
New combinations for the varieties of *Sinopodophyllum hexandrum*

J.M.H. SHAW

c/o Botany Department, RHS Garden Wisley

While in the monograph on *Epimedium* Stearn (2002) considered that there were two genera in the *Podophylloideae*, *Diphylleia* and *Podophyllum*, some other workers divide *Podophyllum* into three genera: *Podophyllum* confined to *P. peltatum*, *Dysosma* for the Eastern Asiatic taxa, and *Sinopodophyllum*, for the Himalayan plant often known as *Podophyllum hexandrum*. The decision to recognise *Sinopodophyllum* is based on several characters that are often used at generic level. While some of these characters are associated with the breeding system, such as pollen exine sculpture and pollen grains released in tetrads, other characters appear more fundamental, including the unique shape of the first leaf which is always palmately trilobed, ovule orientation, and seed shape and structure. These morphological characters provided the basis for Ying (1979) to establish *Sinopodophyllum*.

Several molecular studies have concluded that the *Podophylloideae* is monophyletic including Liu *et al.* (2002) and Wang *et al.* (2007). Kim *et al.* (2003), using the chloroplast gene *ndhF*, also inferred the monophyly of the *Podophyllum* group, and found that the *Sinopodophyllum*-*Dysosma* clade was more closely related to *Diphylleia* than to *Podophyllum peltatum*. Gong *et al.* (2006) have shown that chloroplast *trnD-trnT* region can be used to separate *S. hexandrum* from *Dysosma* spp. More detailed studies that include representatives of all four genera in the *Podophylloideae* along with a greater number of DNA sequences are needed to resolve the relationships within this group.

Much attention has been focused on investigating the relationship between the North American *P. peltatum* and the Asiatic *S. hexandrum*, probably influenced by the many studies in this remarkable disjunction. In fact, Ma and Hu (1997) concluded from their analysis that there was "no direct relationship between *Podophyllum* and *Sinopodophyllum*", which appears to be an overstatement, when morphological and phytochemical data are considered. It would be more informative to focus on the relationship between *P. peltatum* and the *Dysosma* group which have most characters in common. The only consistent characters separating these entities are the elongated internodes of the rhizome and extra stamens present in *P. peltatum*. Hybrids between *P. peltatum* and species of section *Dysosma* have been obtained by several investigators without difficulty.

Sinopodophyllum hexandrum (Royle) T. S. Ying has long been recognised as a very variable taxon. This has recently been studied by Sultan *et al.* (2008) using genetic and phytochemical markers. Their work has revealed a strong correlation between phytochemistry and DNA polymorphism, and demonstrated that morphologically distinct accessions are distinguishable using phytochemistry and by molecular methods. It is therefore useful to establish the correct names to use for the infraspecific taxa.

Wallich, who first proposed the name *Podophyllum emodi* for the species in 1824, also added a variety *royleana* [sic] for the variant with dissected leaflets. However, as both names were published without a description they are invalid as *nomina nuda*. Royle (1834) published the name *Podophyllum hexandrum* and also recognised two taxa. He applied the name *P. emodi* Wall. to the plant with a trilobed leaf and described his *P. hexandrum* as having "leaves 3- or 5-lobed, with the lobes narrowly acute and serrulate towards the apex". This description no doubt influenced Soejarto *et al.* (1981) in choosing the dissected leaved specimen on the right hand side of Royle's herbarium sheet when lectotypifying *P. hexandrum*. There is

no doubt therefore that plants with deeply dissected leaf lobes are correctly var. *hexandrum*.

Chatterjee & Mukerjee (Chatterjee, 1953) described a number of varieties attributed to *P. emodi* (a synonym of *S. hexandrum*) based on foliar characters and position of the flower. In addition to accepting the two distinctive leaf shapes as the basis for varieties, they also recognised a var. *jaeschkei* based on a specimen with the leaf still partly folded and unexpanded; a var. *bhootanense* with the flower inserted just below the upper leaf lamina; and a var. *axillare* with the flower inserted in the axil between the two petioles. These varieties were transferred to *P. hexandrum* by Browicz (1973).

Due to the sympodial organisation and vasculature of the aerial shoot in *Sinopodophyllum* the point at which the flower is inserted along the petiole is very unstable. A single individual plant may produce several aerial shoots bearing the flower in different positions that range from near the axil to just under the leaf lamina. This has been investigated by Martin (1958) and is discussed further in Shaw (2002). Such an unstable character is not a sound basis for the creation of botanical varieties, hence the varieties proposed by Chatterjee & Mukerjee are reduced to synonymy below.

