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Taxonomy and phytogeography of the Scrophulariaceae of Mount Omei

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Mount Omei, the sacred mountain in the western part of Szechuan Province, is botanically one of the most collected areas in China. Its exceedingly rich vegetation was made known by early collectors like E. Faber, E. H. Wilson and others, whose explorations yielded many novelties in botany. Subsequently it was frequented by many other plant collectors and even up to the present, new species are still continuously being discovered from the mountain. Probably no other single locality in China has yielded as many new species as Mount Omei. Though Mount Omei is botanically a well known and classic collecting ground, little has been discussed on its phytogeographic significance. Situated on the eastern fringe of the highest plateau of the world and close to the Sino-Himalayan region in the southwest, it commands a strategic location in phytogeography. To the north it is not remote from the Tsing Lin which is itself an important landmark in floristic divisions. In the east lies the flora of central China which is characterized by the greatest concentration of temperate ancient ligneous stocks. The floristic relationships of Mount Omei with these various regions thus deserve worthy attention.

The scrophulariaceous flora of Mount Omei is a relatively rich one. Of the 49 genera found in China no less than 10 are reported to occur on Mount Omei. The number of species definitely known to be present is 23. This is not an impressive number as compared with the sum total of whole China as the extraordinary prolific genus *Pedicularis* is only little developed on Mount Omei. The genus comprises at least 285 species in China but only 5 are found on Mount Omei while hundreds of species are densely aggregated in the high mountains of northwestern Yunnan and southern Sikang, a region not distant from Mount Omei in its southwest.

Of the different species of the Scrophulariaceae found on Mount Omei, a number of them are wide-spread more or less weedy species of the warmer parts of Asia or of China alone. Species like *Mimulus tenellus* Bunge, *Mazus*

japonicus (Thunb.) Kuntze, *Torenia cordifolia* Roxb., *T. violacea* (Azoala) Pennell, *T. flava* Hamilton, *Lindernia nummularifolia* (D. Don) Wettst., and *L. antipoda* (L.) Alston all belong to this category. These species are generally of the lowlands, frequently of moist habitats and ascending on Mount Omei to heights of around 400-1200 meters, scarcely higher. Their presence thus reveals no particular floristic significance.

Similarly the several species of *Veronica* of Mount Omei are also of wide and common occurrence. These, however, are species of higher altitudes or of colder regions. *Veronica serpyllifolia* L. and *V. anagallis-aquatica* L. are especially wide-spread on mountain ranges of the northern hemisphere. Other species are of more restricted ranges extending from the Himalayas to western China or even to Japan. These species are generally of high altitudes, ranging from 2000-3700 meters. In China these species are present only in the mountainous western provinces.

The relationship of Mount Omei to the eastern Himalayas is shown by the presence of such species as *Calorhabdos brunnöniana* (Wall.) Benth. in both regions. However, this instance is not repeated and thus the bond is only weakly indicated. In the closely allied genus *Botryopleuron*, two species are found on Mount Omei, *B. venosum* (Hemsl.) Hemsl. and *B. stenostachyum* (Hemsl.) Hemsl. Both species extend eastward to central China, a fact which indicates that affinity with the latter area is even stronger than with the eastern Himalayas.

The very widely distributed species *Mimulus tenellus* Bunge is the extremely variable plant. Among the recognized varieties, *M. tenellus* var. *szechuenensis* (Pai) Li is known to occur in Shensi and Szechuan and var. *platyphylla* (Franch.) Li from the eastern Himalayas through northwestern Yunnan to Szechuan. Both varieties are found on Mount Omei, it being the southernmost extension of the range of the former and the northernmost extension of the range of the latter. Again it shows that the flora of Mount Omei is in part derived from sundry sources and consequently its affinities radiate toward different directions.

The more or less taxonomically isolated monotypic genus *Hemiphragma* is a plant characteristic of the high mountains of eastern Asia. The species *H. heterophyllum* Wall. occurs in the eastern Himalayas and western China in northwestern Yunnan, Sikang and Szechuan including Mount Omei at altitudes of 1000-3700 meters. It is also present disjunctly in the high mountains of Formosa and northern Luzon. Apparently when conditions were more favorable to the species in former times, the plant occupied larger and continuous areas and

at lower altitudes than is at present. The present disjunctive distribution is the result of climatic changes which enable the plant to survive only in these separate high mountain areas.

In the genus *Mazus* there are many wide-spread lowland species like *M. japonicus* (Thunb.) Kuntze and also a number of species of the higher altitudes with more or less restricted ranges. Among the latter are two species herein reported as new from Mount Omei, *M. neriiifolius* and *M. omeiensis*. These two species, so far as they are known, are confined only to Mount Omei and they occur at altitudes of about 1000-1800 meters. *Mazus japonicus*, on the other hand, ascends scarcely to 400 meters on Mount Omei. The presence of these endemic species indicates the independent nature of the flora of Mount Omei. The importance of the individualism of the Omeian flora can be further testified by an analysis of its *Pedicularis* population.

