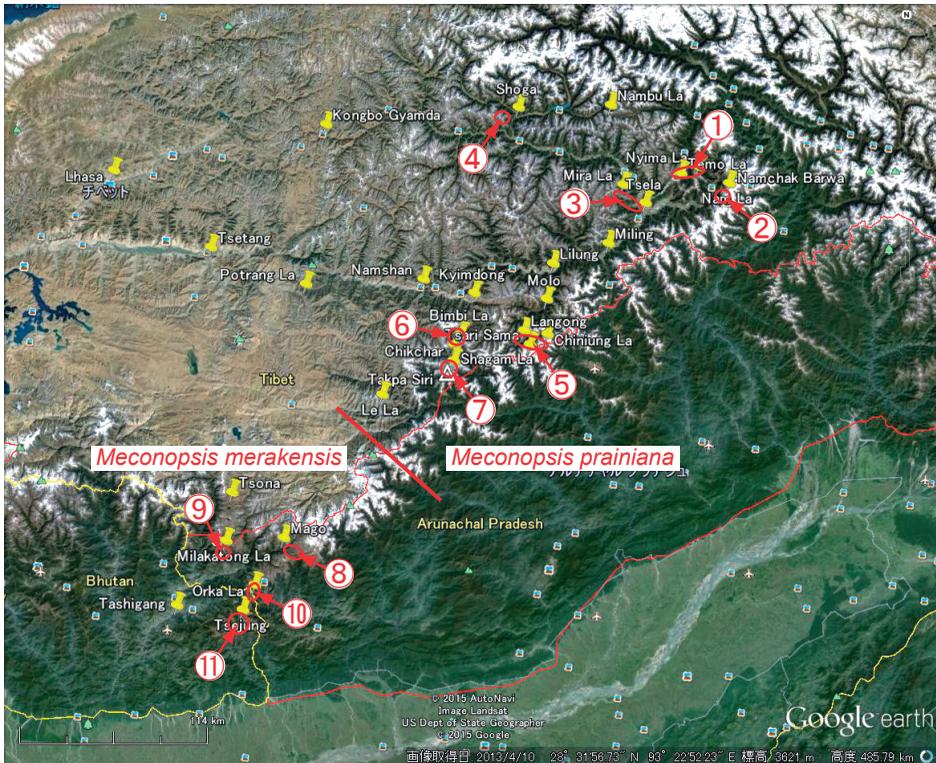


Fig. 13 Distribution map of *Meconopsis prainiana* and *M. merakensis* in 11 regions with a dividing line between the two species and their representative specimens. For specimen details see Appendix.

- ① **Nyingtri (Linzhi) county:** Temo La, Sang La, Nyma La
M. prainiana var. *prainiana*: Kingdon-Ward 5909 (BM, K, E); Ludlow, Sherriff & Taylor 5061 (BM), 5061a (BM, E), 6236 (BM, E).
- ② **Milin county near Namcha Barwa:** Nam La
M. prainiana var. *prainiana*: Ludlow, Sherriff & Elliot 14481 (BM)
- ③ **Nyang Chu region of Ningtri (Linzhi) county:** Tsela Dzong, Mira La, Mira Chu
M. prainiana var. *prainiana*: Kingdon-Ward 5717 (K), Ludlow, Sherriff & Taylor 6056 (E)
M. prainiana var. *lutea*: Ludlow, Sherriff & Taylor 6062 (BM, E)
- ④ **Kongbo region (Gongbu Jiangda county):** Shoga Dzong
M. prainiana var. *prainiana*: Ludlow, Sherriff & Elliot 14173 (E)
- ⑤ **Langong region of Lhuntse (Longzi) county:** Tsari Sama, Chiniung La
M. prainiana var. *prainiana*: Ludlow, Sherriff & Taylor 5550 (BM), 5612 (BM)
- ⑥ **Tsari region of Lhuntse (Longzi) county:** Bimbi La, Chikchar
M. prainiana var. *prainiana*: Ludlow & Sherriff 1789 (BM), 2139 (BM)
- ⑦ **South of Tsari, Lhuntse (Longzi) county:** Shagam La
M. prainiana var. *lutea*: Ludlow & Sherriff 2188 (BM, E), 6062 (BM)
- ⑧ **Mago region of Arunachal Pradesh:** Chera La
M. merakensis var. *albolutea*: Kingdon-Ward 11648 (BM)
- ⑨ **Tawang region of Arunachal Pradesh:** Milakatong La
M. merakensis var. *albolutea*: Ludlow & Sherriff 659 (BM, E)
- ⑩ **Border region of Sakten and Arunachal Pradesh:** Orka La
M. merakensis var. *merakensis*: Kingdon-Ward 13727 (BM); Ludlow & Sherriff 639 (BM)
M. merakensis var. *albolutea*: Kingdon-Ward 13727a (BM)
- ⑪ **Merak region:** Tsejong, Serney La
M. merakensis var. *merakensis*: R. Yangzom & C. Wangmo 730 (THIM), 731 (TI), 732 (E), 733 (THIM), T. Yoshida 4442 (TI)

