

Notes on the Solanaceae of China and Neighboring Areas

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ABSTRACT. Nomenclatural changes are made for the *Flora of China*, affecting *Anisodus*, *Archiphysalis*, *Leucophysalis*, *Physaliastrum*, and *Scopolia*.

ANISODUS

The nomenclature relating to the Asian genus *Anisodus* and its type species differs in various floras and revisions. The generic name and its type species are clarified below, and another species is transferred from *Scopolia* to *Anisodus*.

Since *Anisodus* was described in 1824, the taxonomic validity of its separation from *Scopolia* Jacq. (1764) has been disputed. Some workers have simply placed species of *Anisodus* in *Scopolia* (Dunal, 1852); others have recognized *Anisodus* as a section or series in *Scopolia* (Wettstein, 1895; Weinert, 1972); and others have considered it a distinct genus (Pascher, 1909; Chen & Chen, 1977; Wu & Chen, 1978; Sandina & Tarasevich, 1982). It will be treated as a distinct genus in the *Flora of China* (Zhang et al., in press).

Scopolia and *Anisodus* are members of the solanaceous tribe Hyoscyameae, characterized by capsular fruits that are partly or completely covered by the persistent fruiting calyx and strongly curved embryos contained in compressed seeds. Both genera include herbaceous plants with subactinomorphic flowers and five stamens situated at the level of the corolla mouth. However, in addition to grossly different overall appearance, the groups differ in the conspicuous details shown in Table 1.

Sandina & Tarasevich (1982) studied the pollen of *Anisodus* (*Whitleya*) and *Scopolia* and found differences, particularly in the structure of the pores and the pattern of the exine, that they considered to be of generic significance. Differences in the pollen of *Scopolia* (*S. carniolica*) (Punt & Monna-Brands, 1980) and *Anisodus* (*A. carniolicoides* (as *S. carniolicoides*), *A. tanguticus* (as *A. mairei*), and *A. acutangulus* (Zhang & Lu, 1984)) are contrasted in Table 1.

Anisodus and *Scopolia* are widespread in the Old

World; their geography was reviewed by Weinert (1972) and by Lu & Zhang (1986). When separated, the two genera have distinct geographical ranges. *Anisodus* occurs in the Himalayan region from western Nepal to Yunnan, China, and northward from Assam along the central Yangtze-Mekong-Salwin watersheds (Hengduan Mountains) of China to nearly 39°N latitude. The two species of *Scopolia* show a disjunction between Japan, *S. japonica* Maxim., and eastern Europe, *S. carniolica* Jacq.

Weinert (1972) referred to an unpublished dissertation by Semenowa (1955), which we have not seen, but names he attributed to her in his publication were not effectively published by her nor validly published by him.

NOMENCLATURE OF *ANISODUS* AND *A. LURIDUS*

Anisodus Link in Sprengel, Syst. Veg. 1: 699. 1825 [1823 fide Flora 9: 2, 495. 1826, late 1824 fide Stafleu & Cowan 5: 813]. *Scopolia* sect. *Anisodus* Dunal in DC., Prodr. 13(1): 555. 1852. TYPE: *A. luridus* Link ex Sprengel.

Whitleya Sweet, News of Lit. & Fashion 3: 108. 13 Aug. 1825; Brit. Flower Gard. 2: 125. 1 Oct. 1825 [dates fide Airy Shaw, J. Bot. 85: 192–193. 1937]. TYPE: *Whitleya stramonifolia* Sweet.

Anisodus was described by Link in Sprengel's edition of *Caroli Linnaei . . . Systema vegetabilium*, edition 16, which actually appeared before its title page date of 1825. The original publication, which included the description of *A. luridus*, cited as a synonym *Nicandra anomala* Link, which was not validly described until the following year by Link and Otto (see below). The material on which *Anisodus* was based was grown in Berlin from seed obtained from England that was noted as being from Nepal. About a year later, the genus was again described under the name *Whitleya* from different material that also had come into cultivation in Europe from seed obtained in Nepal.