The genus *Pedicularis* is especially well developed in the high mountains of western China. Of the nearly three hundred species of the genus reported from China, no less than two-thirds are found in northwestern Yunnan and southern Sikang. These are mostly endemic species of very local occurrences. Their great and diverse specializations in floral structures point out that the excessive deployment of species in this area is geologically a relatively recent event. It is strange to note, however, the paucity of number on Mount Omei and that none of the species of the Yunnan-Sikang area, even the relatively more wide-ranged species, ever extend to Mount Omei, though geographically the area is closely proximal to Mount Omei.

In the north, in northern Szechuan and southern Kansu, the genus *Pedicularis* is also well developed, though not comparable to the Yunnan-Sikang area in the richness of species. There are many endemic species in this region, second in number only to the Yunnan-Sikang area. *Pedicularis Davidi* Frauch., however, is the only species that is found in southwestern Kansu and southern Shensi as in Szechuan including Mount Omei. It is a species of alpine meadows at altitudes of 2250-2350 meters and is of fairly common occurrence on Mount Omei. Its presence shows that the floristic relationship of Mount Omei with the north, weak as it is, is probably relatively stronger than with the south, though its distance is greater from the former than the latter.

Although Mount Omei is not richly endowed in species of *Pedicularis*, it is the center of development of a specialized, natural and more or less isolated group of the genus. The section *Pterioides* is characterized by very large radical fern-like leaves, relatively small cauline leaves, and more or less clustered

flowers. This section is specially developed in Szechuan, particularly on Mount Omei, with extensions of occasional species to western Hupeh in the east and northwestern Yunnan in the southwest. The section comprises of three series. Series Pteridifoliae contains but a single species, *P. pteridifolia* Bonati, endemic to Mount Omei only, occurring at altitudes of 800-1600 meters. Series Phaceliaefoliae has two species and a wider range. One of the species, *P. phaceliaefolia* Franch., found on Mount Omei, occurs in western Szechuan and northwestern Yunnan, at altitudes of 1600-3050 meters. The closely related *P. Far-gesii* Franch. has not been collected from Mount Omei but is found in eastern Szechuan and western Hupeh. Series Vagantes, with its only species *P. vagans* Hamsl., is also endemic to Mount Omei only, occurring at altitudes of 950-1900 meters. Besides the Pterioides, *Pedicularis omiiana* Bonati is another distinct species that is endemic only to Mount Omei, with a variety reported to occur on Mount Wa in the west.

Of the four species of the section Pterioides, three of them occur on Mount Omei, with two confined only to the mountain. Undoubtedly Mount Omei is the center of origin and development of the group. This section is well characterized by the large radical fern-like leaves, the species all show close and clear affinities. Within the group, the corolla exhibits considerable variation. There are corollas with pointed galea, short conical beak, cylindric straight beak, and slender curved beak. This shows the long establishment of the group in this area and that considerable amount of evolution has been undergone in this group.

In addition to the presence of this specialized group on Mount Omei, particularly notable is the conspicuous contrast between the number of species in the Yunnan-Sikang area and that in the Omei area. While only 5 species are known from Mount Omei, hundreds of species are present in the former. The extremely variable floral structures indicate that in the former area, the genus *Pedicularis* has undergone and is probably still undergoing at present active processes of speciation. The great difference in the *Pedicularis* floras thus clearly shows the dissimilarity in the habitats of the two areas, Yunnan-Sikang and western Szechuan, and the discontinuity in their floristic affinities.

To summarize, the phytogeography of scrophulariaceous plants of Mount Omei reveals that the flora of western Szechuan with Mount Omei as its probable center and its indicator, is characterized by the presence of many elements peculiar to itself. Its closest affinity is with the east, with eastern Szechuan and western Hupeh, where the characteristic Chinese flora is best developed. Some relationship with the north, with northern Szechuan, southern Kansu, and

southern Shensi, is also indicated. It is, however, manifestly different from the flora of northwestern Yunnan and southern Sikang, and they suggest only little similarities and relationships. It is presumed that geologically the latter area is more recently evolved, and it thus offers new and weird habitats favoring the multiplication of species in some groups of plants. The western Szechuan area, on the other hand, is more stable and settled, and is comparable in this respect, though to a lesser degree, to the central China area in the east.