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APPENDIX

Specimen details of *Meconopsis prainiana* and *M. merakensis* (see Fig. 13). Notes by present authors are marked with *.

Region ①

Kingdon-Ward 5909 (BM, K, E), 7 July 1924, Temo La, 15,000–16,000ft. Note: Petals 4 (sometimes 5), pale blue. Filaments violet, anthers orange. Style and stigma green. Prickles of stem and leaf colourless, those on the sepals more or less purple, or with purple base. Plant 24–30 in. Amongst boulders and shrubs on steep slopes. I find that the hollow stem contains a good deal of water. *Type of *M. prainiana*.

Ludlow, Sherriff & Taylor 5061 (BM), 30 June 1938, Sang La (*near Temo La), 13,500ft. Note: On scree slope – many plants but only one flowering. Spines straw-coloured, spreading, dark purple on sepals. Petals washy pale blue. Filaments violet purple; anthers orange-yellow. Ovary green with purple appressed spines. Style and stigmatic rays yellowish-green.

Ludlow, Sherriff & Taylor 5061a (BM, E), 4 July 1938, Nyima La, 15,000ft. Lat. N 29°37', Long. E 94°47'. Note: Equals 5061.

Ludlow, Sherriff & Taylor 6236 (BM, E), 7 Sept. 1938, Temo La, 14,000–15,000ft. Lat. N 29°30', Long. E 94°30'. Note: Up to 2ft 6in. Scape green suffused reddish-purple, capsules dull green, bristles light brown. In rock boulder scree. *Capsules ellipsoid.

Region ②

Ludlow, Sherriff & Elliot 14481 (BM), 1 Sept. 1947, Nam La, 14,000ft. *Fruits ellipsoid.

Region ③

Kingdon-Ward 5717 (K), 30 May 1924, Tsela Dzong, 14,000–15,000ft. Note: Fruit only – no sign of young plants yet. Grows 3–3.5ft high, bearing as many as 20 flowers on 6in. pedicels. On the windy side of the mountain, amongst boulders and dwarf *Rhododendron*, with the last species. Style straight, averaging 0.5in. long, stigma nearly always bent to one side. Capsule opening by 6 or 7 (generally 6) valves. [On an identification label written by Kingdon-Ward] *M. prainiana* sp. nov. K. Ward. *The specimen was collected on a mountain above Tsela Dzong called Pab Ri, 14,270ft according to *The Riddle of the Tsangpo Gorges*, p. 45. Previous year's fruits ellipsoid.

Ludlow, Sherriff & Taylor 6056 (E), 13 Aug. 1938, Mira Chu, Nyang Chu, 13,500–14,500ft, Lat. N 29°30', Long. E 94°15'. Note: Up to 2.5ft. Corolla satiny pale blue. Filaments pale blue; anthers yellow. Flowers over. Capsule green, with black bristles. Common on open earthy steep slopes. *Fruits ellipsoid.

Ludlow, Sherriff & Taylor 6062 (BM, E), 14 Aug. 1938, Mira La, Nyang Chu, 15,000–16,000ft, Lat. N 29°30', Long. E 94°15'. Note: Block boulder scree, and on very steep grassy hillside. Up to 3ft 6in. Petals pale sulphur-yellow; filaments white; anthers orange yellow. Ovary densely covered with spines, purple at base, straw-coloured at

apex, appressed at first, ultimately spreading. Style green, stigma pale yellow. Common locally. *Young fruits ellipsoid.

