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Quest for *Meconopsis* in western Sichuan, China

Abstract: Recent discoveries of blue poppies, *Meconopsis pulchella*, *M. heterandra*, *M. balangensis*, and its variety *M. balangensis* var. *atrata*, growing on isolated mountains of the western Sichuan, China, are described in detail. Photos of these new taxa taken in the fields are provided, and the publications are cited.

A piglet to a god and discovering *Meconopsis pulchella*

Discovery of *Meconopsis pulchella* is a comparatively simple story. At the beginning of August, 2009, I visited Yele Nature Reserve located in the northern corner of Mianning county, southwestern Sichuan, to photograph *Meconopsis wilsonii*, a magnificent blue poppy with a long, cylindrical panicle.

Its subspecies growing in Yunnan, *M. wilsonii* subsp. *australis*, has been collected several times by Chinese botanists and photographed by myself and a British traveler. The typical plant of the species, subsp. *wilsonii*, was, however, only once collected by E.H. Wilson in 1908 on a mountain in Baoxing county, western Sichuan, and at the time when Christopher Grey-Wilson published the plant as a new species in 2006, no one knew about the living plant of the typical plant.

I reported the rediscovery of *M. wilsonii* subsp. *wilsonii* together with Hang Sun and David E. Boufford in 2007 (*1). It was based on the specimens collected in Yele Nature Reserve in 2005, after some 100 years from the first collection, by the cooperated team between Kunming Institute of Botany, Chinese Academy, and Harvard University Herbaria, USA. I happened to examine the specimens and photos of the living plants taken by H. Sun and D.E. Boufford of this team, but I myself, having no chance to join the team, did not observe the plant in the field.

At first I entered Yunnan and visited Lijiang, an old town listed in the World Heritage of UNESCO, to call Tashi, a Tibetan boy living in a pastureland for yaks, Maoniuping, located on the northern foot of Yulong Xueshan. He was a reliable mountain guide and also an entertainer excellent at dancing and singing in a traditional style.

Accompanied by Tashi, I took an intercity bus to enter Sichuan at Panzhihua, and transferred to a northbound bus to reach Liziping, then went along a narrow road winding up a mountain flank by a taxi to meet Yue Minghua who was working at the office of Yele Nature Reserve located just below the newly constructed Yele dam.

Yue Minghua lived in a Yi-tribe village, Lamagetou, at the western corner of Yele valley. He owned a forestry lodge adjoining his house and we were to stay there at the night. I unfolded a regional map in his office and asked him which mountain we were able to climb for exploring plants including *M. wilsonii* subsp. *wilsonii* in this Nature Reserve. I wanted to start a trek to the mountain next day.

He told me in a dignified manner that we had to wait in his lodge at least three days to take a permission to enter the Nature Reserve, but it was no problem to climb a metalliferous mountain

located outside of the Nature Reserve without the permission and stay in a lodge of a large tent for miners to be supplied with beds and foods on the mountain. He added that the expedition team in 2005 had not climbed the mountain. I blurted out 'Lucky me!' because I expected some rare and unknown plants might grow in the metalliferous mountain.

Yue Minghua took us to his house by car together with his colleagues who carried three cases of beer. Unpaved roads around Lamagetou were seriously muddy with monsoon rains and scattered dung of yaks and sheep. After dark many villagers gathered in his house. Some of them carried a black piglet into a dark corner of a dining room and hauled four legs of the animal in every direction. A man with a butcher knife in his hand squatted in front of the exposed belly of the squeaking animal to be sacrificed.

Yue Minghua seated me at the head of a rude wooden table under a small light as a main guest of the banquet, which was, however, primarily hold to celebrate a success of his eldest daughter in an entrance examination for a collage at the first time in this region, and, to my relief, not to welcome us to this remote village. Chopped meats and some vegetables were boiled in a caldron and served in bowls arranged on the table together with cups of beer.