It should also be noted that the position of the inflorescence is unstable in many taxa of *Podophyllum* section *Dysosma*. Consequently, this raises serious doubts as to the nature of some entities based on this character in the draft *Flora of China* account¹. This instability could lead to an individual plant being identified as *Dysosma aurantiocaulis* in one season and subsequently being determined as *Dysosma tsayuensis* another year. However, a detailed consideration of this problem is beyond the scope of this short note.

A sheet of the Jaeschke collection at Edinburgh has the leaves expanded and provides a basis for identifying var. *jaeschkei* as the trilobed foliage variant.

¹ <http://flora.huh.harvard.edu/china/mss/volume19/Berberidaceae.pdf>

Another variety, particularly desirable in horticulture, is based on plants from China with dissected foliage often with dark purple-brown mottling, sepals often with long linear trichomes on the exterior surface and petals with deep rose-pink, sometimes crimson-flecked, exterior. It was described as var. *chinense* by Sprague, and illustrated in the *Botanical Magazine* in 1920.

Nomenclature of the subspecific taxa of *Sinopodophyllum hexandrum*

S. hexandrum* var. *hexandrum

This is the autonym based on the lectotype specimen designated by Soejarto *et al.* (1981), at LIV-Herb. Royle, specimen on the right-hand side of sheet 13/1.

= *Podophyllum emodi* var. *royleanum* Wall., *Numer. List*, 814C (1829) *nom. nud.*

= *P. emodi* var. *hexandrum* (Royle) R. Chatterjee & Mukerjee, *Records of the Botanical Survey of India* **16**(2): 45 (1953).

S. hexandrum* var. *emodi* (Wall. ex Hook. f. & Thomson) J.M.H. Shaw **comb. nov.*

Basionym: *Podophyllum emodi* Wall. ex Hook. f. & Thomson, *Flora Indica* **1**: 232 (1855).

= *P. emodi* var. *emodi*. Although this name does not appear in Chatterjee & Mukerjee (1953) it is brought into existence by their description of other varieties within *P. emodi*. As the autonym it takes priority over the other varietal names responsible for its existence (ICBN Art. 11.6).

= *P. hexandrum* var. *emodi* (Wall. ex Hook. f. & Thomson) Seliv.-Gor., *Botanicheskii Zhurnal* (Moscow & Leningrad) **54**(10): 1605 (1969).

= *P. emodi* var. *axillare* R. Chatterjee & Mukerjee, *Records of the Botanical Survey of India* **16**(2): 46 (1953).

= *P. hexandrum* var. *axillare* (R. Chatterjee & Mukerjee) Browicz, *Flora Iranica* **101**: 2 (1973).

- = *P. emodi* var. *bhootanense* R. Chatterjee & Mukerjee, *Records of the Botanical Survey of India* **16**(2): 46–47 (1953).
- = *P. hexandrum* var. *bhootanense* (R. Chatterjee & Mukerjee) Browicz, *Flora Iranica* **101**: 2 (1973).
- = *P. emodi* var. *jaeschkei* R. Chatterjee & Mukerjee, *Records of the Botanical Survey of India* **16**(2): 47 (1953).
- = *P. hexandrum* var. *jaeschkei* (R. Chatterjee & Mukerjee) Browicz, *Flora Iranica* **101**: 2 (1973).

S. hexandrum var. *emodi* 'Majus' *Hortus Third* **2**: 891, 1976 [as 'Major'].

= *P. hexandrum* var. *majus* hort., Wehrhahn, *Die Gartenstauden* **1**: 451, 1931, see also Rix (1982).

S. hexandrum var. *chinense* (Sprague) Stearn ex J.M.H. Shaw & Cubey **comb. nov.**

Basionym: *Podophyllum emodi* var. *chinense* Sprague, *Botanical Magazine* **146**: t. 8850 (1920).

= *P. hexandrum* var. *chinense* (Sprague) Stearn in MS (1933) *ined.*

= *P. hexandrum* var. *chinense* (Sprague) Stearn ex Cubey, *Hanburyana* **3**: 81 (2008).

= *P. leichtlinii* Langlet, *Svensk Botanisk Tidskrift* **22**: 176 (1928) *nom. nud.*

This taxon is sometimes listed as *P. hexandrum* 'Chinense' in nursery catalogues.

Key to varieties of *S. hexandrum*

Note. Since seedlings of all varieties first produce leaves without deep dissection like var. *emodi*, only mature or flowering plants can be identified with this key. While this key may work on plants in cultivation where self-pollinating inbred lines are selected and maintained, in the wild there is greater variation, and intermediates occur, partly due to limited outbreeding between varieties. Such individuals often produce very short aborted anthers with sterile pollen and in

cultivation have been called var. “substerilis”—a name which is neither valid under the *ICBN*, nor suitable as a cultivar epithet.