The plant known as *Anisodus luridus* was described four different times with three different epithets in publications that bear the frontispiece date 1824 or 1825; confusion about its correct name persists. The following reviews the history of naming this plant and presents the correct name.

Anisodus luridus Link in Sprengel, Syst. Veg. 1: 699. 1825 [late 1824 fide Stafleu & Cowan 5: 813]. *Scopolia lurida* (Link) Dunal in DC., Prodr. 13(1): 555. 1852. TYPE: same as *Nicandra anomala*.

Physalis stramonifolia Wall. in Roxburgh, Fl. India. ed. Carey, 2: 242. 1824. [Mar.–Apr. 1824 fide Stafleu & Cowan 4: 957]. *Scopolina stramonifolia* (Wall.) Kuntze, Rev. Gen. Pl. 2: 452. 1891. *Scopolia stramonifolia* (Wall.) Shrestha, Bull. Dept. Med. Pl. Nepal 2: 81. 1969. *Scopolia stemonifolia* Chen Cheih & Chen Chung-lien, Acta Phytotax. Sin. 15(2): 61. 1977, orthographic variant. *Scopolia stramonifolia* (Wall.) N. P. Balakrishnan, Bull. Bot. Surv. India 22: 176. 1980 [1982] redundant combination. TYPE: cultivated, London, from seed obtained from Robert Henry Jenkinson, perhaps through Reginald Whitley, noted as being from Nepal, specimen not known. Nepal, herb. Wallich 2632 not seen, IDC microfiche 7394: 295.

Nicandra anomala Link & Otto, Icon. pl. select. 77. t. 35. July–Dec. 1825 [fide Stafleu & Cowan 3: 68]. TYPE: cultivated, Berlin, from seed obtained from England, noted as being from Nepal, specimen not known (lectotype, Link & Otto plate 35; same as *Anisodus luridus*). *Scopolia anomala* (Link & Otto) Airy Shaw, J. Bot. 75: 195. 1937.

Whitleya stramonifolia Sweet, News of Lit. & Fashion 3: 108. 13 Aug. 1825; Brit. Flower Gard. 2: 125. 1825 [1 Oct. 1825 date fide Airy Shaw, J. Bot. 85: 192–193. 1937]. *Anisodus stramonifolius* (Sweet) G. Don in Loudon, Hort. Brit. 61. 1830. Based on *Whitleya stramonifolia* Sweet. *Physalis stramonifera* Chen Cheih & Chen Chung-lien, Acta Phytotax. Sin. 15(2): 61. 1977, orthographic variant. *Anisodus stemonifolius* Wu Cheng-yih & Chen Cheih, Fl. Reipubl. Popularis Sin. 67(1): 23. 1978, orthographic variant.

Anisodus fischerianus Pascher, Repert. Spec. Nov. Regni Veg. 7: 226. 1909. *Anisodus luridus* var. *fischerianus* (Pascher) C. Y. Wu & C. Chen, Acta Phytotax. Sin. 15(2): 62. 1977. TYPE: cultivated in Leningrad, seed from Sikkim–Tibet, specimen not seen.

Scopolia mairei Lévillé, Bull. Geogr. Bot. 25: 37. 1915 [Année 24 (4^e Série)], fide Lauener, Notes Roy. Bot. Gard. Edinburgh 37: 146. 1978. *Anisodus mairei* (Lévillé) C. Y. Wu & C. Chen, Acta Phytotax. Sin. 15(2): 64. 1977. TYPE: China, Yunnan (Yun-Nan): Ma-Kong, rocks, 2,800 m, *E. E. Maire s.n.* not seen.

The first description of a plant of *Anisodus* was of *Physalis stramonifolia* by Nathaniel Wallich in a compilation of his plant descriptions published by Carey early in 1824. The description of *Anisodus*

TABLE 1. Differences between *Scopolia* and *Anisodus*.