The following is an account of the species of the Scrophulariaceae of Mount Omei as actually studied by the present writer. The material is based on specimens deposited at the different herbaria enumerated below, to whose curators the writer wishes to tender his thanks for their kind cooperation. He is particularly grateful to Dr. W. P. Fang of the Department of Biology of the National Szechuan University, who generously sent to the writer scrophulariaceous plants collected by himself and his associates from Szechuan. Abbreviations for the different herbaria where the examined specimens are in deposition are as follows:

AA Arnold Arboretum of Harvard University.

ANSP Academy of Natural Science of Philadelphia.

GH Gray Herbarium of Harvard University.

NTU National Taiwan University.

NYBG New York Botanical Garden.

UCLA University of California at Los Angeles.

USNH United States National Herbarium.

Mimulus (L.) Linnaeus

1. **Mimulus tenellus** Bunge, *Enum. Pl. Chin. Bor.* 49. 1833; Forbes & Hemsley in *Journ. Linn. Soc. Bot.* 26: 181. 1890; Hand.-Maz., *Symb. Sin.* 7: 832. 1936.

Mimulus nepalensis Benth. in Wall., *List. No.* 3917. 1829, in *Scroph. Ind.* 29. 1835; Grant in *Ann. Missouri Bot. Gard.* 40: 207. 1924; Pai in *Contr. Instr. Inst. Bot. Nat. Acad. Peiping* 2: 118, 185. 1934.

Moist places or stream-sides, at altitudes of 350-2100 meters, widely distributed from eastern India to China and Japan. Flowers yellow. Flowering from April to July.

Mount. Omei: *E. Faber* 678 (NYBG), 783 (NYBG), 993 (NYBG), *T. C. Peng* 39 (AA), *W. P. Fang* 16389 (NTU), 17584 (NTU), *C. L. Chow* 5804 (NTU), 5871 (NTU), 14361 (NTU).

This is a widely distributed species in eastern Asia. It is a variable plant and most authors now consider the plant as described by Bunge from northern China and that named by Wallich from India as conspecific. Several varieties

are recognized among which the followings are also known from Mount Omei.

1a. **Mimulus tenellus** var. **szechuanensis** (Pai) comb. nov.

Mimulus szechuanensis Pai in Contr. Inst. Bot. Nat. Acad. Peiping 2: 119. 1934.

Mimulus szechuanensis Pai var. *glandulosa* Pai, l. c. 120, 189, 1934.

Mount Omei: *W. P. Fang* 2645 (USUH), 12609 (AA).

Mimulus szechuanensis Pai is based on *Fang* 2646 from Mount Omei, a duplicate of which is observed. *M. szechuanensis* var. *glandulosa* is based on *Kung* 3135 from Shensi. Handel-Mazzetti was of the opinion, and I concur, that *M. szechuanensis* Pai can at most be considered as a variety of *M. tenellus* Bunge. It differs from the typical form of the species only in the oblique calyx bearing unequal teeth in the more matured specimens.

1b. **Mimulus tenellus** var. **Platyphylla** (Franchet) comb. nov.

Mimulus nepalensis Benth. var. *platyphylla* Franch. in Nouv. Arch. Mus.

Hist. Nat. Paris II. 10: 65. 1888 (Pl. David.); Diels in Bot. Jahrb. 36.

Beibl. 82: 96. 1905.

Mimulus nepalensis Benth. f. *major* H. Winkl. ex Limpricht in Rep. Sp. Nov. Beih. 12: 480. 1922.

Mimulus nepalensis Benth. var. *procerus* Grant in Ann. Missouri Bot. Gard. 40: 207. t. 3. f. 2. 1924.

Mimulus tenellus Bunge var. *procerus* Hand.-Maz., Symb. Sin. 7: 832. 1936.

Mimulus tenellus Bunge var. *major* Hand.-Maz., l. c. 833.

Stream sides at altitudes of 1300-3800 meters, in Sikang, Szechuan, northwestern Yunnan, Upper Burma, and Sikkim Himalaya. Flowers yellow. Flowering from May to August.

Mount Omei: *W. P. Fang* 16439 (NTU), 13769 (NTU), *C. L. Sun* 2151 (NTU).

This variety was described as var. *procerus* Grant in her monograph. Grant overlooked the fact that this large-leaved and large-flowered form of the species had been previously described as var. *platyphylla* Franchet in 1888 and again as f. *major* by H. Winkler, not being aware of Franchet's earlier name in 1922. In this variety, the upper leaves are sessile. In general appearance this plant resembles closely *M. sessilifolius* Maxim. of Japan.

Mazus Loureiro

1. **Mazus japonicus** (Thunb.) Kuntze, Rev. Gen. 462. 1891; Hand.-Maz., Symb. Sin. 7: 833. 1936.

Lindernia japonica Thunb., Fl. Jap. 253. 1784.