Region ④

Ludlow, Sherriff & Elliot 14173 (E), 22 July 1947, Shoga Dzong, Kongbo, 13,000ft. Note: Calyx green; corolla pale blue. Filaments mauve, anthers orange-yellow. Ovary dark green, style and stigma paler green. Fragrant. Hab. in scree. *The specimen was actually collected by Elliot on Nambu La according to *Quest of Flowers*, p. 298.

Region ⑤

Ludlow, Sherriff & Taylor 5550 (BM), 14 June 1938.6, Tsari Sama, Laongong, 14,500ft. Lat. N 28°45', Long. E 94°00'. Note: Corolla pale Cambridge blue. Filaments deep blue-violet, anthers golden yellow. Only one plant seen in flower, on steep hillside, below cliff.

Ludlow, Sherriff & Taylor 5612 (BM), 20 June 1938, Chiniung La, Langong, 15,000ft. Lat. N 28°45', E 94°00'. Note: Corolla pale blue. Filaments deep blue violet. Not yet in full flower. On grassy cliff ledges. *Young fruits ellipsoid.

Region ⑥

Ludlow & Sherriff 1789 (BM), 7 June 1936, Bimbi La, Tsari, 14,500ft. Note: (Colour 75 R) Plum to blue-purple. Filaments dull purple, anthers dull yellow. On open rocky hillside, among dwarf rhododendron.

Ludlow & Sherriff 2139 (BM), 13 June 1936, Chikchar, Tsari, 14,500ft. Note: (Colour between 285 and 286) Deep purple-violet. Root about 20in. long, 0.5–0.75in. in diameter. Growing in very steep shale or grassy hillside.

Region ⑦

Ludlow & Sherriff 2188 (BM, E), 20 June 1936, Shagam La, 16,000ft. Note: Corolla pale golden yellow (colour 254); filaments pale yellow; anthers golden yellow; style green; stigma dull green. Fragrant. On cliff faces, south face. Very few seen. *Type of *Meconopsis horridula* var. *lutea*.

Ludlow & Sherriff 6062 (BM). Note: *Meconopsis horridula* var. *lutea* G. Taylor. *A photograph only (without plant materials). Young fruits ellipsoid.

Region ⑧

Kingdon-Ward 11648 (BM), 8 June 1935, Mago (Chera La), 12,000–13,000ft. Note: Petals 4, silky, white. Stamens yellow; fragrant. Leaves narrow strap-shaped, distantly toothed. On boulder screens.

*Ludlow & Sherriff reported to have observed similar plant to *Ludlow & Sherriff 659* at Lap (probably close to Tse La in Kingdon-Ward), Mago district, according to a note written in the specimen label.

Region ⑨

Ludlow & Sherriff 659 (BM, E), 14 July 1934, Milakatong La, near Tawang, 14,500ft. Note: White. Rocky open hillside, above tree zone. (Also found common in Mago 15,000ft at Lap.) *Type of *M. merakensis* var. *albolutea*.

Region ⑩

Kingdon-Ward 13727 (BM), 12 June 1938, Orka La, Bhutan frontier: Assam Himalaya, c. 14,000ft. Note: Just coming into bloom; flowers deep vinous red. Ultimate height in fruit 18–24 in. On rocky alpine slopes. Scattered. *A young flowering plant with a single flower opened and a previous year's fruiting plant. Fruits sub-cylindrical.

Ludlow & Sherriff 639 (BM), 10 July 1934, Orka La, Sakden, east Bhutan, 13,500ft. Note: Grape purple. On open rocky hillside. *An upper part of a flowering plant with 3 flowers opened.

Kingdon-Ward 13727a (BM), 13 June 1938, Orka La, Bhutan frontier, Assam Himalaya, c. 14,000ft. Note: Another specimen with pure yellow flowers, exactly the colour of *M. paniculata*. On rocky alpine slopes.

Region ⑪

R. Yangzom & C. Wangmo 730 (THIM), 731 (TI), 732 (E), 733 (THIM), 2–3 July 2014, Tashigang district, Merak region, near Tsejong, 4,258–4,405m. *730 is holotype of *M. merakensis*. Details of the specimens are written above.

T. Yoshida 4442 (TI), 2 July 2014, Tashigang district, Merak region, above Tsejong, 4,200m, N 27°18'32", E 91°57'32". Note: Flowers pale blue to pale reddish-purple. Growing on a north-west facing stable boulder slope partly covered with mosses.