<i>Scopolia</i>	<i>Anisodus</i>
	Flower and fruits twice as large
Calyx and corolla conical with straight lobes and limb	Calyx and corolla broadly campanulate with recurved lobes and limb
Corolla conspicuously exerted, at least twice as long as the calyx	Corolla shorter relative to calyx, less than twice as long or only slightly exerted
Flowering calyx of five, equal, membranaceous lobes	Flowering calyx splitting irregularly into 1–5 unequal, fleshy or subcoriaceous lobes
Corollas reddish purple, drying blue-purple	Corollas brownish purple or yellow, usually drying yellow
Pollen grains elliptical in equatorial view, aperture with scabrate exine and 3–4-colpate	Pollen grains consistently subspheroidal, nonaperturate with verrucate exine and indistinct stratification

luridus followed later in the year: late in the following year, the same species was described as *Whitleya stramonifolia* by Robert Sweet. One might suspect that Sweet’s name was in some way based on that chosen by Wallich, but there is no evidence to substantiate this. Sweet noted that his plant was “nearest related” to Link’s *Anisodus*, which was first cultivated in Berlin in 1821, but he did not mention Wallich’s work: his description is in different terms and differs in some details from that of Wallich, for example, “peduncle short, densely villous” compared with Wallich’s “peduncle . . . sparingly villous.”

Soon thereafter, George Don (1830) accepted Link’s generic concept and transferred Sweet’s name to *Anisodus*. Thus, the name *A. stramonifolius* is occupied by *A. stramonifolius* (Sweet) G. Don, preventing the transfer of the earlier *Physalis stramonifolius* Wall. into *Anisodus* and supplanting *A. luridus* Link.

We recognize *Anisodus* as a genus, but for those who place *Anisodus* in *Scopolia*, the correct name in *Scopolia* is *S. stramonifolia* (Wall.) Shrestha.

We saw no material of *Anisodus fischerianus* and place it in synonymy based on the original description, which notes a funnellform-campanulate flowering calyx. Wu & Chen (1978), in making the combination *A. luridus* var. *fischerianus*, noted

leaves with 1–3 pairs of irregular coarse teeth and purple eyes inside the base of the corolla tube, but apparently they did not see the type. Pascher suspected this species to be a hybrid of *A. luridus* and *A. tanguticus*. Its provenance from Xizang (Tibet), China, and Sikkim, India, is within the range of *A. lurida*. *Anisodus luridus* is recorded from Sikkim, Bhutan, Nepal, and in China from Sichuan, Xizang, and northwestern Yunnan, occurring from 3,000 to 4,450 m.

Anisodus carniolicoides (C. Y. Wu & C. Chen) D'Arcy & Zhang Zhi-yun, comb. nov. Basionym: *Scopolia carniolicoides* C. Y. Wu & C. Chen, Acta Phytotax. Sin. 15(2): 59. 1977. TYPE: China. Yunnan: Degen Xian, Baima Mountain (Pei-ma-shan), T. T. Yu 8773 (holotype, HY). Paratypes: K. M. Fang 392, T. T. Yu 9451, 11396, 13692 (all A).

Scopolia carniolicoides C. Y. Wu & C. Chen var. *dentata* C. Y. Wu & C. Chen, syn. nov. Acta Phytotax. Sin. 15(2): 60. 1977. TYPE: China. Sichuan: Muli Xian, T. T. Yu 6291 (holotype, HY not seen; isotype, A). Paratype: T. T. Yu 7180 (A).

Following our review of material from the full geographical range of the tribe Hyoscyameae—Europe to Japan and the former U.S.S.R. to India—we conclude that *Scopolia carniolicoides* should be placed in *Anisodus* and not with the European and Japanese species that have been called *Scopolia*. Variety *dentata* is based on specimens with toothed leaves, but such leaves sometimes occur in other specimens that are otherwise not different from more typical plants. It should be noted that during the period when Wu and Chen described these taxa, difficulties beyond their control prevented consultation of collections from places outside of China.

LYCIANTHES

Lycianthes neesiana (Nees) D'Arcy & Zhang Zhi-yun, comb. nov. Basionym: *Solanum neesianum* Wall. ex Nees, Trans. Linn. Soc. London 17: 42. 1837. *Solanum subtruncatum* Wall. ex Dunal in DC., Prodr. 13(1): 180. 1852. *Lycianthes subtruncata* (Wall. ex Dunal) Bitter, Abh. Naturwiss. Vereine Bremen 25: 478. 1919 [1920]. TYPE: Wallich. Cat. supp. 2620, year 1828 [or later?].