Mazus rugosus Lour., Fl. Cochinch. 385. 1790; Forbes & Hemsl. in

Journ. Linn. Soc. Bot. 26: 181. 1890; Pai in Contr. Inst. Bot. Nat. Acad. Peiping 2: 189. 1934.

Moist swampy places, in India, China, Japan, south to the Philippines and Java, ascending to a height of 400 m. on Mount Omei. Flowers purplish. Flowering from March to June.

Mount Omei: *E. Faber* 782 (NYBG), *W. P. Fang* 13222 (TIU), 13972 (NTU), 14002 (NTU), 14130 (NTU), *C. L. Chow* 5621 (NTU), 5803 (NTU).

This is a widely distributed species with considerable variation in its size, leaf shapes, etc. In China, it occurs commonly from Shangtung, Hupeh to Szechuan southward to all warmer provinces of the country.

2. **Mazus neriifolius** sp. nov.

Planta parva, circiter 12 cm. alta, glabra vel glabrescente, estolonosa, acauliscente vel subcaulescente, rhizomate elongata, dense bracteata; follis omnino basalibus, numerosis, caespitosis, longe petiolatis, petiolis 1.5-2.5 cm. longis, plus minusve alatis, margine glabris vel parce ciliatis, laminis chartaceis, utrinque glabris, lanceolatis, circiter 5-9 cm. longis, 6-11 mm. latis, apice obtusis vel subrotundatis, margine et superne remote serratis, et integris, basi in petiolis longe attenuatis; scapis singularibus, elongatis, basalibus gracilibus, ad 20 cm. longis, glabris, efoliatis, ad apice 5-floris, pedicellis gracilibus, 0.5-2 cm. longis, minute puberulis vel glabrescentibus; bracteis lanceolatis, acuminatis, 3-5 mm. longis, glabris vel puberulis; calycibus infundibularibus, parce pubescentibus, 5-7 mm. longis, 3-3.5 mm. latis, superne minute 5-lobatis, lobis triangularibus, acutis, haud 1 mm. longis; corolla purpurea (?), circiter 20 mm. longa, extra glabra, intus palato pilosa, tubo circiter 10 mm. longo, 4 mm. lato, dimidio superiore ampliato, labio superius 5 mm. longo, anguste triangulari-ovato, apice bifido, inferiore triplo longiore, ad 15 mm. longo, infra dimidio trilobo, lobis subrotundatis medio quam laterales longiore et subduplo-angustiore; filamentis glabris, inclusis vel superiore a fauce paulo exsertis; stylis inclusis; fructis ignotis.

Mount Omei: Lung-men Tung, *C. L. Chow* 5678, March 31, 1942, (Type, NTU).

This species, though represented by a single collection, is nevertheless a distinct one. Its long narrow lanceolate leaves and long rhizome densely covered by scales are characteristic. It is apparently closely related to the following new species but is readily distinguished by its narrow leaves. The color of the corolla is not indicated on the field label, but judging from the preserved state, it is probably purplish or rose.

3. **Mazus omeiensis** sp. nov.

Planta parva, ad 13 cm. alta, glabra vel parce pubescente, estolonosa, acauliscente vel subcaulescente, rhizomate elongata, radicibus longis fibrosis laxo ramosis; follis basalibus, subcaespitosis, subsessilibus vel petiolatis, petiolis ad 20

mm. longis, glabris vel ciliatis, distincte alatis, lamina linearis-ovatis vel linearis-obovatis, ad 10 cm. longis et 3.5 cm. latis, tenuiter chartaceis, utrinque glabris vel tenuiter ciliatis, apice late rotundatis, margine grosse distincte crenatis, basi intergis, in petiolis longe attenuatis; scapis basalibus, gracilibus, ad 23 cm. longis, glabris vel parve ciliatis, efoliatis, superne laxe 5-8-floris, pedicellis gracilibus, ad 1.5 cm. longis, puberulis; bracteis membranaceis, linearibus, acuminatis, 3-5 mm. longis, glabris vel puberulis; calycibus infundibularis, glanduloso-pubescentibus, 6-7 mm. longis, 5-7 mm. latis, superne 5-lobatis, lobis triangularibus, acutis, circiter 2 mm. longis; corolla purpurea, circiter 20 mm. longa, extralabrum, intus palato pilosa; tubo circiter 10 mm. longo, 4 mm. lato, dimidio superne ampliato, labio superius circiter 5 mm. longo, anguste triangulari-ovato, apice bifido, inferiore triplo longiore, ad 15 mm. longo, infra dimidio trilobo, lobis rotundatis medio quam laterales longiore; filamentis glabris, inclusis vel superiore a faucibus exsertis; stylis inclusis; fructis ignotis.