Yue Minghua's wife, a gravel-voiced woman, sang a unique melody of a folk song in a tradition of Yi-tribe and offered a small cup of baijiu, a terribly strong liquor, one by one to the attendants. Each villager who was served the liquor made the audience burst into laughter by a witty and probably sexy envoi. Tashi, as a substitute for me, sang a cheerful melody in a Tibetan tradition with a full-throated voice echoing throughout the house, and other two modern melodies as encores urged by the villagers.

Climbing the iron mine

Next day, after waiting long for a horseman who had a hangover, we started to walk toward north in the afternoon. At the end of a bumpy road trodden by dump cars appeared many plants of the *Meconopsis wilsonii* subsp. *wilsonii*. The plants were about to finish flowering and bore many ellipsoid fruits in the upper half of the cylindrical panicles. As climbing along a lift carrying iron ore, I saw some large plants of this type subspecies, nearly 2 m tall, growing on the half-shadowed edge of a mixed forest with numerous flowers still opened.

The plants seemed to be clearly different from the subsp. *australis* of the same species in the shape and the color of flowers and the shape of leaves. On the other hand, it seemed difficult for me to find any distinct character differentiating it from another plant of the same species recently introduced to a garden in Britain from Wumeng Shan, northern Yunnan, and caused disputes about its taxonomy among blue poppy enthusiasts. The latter plant was, however, to be published as a new subspecies, *M. wilsonii* subsp. *orientalis*, by Christopher Grey-Wilson and others in the spring of 2011 (*2).

At dusk we got to a large domed tent at 4,100m in elevation beside a mound of coals and surrounded by several barrel-roofed tents for miners to sleep. There was a big coal stove at the center of the domed tent and we were allocated to special beds for guests near the stove to sleep without sleeping bags.

Next morning, just after a fresh sunshine penetrated drifting fogs and reached to our feet, we began to explore the slope above our tent, and soon I noticed a small plant of *Meconopsis* bearing a brilliant magenta flowers and a few young fruits on scapes. The flower had only 4 petals; the fruits were

relatively large and obconical; the leaves were entire; the bristly hairs covering the plant had a thick and blackish base. I could not remember any scapose plant of *Meconopsis* having all these characters.

As we climbed higher, I saw more of the same plant rooting into a blackish soil among stratified rocks of shale on the slopes scattered with grasses and herbs. Some flowers of the plant had 5 or 6 petals in an irregular arrangement, and they were considered to be abnormal. Every plant appeared to be scapose, that is to say, with flowers singly born at the top of long scapes and without a stem exposed above the ground.

The plant looked like *Meconopsis impedita* at a glance. The latter species has, however, flowers with 5 or more (never 4), blue (not magenta) petals, and usually has pinnately lobed leaves. Therefore, the two plants seemed clearly different each other. I provisionally named the plant *M. pulchella* in order to avoid to call it with a contradictory name of a 'magenta-colored blue poppy'. The specific name 'pulchella' literally means small and pretty, but has an implication of a resemblance to *Primula pulchella* in the flower color. The plant was published on the Christmas Day of 2010 after cooperated studies with H. Sun and D.E. Boufford (*2).

A thermal insulator in *Meconopsis heterandra*

While photographing several plants of *M. pulchella* in the metalliferous mountain, I climbed a steep slope of boulders colored in reddish brown caused by iron, and glanced at a racemose blue poppy with prickly hairs growing beside a large rock above the reddish slope. At first I regarded the plant as a common species of prickly blue poppies in this region, either *M. rudis* or *M. racemosa*. In looking at the plant through my camera, however, I felt there was something different from these species.

After taking pictures, I examined the plant and got surprised by the sight of a flower in my hand, because the stamens of the plant looked to be divided into two groups, inner and outer, and the inner half of the stamens had curious filaments that were inflated like a insulating hollow fiber and curved inward all together to surround the ovary. I heard myself saying, 'what about that !'