Lycianthes neesiana was treated as *Solanum subtruncatum* in the handwritten catalog of specimens collected by Nathaniel Wallich that was prepared by Wallich and George Bentham, and as *Solanum neesianum* in the supplement to the catalog. The

catalog and supplement are handwritten lists without descriptions, and they do not meet requirements for effective, much less valid, publication. Up to the present, this species has gone under the name *Solanum subtruncatum*, probably because this name was used first in the 1828 catalog; *Solanum neesianum* first appeared in the supplement, presumably a later publication. The names were not validly published until later, the first being *Solanum neesianum* by Nees in 1837, who attributed the name to Wallich. The name *Solanum subtruncatum* was not validated until 1852 by Dunal and is considered to be a synonym of *L. neesiana*.

This species has a calyx with an entire, truncate margin and 1–10 teeth arising below the apex, a feature placing it in *Lycianthes* rather than *Solanum*.

PHYSALIASTRUM

Solanaceae subtribe Physalidinae Miers includes about a dozen genera characterized by having accrescent calyces, longitudinally dehiscent anthers, and mostly rotate corollas. The subtribe is centered in northern Mexico (*Chamaesaracha*, *Jaltomata*, *Margaranthus*, *Physalis*, *Quincula*), but it is also represented in temperate Asia (*Physaliastrum*, *Physalis*) and elsewhere. Generic lines have been unclear, leading to diverse nomenclature. A series of Asian species that has been variously known in *Archiphysalis*, *Chamaesaracha*, *Leucophysalis*, *Physaliastrum*, and *Physalis* appear to belong to a single genus, which should be called *Physaliastrum*.

Physaliastrum was described by Makino (1914) with two Japanese species, *P. echinatum* (Yatabe) Makino and *P. savatieri* (Makino) Makino, which were transferred from the American genus, *Chamaesaracha*. In a revision of *Chamaesaracha*, Averett (1973) concurred in excluding these species from *Chamaesaracha*. Kuang & Lu (1965) revised *Physaliastrum*, recognizing seven species, all in Asia. Kuang (1966) described the genus *Archiphysalis*, basing it on one element from Japan and another from western China. These species had been known as *Physalis*, *Physaliastrum*, or *Chamaesaracha*. Averett (1977), extending his studies on *Chamaesaracha*, reviewed a series of the Chinese species hitherto placed in *Physaliastrum* and concluded that they and other enigmatic North American species are congeneric with *Leucophysalis*; he had transferred these species into *Leucophysalis* earlier (Averett, 1970, 1973). Following Averett's view, Grierson & Long (1978) described a new variety in *Leucophysalis* from Bhutan.

After studying a range of material for preparation of the Solanaceae treatment for the *Flora of China* and for a study of *Leucophysalis grandiflora* (D'Arcy et al., 1990; D'Arcy & Keating, in prep.), the type species of *Leucophysalis*, we are able to separate the Asian from the American groups at the generic level on the basis of aspects of their fruiting calyces. In some of the Asian species the walls of the fruiting calyx are elaborated by emergences that give the entire living fruit a bristly appearance. This is illustrated for *Physaliastrum japonicum* by Yasaka (1983: 80, figs. 4, 5) and by Yoshisuke (1985: 199). When dried, the emergences are sometimes difficult to see, resembling flattened, near-hyaline scales or giving the calyx wall a muricate or roughened appearance. In two other cases, which had been segregated in the genus *Archiphysalis*, the calyx modification is somewhat different. In one of these, *Physaliastrum sinense*, the ribs are greatly thickened. In the other, *Physaliastrum chamaesarachoides* (Makino) Makino, illustrated by Kuang & Lu (1978: 51, plate 14, fig. 7, as *Archiphysalis kwangsiensis* Kuang), the calyx ribs are thickened and bumpy, suggestive of incipient teeth. Such emergences or elaborations are lacking on American species of *Leucophysalis* and related groups, e.g., *Physalis*, *Chamaesaracha*.