Mount Omei: Shiang-shu Tu, *W. P. Fang* 18252, April 1, 1942 (Type NTU); Chiu-lau Tung, *W. P. Fang* 14697, May 19, 1940, alt. 1800 m. (NTU); Hsien-sing Su, *W. P. Fang* 15892, March 19, 1941 (NTU); Ti-shang An, *W. P. Fang* 16149, April 12, 1942 (NTU); Pien-tan Yen, *W. P. Fang* 18441, April 20, 1942, on cliffs, alt. 1000 m. occasional (NTU); Cha-chi Wan, *W. P. Fang* 18583, April 28, 1942 (NTU); Hung-chuang Ping, *C. L. Sun* 2128, March 21, 1940 (NTU).

Mazus omeiensis, judging from its numerous collections, may not be an uncommon plant on Mount Omei. This species and *M. nerifolius* are related with *Mazus japonicus* (Thunb.) Kuntze and *M. Delavayi* Bonati, but they are readily distinguished by their aculeate habit. With *M. Lecomte* Bonati of northwestern Yunnan, the two are also closely related, but the latter is a densely hirsute plant with more numerous flowers.

Mazus omeiensis differs from *M. nerifolius* in the much broader, thinner, rounded leaves with shorter petioles, in the more deeply lobed calyx with glandular pubescence, and in the more rounded lobes of the lower corolla-lip.

Torenia Linnaeus

1. ***Torenia cordifolia*** Roxburgh, Pl. Corm. 2: 52. t. 161, 1760; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 187. 1890; Hand.-Maz., Symb. Sin. 7: 837. 1936.

Mountain slopes to altitudes of 850-1900 meters, in northern India, China, Burma, and Java. Flowers purple. Flowering from July to September.

Mount Omei: *E. Faber* 679 (NYBG), 680 (NYBG), 994 (NYBG), *C. L. Chow* 7063 (NTU).

Species of *Torenia* are generally not sharply marked or characterized and are especially difficult to distinguish in their dried state. The several species

that occur on Mount Omei are all widely distributed ones of the warmer parts of Asia. On the mountain they may ascend to a height of 600-700 meters or sometimes even to 1200 meters.

2. **Torenia violacea** (Azoala) Pennell in Journ. Arnold Arb. 24: 255. 1943.
Mimulus violaceae Azoala ex Blanco, Fl. Filip. ed. 2. 357. 1845.

Torenia peduncularis Benth. in Wall., List No. 3956. 1831, *nomen nudum*, ex Hook. f., Fl. Brit. Ind. 4: 276. 1884; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 189. 1890.

A. weedy plant, wide-spread in India, Malaysia, and southern China. Flowers bluish. Flowering from August to October.

Mount Omei: *W. P. Fang* 2431 (USNH), 3247 (USNH), 3271 (USNH), *Y. S. Liu* 1485 (AA), *T. C. Peng* 4 (AA), *K. N. Yin* 150 (AA), *W. F. Fang* 17654 (NTU), 17640 (NTU), *C. L. Chow* 6713 (NTU), 6993 (NTU).

This is a suberect much branched plant with pale bluish flowers and is widely distributed in the lowlands of southern Asia. On Mount Omei it ascends to an altitude of 650 meters.

3. **Torenia flava** Hamilton ex Benth., Scroph. Ind. 38. 1835; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 188. 1890.

Sides of fields to altitudes of 900-1200 meters, in eastern India, southern China and western Malaysia. Flowers yellow. Flowering in August. On Mount Omei, it occurs at an altitude of about 1200 meters.

Mount Omei: *W. P. Fang* 3271 (NYBG), 17615 (NTU).

Lindernia Allioni

1. **Lindernia nummularifolia** (D. Don) Wettst. in Engl. & Prantl, Nat. Pflanzenf. 4 (36): 29. 1895; Hand.-Maz., Symb. Sin. 7: 837. 1936.

Vandellia nummularifolia D. Don., Prodr. Fl. Nep. 86. 1825; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 190. 1890.

India, Burma, and western China (Hupeh, Szechuan, Yunnan); road sides along streams, or on grassy slopes, up to an altitude of 1700 meters. Flowers light purplish. Flowering from July to November.

Mount Omei: *E. Faber* 320 (NYBG), *C. Y. Chiao* & *C. S. Fan* 334 (AA), *T. C. Peng* 1 (AA).

2. **Lindernia antipoda** (L.) Alston, Fl. Ceylon 6: 214. 1931; Pennell in Journ. Arnold Arb. 20: 81. 1939.

Ruellia antipoda L., Sp. Pl. 635. 1753.

Bonnaya reptans Spreng., Syst. Veg. 1: 41. 1825; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 192. 1890.