- 1a. Leaves 3-lobed at maturity, lobes more or less entire.....var. *emodi*
 1b. Leaves 3–5 lobed at maturity, lobes dissected2
 2a. Petals deep rose pink on exterior surface, China..... var. *chinense*
 2b. Petals white to pale pink, Afghanistan to Bhutanvar. *hexandrum*

Postscript. Subsequent to preparing the above note, the combination *Podophyllum hexandrum* var. *sikkimense* (Chatterjee & Mukerjee) R.C. Srivastava, *Flora of Sikkim*: 62 (1998)² came to light. It should be noted that *Podophyllum sikkimense* is better treated as a synonym of *P. aurantiocaulis*. The isotype at BM! has pollen in monads and the characteristic leaf margins of *P. aurantiocaulis*. *Sinopodophyllum hexandrum* releases pollen in tetrads, and has simple leaf marginal teeth. See Shaw in Stearn (2002: 301–302), Grierson & Long, *Flora of Bhutan* 1(2): 329 (1984).

REFERENCES

- Browicz, K.** (1973). *Podophyllaceae*. In: Rechinger (ed.) *Flora Iranica*, 101: 1–2 .
- Chatterjee, R.**(1953). Studies in Indian *Berberidaceae*. *Records of the Botanical Survey of India* 16(2): 43–51.
- Gong, W., Fu, C.X., Luo, Y.P. & Qiu, Y.X.** (2006). Molecular identification of *Sinopodophyllum hexandrum* and *Dysosma* species using *cpDNA* sequences and *PCR-RFLP* markers. *Planta Medica* 72(7): 650–652.
- Kim, Y.-D., Kim, S.-H., Kim, C.H.K. & Jansen, R.K.** (2004). Phylogeny of *Berberidaceae* based on sequences of the chloroplast gene *ndhF*. *Biochemical Systematics and Ecology* 32(3): 291–301.

² Oriental Enterprises, Dehra Dun, India. (There is no volume number given on this part, which covers *Ranunculaceae–Moringaceae*. *Flora of Sikkim* vol. 1 covering Monocotyledons appeared in 1996, edited by Hajra, P.K. & Verma, D.M., published by Botanical Survey of India. Since then, some further families have appeared as separate works, e.g. Kumar, S. & Singh, V. (2001), *Asteraceae of Sikkim*, Deep Publications, New Delhi.)

- Liu, J.Q., Chen, Z.D. & Lu, A.M.** (2002). Molecular evidence for the sister relationship of the eastern Asia-North American intercontinental species pair in the *Podophyllum* group. *Botanical Bulletin of Academia Sinica* (Taipei) **43**: 147–154.
- Ma, S., Xu, Z. & Hu, Z.** (1997). A contribution to the geographical distribution and phylogeny of *Podophylloideae* (*Berberidaceae*). *Acta Botanica Yunnanica* **19**(1): 48–56.
- Martin, F.W.** (1958). Variation and morphology of *Podophyllum peltatum*. Unpublished Ph.D thesis, Washington University in St Louis, Missouri.
- Rix, E.M.** (1982). The herbaceous *Berberidaceae*. *The Plantsman* **4**(1): 1–15.
- Royle, J.F.** (1834). *Illustrations of the Botany of the Himalayan Mountains* **1**: 64.
- Shaw, J.M.H.** (2002). *Podophyllum*. In: Stearn, The genus *Epimedium* and other herbaceous *Berberidaceae* including the genus *Podophyllum*. Kew: Royal Botanic Gardens, Kew.
- Soejarto, D.D., Greenwood, B.D., Lauener, L.A. & Farnsworth, N.R.** (1981). Typification of *Podophyllum hexandrum* Royle. *Taxon* **30**: 652–656.
- Stearn, W.T.** (2002). The genus *Epimedium* and other herbaceous *Berberidaceae* including the genus *Podophyllum*. Kew: Royal Botanic Gardens, Kew.
- Sultan, P., Shawl, A.W., Ramteke, P.W., Kour, A. & Qazi, P.H.** (2008). Assessment of diversity in *Podophyllum hexandrum* by genetic and phytochemical markers. *Scientia Horticulturae* **11**(4): 398–408.
- Wang, W., Chen, Z.D., Liu, Y., Li, R.Q. & Li, J.H.** (2007). Phylogenetic and biogeographic diversification of *Berberidaceae* in the northern hemisphere. *Systematic Botany* **32**(4): 731–742.
- Ying, T.S.** (1979). On *Dysosma* Woodson and *Sinopodophyllum* Ying gen. nov. of the *Berberidaceae*. *Acta Phytotaxonomica Sinica* **17**(1): 15–22.