The separation of *Physaliastrum* from *Physalis* rests largely on the elaboration of the calyx in *Physaliastrum*. Flowering material of most species of *Physaliastrum* appears to be scarce in herbaria and was not available for our study. However, the literature notes that in most species of *Physaliastrum* the corolla is lobed, while in most species of *Physalis*—all those from the Americas—the corolla is apically subentire. (Although Waterfall's (1958, 1967) revision of the North American species included some species with lobed corollas, these have since been removed to other genera.) *Physalis alkekengi*, perhaps the only species of *Physalis* native to the Old World, does have shallowly lobed corolla lobes, but it has no sign of calyx elaborations typical of *Physaliastrum*.

One of the main characters that was used to justify separation of *Archiphysalis* is the degree to which the berry fills the fruiting calyx. In the species that were left in *Physaliastrum*, the berry fills the fruiting calyx, which is appressed to the berry wall. In *Archiphysalis*, the fruiting calyx greatly exceeds the berry in diameter and length, and the berry is free within the bladdery calyx. In *Physalis*, the fruit is usually like that of *Archiphysalis*, but sometimes it is like that in *Physaliastrum*. For example, in *Physalis philadelphica*, which is widely marketed for food in North America and Mexico, within a

single lot of fruits, some will have the berry filling the calyx and tightly appressed to it, and others will have a small berry that is free from the bladdery calyx. This variability seems to be related to degree of overall development of the fruit: larger berries tend to fill the calyx, while younger or "poorer" fruits tend to have loose calyces. Thus, the degree to which the berry fills the calyx varies within a single population or species, and because the species in *Physaliastrum* and *Archiphysalis* are closely related to *Physalis*, we do not think this is an appropriate character for generic separation of *Archiphysalis* from *Physaliastrum*.

In *Physaliastrum* (*Archiphysalis*) *chamaesarachoides*, there are no emergences on the fruiting calyx walls, but the greatly thickened calyx ribs have erect teeth, presenting a somewhat bristly appearance. In *Physaliastrum* (*Archiphysalis*) *sinense*, the calyx ribs are thickened, resembling those of *P. chamaesarachoides*, but there are no teeth. This species is more like *Physalis* than any of the others in *Physaliastrum*, but differs in the thickened calyx ribs, which we have not seen in any species of *Physalis* or in any species of Physalidinae from North America. We consider the Asian species to be distinct from the American species and to form the single genus *Physaliastrum* on the basis of the elaborations of the fruiting calyx.

The differences noted between the species from *Archiphysalis* and those previously part of *Physaliastrum* may warrant recognition of the group at the sectional level or perhaps as a subgenus.

Physaliastrum yunnanense* subsp. *bhutanicum (Grierson & Long) D'Arcy & Zhang Zhi-yun, comb. nov. Basionym: *Leucophysalis yunnanensis* subsp. *bhutanica* Grierson & Long, Notes Roy. Bot. Gard. Edinburgh 36: 141. 1978. TYPE: Bhutan: Rinchu-Kancham, 5,000 ft., Cooper 3943 (holotype, E not seen; isotype, BM not seen).

Although no material of this taxon was seen, the description by Grierson and Long notes "the acrescent acutely muricate calyx," which is characteristic of the Asian *Physaliastrum* and not the American *Leucophysalis*.

Physaliastrum sinense (Hemsley) D'Arcy & Zhang Zhi-yun, comb. nov. Basionym: *Chamaesaracha sinensis* Hemsley, J. Linn. Soc., Bot. 26: 174. 1890. *Archiphysalis sinensis* (Hemsley) Kuang, Acta Phytotax. Sin. 11(1): 62, pl. 8, 9, figs. 1–6. 1966. *Physalis sinensis*

(Hemsley) Averett, Ann. Missouri Bot. Gard. 57: 380. 1970. TYPE: China. Hubei (Hupeh): Yichang (Ichang) Xian and immediate neighborhood, *Henry 2902* (holotype, K not seen).

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