Illysanthes antipoda Merrill in Interp. Rumph. Herb. Ambion. 467. 1917, in Lingnan Sci. Journ. 5: 166. 1927; *Pai* in Contr. Inst. Bot. Nat. Acad.

Peiping 2: 193. 1934; Hand.-Maz., Symb. Sin. 7: 838. 1936.

Moist places and watersides, throughout India, Ceylon, Malaysia to southern China, Formosa and the Liukius. Flowers purple. Flowering from June to September.

Mount Omei: *C. Y. Chiao & C. S. Fan 137* (AA).

This plant, commonly known as *Bonnaya reptans* (Roxb.) Spreng., should be given the older name *Lindernia antipoda*. See Pennell l. c. for full discussions.

Scrophularia [Bauhin] Linnaeus

1. **Scrophularia microdonta** Franch. in Bull. Soc. Bot. France 47: 11. 1907; Stiefelbogen in Bot. Jahrb. 44: 458. 1910.

Szechuan. Flowers purple. Flowering in August.

Mount Omei: *C. Y. Chiao & C. S. Fan 430* (AA), *W. P. Fang 19075* (NTU), fruiting specimen).

Franchet's type is a Farges collection from eastern Szechuan. The above determinations are based on Franchet's original description. This is a species related to *S. ningpoensis* Hemsl. of coastal southeastern China and *S. grayana* Maxim. of Hopei, Manchuria, and Japan. It can be distinguished from both by its shorter petiolate leaves very finely denticulate on the margins.

Hemiphragma Wallich

1. **Hemiphragma heterophyllum** Wall. in Trans. Linn. Soc. London 13: 612. 1822; Fores & Hemsl. in Journ. Linn. Soc. Bot. 26: 193. 1890.

Eastern Himalaya to mountains of northern Yunnan and adjacent regions of Sikang and Szechuan, also in the high mountains of Formosa and northern Luzon. At altitudes of 1000-3700 meters, on mountain slopes and alpine woods. Flowers pink. Flowering from May to June.

Mount Omei: *C. Y. Chiao & C. S. Fan 828* (AA).

This high montane species has widely disrupted areas in northern India, western China, and also in the islands Formosa and Luzon. It is a monotypic genus of anomalous status in the Scrophulariaceae.

The plant is unique also in the dimorphism of the leaves. The large foliage leaves are those of the warm wet season of the year and the small subulate ones are those of the cool dry season.

Veronica [Bauhin] Linnaeus

1. **Veronica serpyllifolia** L., Sp. 12. 1753; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 200. 1890; Pai in Contr. Inst. Bot. Nat. Acad. Peiping 12: 198. 1934.

Stream sides and moist shady mountain slopes, wide-spread in the mountain ranges of the northern hemisphere. In China it is confined to the western parts of the country (Szechuan,

Hupei, Sikang, and Yunnan), at altitudes of 2300-3700 meters. Flowers violet blue. Flowering from April to June.

Mount Omei: *E. Faber* 298 (NYBG), *W. P. Fang* 16201 (NTU), 18822 (NTU), *C. L. Chow* 5911 (NTU), 6599 (NTU).

A repent plant with ovate or ovate-oblong, obscurely crenate leaves. It is a species of the cold regions and in China it occurs only at high altitudes in the mountainous western part of the country.

2. ***Veronica capitata*** Royle ex Benth., *Scroph. Ind.* 45. 1835.

Grassy slopes or ravines at altitudes of 2700-4200 meters, in the eastern Himalayas, Tibet, and western China. Flowers bluish. Flowering in July.

Mount Omei: *W. P. Fang* 12973 (AA).

This is also an alpine plant with a more or less densely hairy habit. The stems are short, suberect and simple. The flowers form a terminal head or umbel in the axils of the uppermost pairs of leaves.

3. ***Veronica cana*** Wall., List No. 401. 1829, *nomen nudum*; Benth., *Scroph. Ind.* 45. 1835; Forbes & Hemsl. in *Journ. Linn. Soc. Bot.* 26: 198. 1890.

Widely distributed from the Himalayas, western China (Szechuan and Yunnan), to Formosa and Japan. In western China, it occurs at altitudes of 2000-3000 meters. Flowers yellow. Flowering in April.

Mount Omei: *W. P. Fang* 16222 (NTU), *C. L. Chow* 5979 (NTU).

This species have long racemed flowers and characteristically laterally acute capsule-lobes.

4. ***Veronica anagallis-aquatica*** L., *Sp. Pl.* 12. 1753; Forbes & Hemsl. in *Journ. Linn. Soc. Bot.* 26: 198. 1890.

Wide-spread in Europe, Africa, and Asia. In China along streams and ditches at altitudes of 400-4300 meters. Flowers blue. Flowering in June and July.