Then, I changed the target of my search from *M. pulchella* to this strange plant. On the steep slopes near the ridge, I found more plants of the same taxon growing among rocks or at crevices or ledges of large rocks, and realized all the plants I examined had similar dimorphous stamens.

The plants had relatively large flowers, to 7 cm across, with usually 5, rarely 6 or 7, blue petals and never with 4 petals. The leaves were wider than the related species, *M. rudis* and *M. racemosa*, with usually 2-4 pairs of coarse teeth. The prickly hairs covering over the plant were hard, but thinner than the latter two species, with blackish thick bases that were not so prominent as those in *M. rudis*. Stigma at the top of style was much larger than the related species. The plants had 2-8 flowers in a raceme, but looked as if they were scapose because of the very short rachis of the raceme.

The unique character of the inflated filaments surrounding ovary was unknown in any species of *Meconopsis* except *M. henrici*. The latter species has, however, isomorphous (not dimorphous) filaments, which are flatly dilated and inwardly curved in the lower half to surround ovary, but are filiform and erect along the style in the upper half. Such a character of inflated or dilated filaments was considered to be not easy for the plants to acquire in their history of adaptation and enough to separate them from the related species as different species. I provisionally named this prickly blue poppy growing on the metalliferous mountain in Mianning as *M. heterandra*. 'Hetero' means to be differently shaped, 'andra' means stamens. The *M. heterandra* was to be published as a new species

together with *M. pulchella* in 2010 (*2).

An adaptation by the inflated filaments

We climbed southwest facing slopes, where pits for iron ore scattered, and reached the foot of a perpendicular rock wall at 4,500m in elevation. I looked up the wall and perceived many plants of *M. heterandra* growing along fissures of the rock face to a height where drifting fogs obscured the scenery. Fogs carried by the southwest summer monsoon blowing over the Yele valley were incessantly watering the plants growing on the slopes and the rock walls that seemed to have a scanty supply of underground water.

Such habitats as rocky slopes or fissures on the rock wall at a high alpine zone around 4,500m in elevation seemed quite severe for the plants growing there. They may be exposed to cool and wet updrafts of the monsoon and often covered with frozen dews at night, and also exposed to strong sunshine with an excess ultra-violet ray through a brake of fogs in the daytime. The most severe season for the plants would be early summer when they bear sensitive flower-buds.

I imagined that *M. heterandra* would have been adapted to such a severe climate in a long period of glacial ages and subsequent interglacial ages by an intricate device of the inflated inner filaments covering ovary to protect itself against cold winds, drastic changes of temperature, and also excess ultra-violet rays.

Flower-buds of the plants are preserved within the crevice of rocks owing to their short stalks and the short rachis of raceme. As the flowers begin to open, the flower-stalks begin to develop and rapidly increase the length to make them prominent for the eye of pollinators such as bumblebees that can fly against cold and strong winds. The bumblebees would assist diversifying genes to overcome drastic changes of temperature in the future.

Before returning to Yunnan, We explored a high mountain near Wuxuhai in Jiulong county to the west of Mianning, and then Jipo Shan in Muli county to the south for searching *Meconopsis heterandra*, but I found only the related *M. rudis*, and could not find any plant with the inflated filaments of a prickly blue poppy on both of the mountains. Then I visited the herbarium in Kunming Institute of Botany for searching the plant among specimens of *M. rudis* and *M. racemosa*, but it was quite difficult to examine the unique character on them because most of the stamens were already removed and the remnant of filaments were shriveled.

After returning to Japan, I noticed a photo of a prickly blue poppy in a calendar produced by Kazuo Mori, a founder of the Society for the Study of East-Asian Wild Plants, hung on a wall in my room, and was startled at the sight of a flower that had stamens separated into two groups, inside and outside. The plant was taken by himself on Balang Shan, western Sichuan, according to the photo-captation.