Mount Omei: *C. L. Chow* 5916 (NTU), 6262 (NTU).

Calorhabdos Bentham

1. ***Calorhabdos brunnoniana*** (Wall.) Benth., *Scroph. Ind.* 44. 1835.

Veronica? *brunnoniana* Wall., List No. 405. 1828.

"*Calorhabdos sutchuenensis*" *sensu* Pai in *Contr. Inst. Bot. Nat. Acad. Peiping* 2: 202. 1934, *non* Franch.

Mountain slopes and ravines, at altitudes of 2100-4000 meters, from the eastern Himalayas to northwestern Yunnan and southwestern Szechuan. Flowers greenish to yellowish. Flowering in August and September.

Mount Omei: *W. P. Fang* 12775 (AA, USNH), *C. Y. Chiao & S. S. Fan* 516 (AA), 788 (AA), *T. C. Peng* 129 (AA).

Pai identified *Fang* 2775 from Mount Omei as representing *C. sutchuenensis* Franch. The latter species occurs only in eastern Szechuan and western Hupei,

much farther north than the range of *C. brunnoniana*. *C. sutchuensis* is very closely related to *C. brunnoniana*, but the former has decurrent leaves which are more distinctly and sharply serrulate than in the latter.

Botryopleuron Hemsley

1. **Botryopleuron venosum** (Hemsl.) Hemsl. in Hook., Icon. Pl. 27: t. 2670 1900; Pai in Contr. Inst. Bot. Nat. Acad. Peiping 2: 209. 1934.

Calorhabdos venosa Hemsl. ex Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 197. 1890.

Hillsides and shaded ravines, in western and central China. Flowers purple. Flowering from July to September.

Mount Omei: *W. P. Fang* 2396 (ANSP), 2439 (ANSP), 3109 (ANSP) 5310 (ANSP, NYBG), 5798 (AA, ANSP), 12520 (AA), *C. Y. Chiao & C. S. Fang* 6 (AA), *Y. S. Liu* 1537 (AA), 1546 (AA), *K. N. Yin* 190 (AA), *T. C. Peng* 27 (AA), *W. K. Hu* 8519 (NTU), 8945 (NTU), 9104 (NTU).

2. **Botryopleuron stenostachyum** (Hemsl.) Hemsl. in Hook., Ic. Pl. 27: sub. t. 2670. 1900; Pai in Contr. Inst. Bot. Nat. Acad. Peiping 2: 203. 1934.

Calorhabdos stenostachya Hemsl. ex Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 196. 1890.

Shaded slopes at altitudes of 1100-1300 meters, in Sikang, Szechuan, western Hupeh, Kiangsi and Hunan. Flowers white. Flowering in July and August.

Mount Omei: *E. Faber* 589 (NYBG), *C. Y. Chiao & C. S. Fan* 101 (AA).

Botryopleuron venosum and *B. stenostachyum*, two closely related species, are very similar in their general appearance. Both have long and narrow leaves varying to oblong-ovate. The inflorescences are all long and slender, with the flowers sometimes loosely arranged. In general, *B. venosum* has more conspicuously veined leaves with sharper and more distinct serrations, with relatively shorter inflorescences, and with purplish instead of whitish flowers. The racemes of *B. venosum* are up to 3-5 cm. long, while those of *B. stenostachyum* may attend to a length of 10 cm.

Pedicularis Linnaeus

1. **Pedicularis Davidi** Franch. in Nouv. Arch. Mus. Hist. Nat. Paris II. 10: 67. 1888 (Pl. David. II); Limpricht in Rep. Sp. Nov. 20: 247. 1924.

Alpine meadows at altitudes of 2250-2350 meters in southwestern Kansu, southern Shensi, and Szechuan. Flowers purple. Flowering from June to August.

Mount Omei: *E. H. Wilson* 5078 (UCLA), *E. Faber* 184 (NYBG), *W. P. Fang* 2287 (GH), 2289 (GH), 2942 (ANSP, GH, USNH) 17296 (NTU), *Y. S. Liu* 1252 (AA), *T. C. Peng* 118 (AA), *K. N. Yin* 131 (AA), *C. Y. Chiao & S. C. Fan* 670 (AA), 817 (AA), *C. L. Chow* 6988 (NTU);

T. C. Lee 3512 (NTU), *C. L. Sun 1136* (NTU).

This species has pinnatisect leaves and a long and slender beak (6-7 mm.) on the corolla, which is distinctly coiled. Mount Omei represents the southernmost extension of the range of the species. A related species, *P. torta* Maxim., frequently confused with the present species in the herbaria, has a similar range but it has never been collected in Mount Omei. In *P. Davidi*, the galea of the corolla is twisted at its base and the color of the corolla is purple. In *P. torta*, the galea is twisted near its base and the corolla is yellow. Another species of close affinity is *P. oxycarpa* Franch. This species has a more southerly range, occurring at high altitudes in northwestern Yunnan and southern Sikang. It has a white corolla with a purple galea but with the untwisted.