Then, I inspected all the photos of prickly blue poppies I had ever taken in the southwestern China, and realized that those taken in the limited area of western Sichuan including Balang Shan and Siguniang Shan had the stamens separated into two groups, and such stamens were unseen in all the photos taken anywhere out of this area. The inflated filaments similar to those of *M. heterandra* were observed in a flower falling petals by magnifying a digital image of the plant photographed on the Balang Shan.

Around the pass on a mountain range named Jiajin Shan located in a short distance to the southeast of Balang Shan grows a curious prickly poppy resembling to the Balang Shan plant except flower color that was a strange color of dark red. I perceived the inflated filaments also in the photos of the Jiajin Shan plant.

The area around Balang Shan and Siguniang Shan is one of the famous sightseeing spots in the western China. It is quite strange that no one, including me, visited there with an interest in blue poppies noticed the strange character of the stamens until now.

A prickly blue poppy on Balang Shan proved to be another new species !

After the death of Mao Zedong and the arrest of the Gang of Four who had led the Great Cultural Revolution, Chinese government invoked a so-called reform and open policy in various fields in the end of 1970s under the leadership of Deng Xiaoping. It was one of such policies that many high mountains in China was opened in 1980 to foreigners to climb the summit.

In response to this announcement, several Japanese mountaineering teams immediately set about applying to climb virgin peaks of the mountains. The highest peak of Siguniang Shan (6,250m) was first climbed in 1981 by the team of the Doshisha University. It was followed by brilliant first climbs of Gyalha Peri (7,294m) in 1985 and Namcha Barwa (7,822m) in 1990, but with some tragic disasters such as in Minya Konka, or Gongga Shan, in 1982 and Meili Xueshan in 1991.

Following the climbers aiming at the summits, travelers, trekkers and nature-lovers like me began to visit mountains in China. Siguniang Shan was one of the most well-known destinations in the western China for Japanese trekkers. The name of Siguniang Shan means a mountain range of four sisters; the highest peak is called Yaomei Feng, or a peak of the youngest sister, whereas the lowest peak at an elevation of 5,250m is called Daguniang Shan, or a peak of the eldest sister, to which most of mountaineering tour groups intend to climb.

My first visit to Siguniang Shan was in the late summer of 1992, and it took two days to reach the pass, Balang Shan, located at the entrance of Siguniang Shan, by car from the capital of Sichuan, Chengdu, after passing across some muddy places of unpaved roads and landslides by walk, although it will take only a half day today. I observed the prickly blue poppy on sunny slopes composed of shale and earth on Balang Shan and Daguniang shan.

Since then I visited this area around Balang Shan and photographed the prickly blue poppy there in some occasions, but determining a specific name of the plant was a difficult work for me, because the plant had been called *Meconopsis horridula*, *M. racemosa* or *M. rudis* by various botanists in these years. I thought the plant would be akin to *M. rudis*, but in the same time I felt something different in the shape and color of the plant from *M. rudis* when comparing the photos each other. Eventually I could not settle this taxonomy problem until I recognized a unique character of the inflated filaments in *M. heterandra* and in the photos of the blue poppy taken in the area around Balang Shan.

A field research for *Meconopsis balangensis*

In the mid July of 2010, the best season to see the flowers of the prickly blue poppy in question, I visited Balang Shan and Jiajin Shan to examine the plant in the fields and collect its flowering specimens for the Kunming Institute of Botany. Owing to a sense of purpose to distinguish the plant from the related species, I could at last recognize its unique features I had never noticed in the

previous visits.

As I had observed it in my photos beforehand, the prickly blue poppy growing on Balang Shan proved to have the inflated filaments similar to those of *Meconopsis heterandra*. Such a feature of the filaments, together with the large stigma and the rounded top of the fruit capsules of the plant, seemed to clearly differentiate it from the related *M. rudis*.

The Balang Shan plant looked to have a long rachis of raceme and short, ascending pedicels, similarly to *M. rudis*, and measured much taller than *M. heterandra*, which looked, however, as if it were scapose from a distant view because of the short rachis of raceme and the elongate, erect pedicels. Prickly hairs of the plant have thick and blackish bases similarly to those of *M. rudis*, but they are not so prominent as in the latter; the leaves of the plant are similar to those of *M. rudis*, but usually wider than the latter, whereas *M. heterandra* has leaves usually with 2-4 pairs of coarse teeth.

Meconopsis heterandra grows on a severe habitat with poor soil at rock-crevices or rock-shelves exposed to updrafts of the wet summer monsoon. *M. rudis* also grows on a severe habitat with poor soil, not less than those of the former, such as rocky slopes near the ridge exposed to the monsoon. Both species, *M. heterandra* and *M. rudis*, grow only on the western side of ridges exposed to the monsoon and never grows on the eastern side of the same ridge in my observations. On the other hand, the Balang Shan plant grows on a relatively mild habitat, such as unstable stony slopes composed of shale mingled with blackish soil, irrespective of a particular aspect.

I convinced the Balang Shan plant as a new species different from both of *Meconopsis heterandra* and *M. rudis*, and provisionally named it *Meconopsis balangensis*. The specific name derives from the locality, Balang Shan. The plant growing on Jiajin Shan proved to be different in its smaller stature and the narrower hairs as well as the much darker petals than the Balang Shan plant, so that I named it *M. balangensis* var. *atrata*. The varietal name 'atrata' means to be dark colored. These new taxa was published in the summer of 2010 after cooperated studies with H. Sun and D.E. Boufford (*3).

I thought *Meconopsis balangensis* would derive from a natural hybrid between *M. heterandra* and *M. rudis* by a good reason of its characteristics midway between these two species, and imagined a natural history of these species as follows. *M. heterandra*, provided with an insulation device of inflated inner filaments protecting ovary against a freezing cold weather, developed in a glacial epoch. In the following warm epoch, *M. rudis* tolerant toward a dry and hot weather became prosperous with an extended distribution. Some population of *M. heterandra* survived at unique habitats of rock-fissures and rock-shelves on isolated mountains in Mianning county and probably in the area around Balang Shan. Then, the plants on Balang Shan hybridized with *M. rudis* having extended the distribution toward north, and finally formed a new species of *M. balangensis*.

(*1) Yoshida, T., H. Sun and D.E. Boufford, 2007. *Meconopsis wilsonii* subsp. *wilsonii* (Papaveraceae) Rediscovered. *Acta Botanica Yunnanica* 29: 286-288.

(*2) Yoshida T., H. Sun & D.E. Boufford, 2010. New species of *Meconopsis* (Papaveraceae) from Mianning, southwestern Sichuan, China. *Acta Botanica Yunnanica* 32: 503-507.

(*3) Yoshida T., H. Sun & D.E. Boufford, 2011. New species of *Meconopsis* (Papaveraceae) from Balang Shan, western Sichuan, China. *Plant Diversity and Resources* 33: 409-413.



Meconopsis balangensis var. *atrata*,
2007. 7. 19, Jiajin Shan 3,95m



Meconopsis balangensis var. *atrata*,
2007. 7. 20, Jiajin Shan 3,950m



Meconopsis balangensis,
2007. 7. 19, Balang Shan, 4,500m



Meconopsis balangensis,
2007. 7. 19a, Balang Shan, 4,250m



Meconopsis pulchella,
2009. 8. 5, Mianning, 4,300m



Meconopsis heterandra,
2009. 8. 4, Minaning, 4,400m



Meconopsis heterandra,
2009. 8. 5, Mianning, 4,400m



Meconopsis heterandra, Flower,
2009. 8. 4, Minaning, 4,400m



Meconopsis balangensis, Flower,
2010. 7. 19, Balang Shan, ., 4,250m