2. ***Pedicularis pteridifolia*** Bonati in Kew Bull. 1908: 252. 1908; Limpricht in Rep. Sp. Nov. 20: 228. 1924.

Known from Mount Omei only, at altitudes of 800-1600 meters. Flowers yellow. Flowering in September and October.

Mount Omei: *Y. S. Liu 1710* (AA), *C. L. Chow 6767* (NTU), *7020* (NTU).

A strongly characterized species with large, radical fern-like leaves and an erect, almost leafless stem. The leaves are long-petiolate, pinnatisect, with 7-9 pinnatifid segments. The subsessile flowers are in terminal short spikes, with a corolla bearing pointed but not beaked galea.

This species resembles *P. vagans* Hemsley, but the latter has leaves with 11-12 pairs of segments, long, slender, trailing to scandent stem bearing radical and cauline leaves, densely clustered flowers, and distinctly conical-beaked corolla.

3. ***Pedicularis phaceliaefolia*** Franch. in Bull. Soc. Bot. France 47: 27. 1900; Limpricht in Rep. Sp. Nov. 20: 239. 1924; Pai in Contr. Inst. Bot. Nat. Acad. Peiping 2: 215. 1934.

Mountain slopes at altitudes of 1600-3035 meters, in northwestern Yunnan and western Szechuan. Flowers white. Flowering in August.

Mount Omei: *W. P. Fang 2644* (AA, GH, USNH), *C. Y. Chiao & C. S. Fan 472* (AA), *T. C. Lee 3385* (NTU).

This species was originally described from northwestern Yunnan. It has large, very long-petiolate, radical, pinnatisect leaves, which are sometimes not collected with the flowering specimens. The stems are simple or few-branched above, erect or suberect, and bearing a few leaves. The flowers are compactly arranged, short-pedicellate, and with a galea ending in a distinct slender beak.

A closely related species, *P. Fargesii* Franch., with very similar vegetative and floral characters, occurs in eastern Szechuan and western Hupeh in the east, but it has not been collected from Mount Omei. It can be distinguished from

the former by the thinner leaves, longer calyx, pink corolla with a longer tube and a more or less straight beak which extends forward at right angles with the lower part of the galea. In *P. phaceliaefolia*, the beak curves downward, and is parallel to the lower part of the galea.

4. ***Pedicularis vagans*** Hemsley ex Forbes & Hemsley in Journ. Linn. Soc. Bot. 26: 218. 1890, in Hook., Ic. Pl. 20: 1928. 1891, Limpricht in Rep. Sp. Nov. 20: 232. 1924.

Known from Mount Omei only, in thickets at altitudes of 950-1900 meter. Flowers pink. Flowering in July.

Mount Omei: *E. Faber 183* (UCLA), *E. H. Wilson 5081* (ANSP), *W. P. Fang 2623* (ANSP; GH, USNH), *F. T. Wang 23332* (AA), *T. C. Peng 83* (AA), *C. Y. Chiao & C. S. Fan 543* (AA), *C. L. Sun 695* (NTU), *G. L. Chow 6686* (NTU).

A very distinct and striking plant with large, long-petiolate fern-like, radical leaves and long, slender more or less prostrate stems bearing small cauline leaves and clusters of flowers on short lateral branches. The large basal leaves are sometimes not collected with the flowering specimens. The flower is characterized by its long-tubular calyx, distinctly conical-beaked corolla with broad and long lower lip which is longer than the beak. In some specimens, compact clusters of flowers are found on very short branches near the base of the large radical leaves suggesting the possibility of cleistogamy.

5. ***Pedicularis omiiana*** Bonati in Bull. Soc. Bot. France 54: 184, 375. 1907; Limpricht in Rep. Sp. Nov. 20: 257. 1924; Pai in Contr. Inst. Bot. Nat. Acad. Peiping 2: 215. 1934.

Mount Omei: *E. H. Wilson 5079* (UCLA).

This distinct species has large pinnatisect radical leaves and much smaller pinnatifid cauline leaves, a condition resembling that in the group of *Pedicularis vagans*. In their floral characters, however, the two are quite different. *Pedicularis omiiana* has an erect, long corolla-tube, attaining to four times the length of the calyx, and a cylindric, erect, and upraised beak. It is thus more advanced than any other species of Mount Omei, and may possibly be derived from these more primitive ones.

Bonati also described a variety *diffusa*, with procumbent stem, from Mount Wa in western Szechuan at an altitude of about 3200 meters. It is known from the original collection only.

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