Notes RBG Edinb. 40(2):359–367 (1982)

CONTRIBUTIONS TO THE MORPHOLOGY AND SYSTEMATICS OF KLUGIEAE AND LOXONIEAE (GESNERIACEAE) IX. THE GENUS WHYTOCKIA

A. WEBER*

ABSTRACT. In the genus *Whytockia* W. W. Smith three species are recognized: *W. chiritiflora* (Oliv.) W. W Smith (China: Yunnan), *W. tsiangiana* (Hand.-Mazz.) A. Weber, *comb. nov.* (with three varieties: var. *tsiangiana*: Kweichow (Guizhou), Yunnan; var. *minor* (W. W. Smith) A. Weber, *comb. nov.*: Yunnan; var. *wilsonii* A. Weber, *var. nov.*: Szechuan (Sichuan)), and *W. sasakii* (Hayata) B. L. Burtt (Taiwan). A key and some general information on taxonomic history, affinities, distribution and ecology are provided.

INTRODUCTION

The genus *Whytockia* W. W. Smith is a small and little-known genus of the tribe Klugieae (incl. Loxonieae) occurring in SW China and Taiwan. Recently it has attracted considerable interest, because from morphological and anatomical investigations (Weber, 1976b) it became evident that it is closely allied to the curious unifoliate genus *Monophyllaea* (recently revised by Burtt, 1978), obviously representing an ancient relic of the stock from which *Monophyllaea* evolved.

In the course of these investigations specimens and types of all taxa have been investigated. It was felt that one taxon, currently treated as a variety, should be raised to specific rank; then it was found to be conspecific with a species currently placed in *Stauranthera*. These inconsistencies initiated the following revision in which three species, one including three varieties, are recognized. Additionally, some general considerations about generic relationships, geographical distribution and ecology are presented. Unfortunately, in view of the extremely scanty collections and scarce data available, knowledge of the genus remains rather poor.

MATERIALS

Material of *Whytockia* from the following herbaria was studied: British Museum (Nat. Hist.), London (BM); RBG Edinburgh (E); Botanical Institute of Kwangtung (Guangdong)[1] province, Kwang-chow (Guangzhou) (IBSC); RBG Kew (K); Dept of Botany, National Taiwan University, Taipei (TAI); Dept of Botany, Fac. of Science, University of Tokyo (TI); Institute of Botany, Academia Sinica, Peking (Beijing) (PE); Naturhistorisches Museum Wien (W).

* Institute of Botany, University of Vienna, Rennweg 14, A-1030 Vienna, Austria.

[1] In the citation of geographical names in the People's Republic of China the official Pinyin transcription is given in parentheses where necessary.

TAXONOMIC HISTORY

The genus is named after James Whytock, once president of the Botanical Society of Edinburgh. It was proposed by W. W. Smith (1919) for the accommodation of *Stauranthera chiritiflora* Oliv. (original spelling: *chiritaeflora*), the somewhat doubtful generic position of which had been already noticed by Oliver (1896) himself. Within *W. chiritiflora,* Smith (l.c.) distinguished a var. *minor*, both this and the type variety occurring in Yunnan.

In 1934, the Japanese botanists Masamune and Suzuki proposed a new genus, *Oshimella*, for two Formosan plants (one new, the other *Rhynchoglossum sasakii* Hayata) and named them *O. formosana* and *O. sasakii,* respectively. The publication of these names, however, was invalid as it offended against Art. 41 and 43 of the *International Code of Botanical Nomenclature.* Some years later, Burtt (1941) recognized that *Oshimella* and *Whytockia* were identical and, moreover, regarded *O. formosana* and *O. sasakii* as representing a single species, *Whytockia sasakii.* This was confirmed by Kao & De Vol (1972) in their revision of the Gesneriaceae of Taiwan and is accepted here as well.

In the same year as the publication of *Oshimella,* Handel-Mazzetti (1934) described a plant from Kweichow, which is relevant here too: *Stauranthera tsiangiana.* His annotation 'proxima *St. chiritaeflora*' already suggests that this taxon should be placed in *Whytockia,* but, since no valid transfer has been made, the name still stands. Handel-Mazzetti was apparently not aware of the establishment of a new genus for *Stauranthera chiritiflora*, nor did he know of Smith's var. *minor*. I for my part cannot find any major differences between the latter and *Stauranthera tsiangiana* and treat them, based on the different flower colour, as varieties of one species.

GENERIC DELIMITATION AND AFFINITIES

Up to now *Whytockia* has been regarded as a close ally of *Stauranthera* (Smith, 1919; Burtt, 1941). Indeed the habit seems similar and the differences in flower structure, given by Smith (1919) for separating *Whytockia* from *Stauranthera* (ecalcarate corolla, longer style and 'subbilocular ovary'), do not appear profound. Burtt (1941) lists some more differentiating characters of *Whytockia*: not-campanulate and not-winged calyx and the long, slender and didynamous stamens paralleling the well-developed corolla tube. However, still more characters can be added (see below), which also link *Whytockia* to *Monophyllaea* and in fact flower structure does not indicate a close affinity of *Whytockia* to *Stauranthera.* As to habit, strangely enough, it has always been overlooked that there is a fundamental difference in the architecture of these two genera. In *Whytockia* the reproductive region simply consists of an unbranched axis bearing several markedly anisophyllous leaf-pairs; from the major leaves (plus-leaves) the inflorescences (pair-flowered cymes) emerge. In contrast, the reproductive part of *Stauranthera* is a sympodium of shoot units, that is short axes bearing one anisophyllous leaf-pair and several pairs of bracts. From the axil of the foliage leaf (plus-leaf) the following shoot unit emerges and from the plus-bracts the pair-flowered cymes emerge, forming together a more or less complex terminal inflorescence (Weber, 1977).

Though *Whytockia* and *Monophyllaea* look quite different, the affinities are definitely much closer. They have several characters in common, and these are shared by no other member of Klugieae: descending aestivation of calyx and corolla, (chalk) glands on the inside of the sepals (as well as on the undersurface of the foliage leaves), secretory canals in the sepals, and a bilocular ovary. The curious 'unifoliate' habit of *Monophyllaea* can be derived from *Whytockia* by three main steps: 1) extreme anisophylly of the cotyledons (anisocotyly) and permanent persistence of the macrocotyledon; 2) extreme condensation of the epicotyledonary internodes; 3) reduction of epicotyledonary leaves to tiny bracts, the plus-bracts of which again bear the inflorescences (pair-flowered cymes). For details see Weber (1975, 1976b).

With respect to shoot construction, *Whytockia* is easily distinguishable from the remaining members of Klugieae: *Loxonia,* which comes closest in habit, has a sympodial architecture like that of *Stauranthera*, but even more pronounced; *Epithema* differs by its usually three-leaved, scarcely anisophyllous habit and capitulum-like inflorescences; and *Rhynchoglossum* by the complete abortion of the minus-leaves and racemose inflorescences (see Weber, 1976c–1978). Nevertheless, the shoot structure of all these genera can be derived from that of *Whytockia* and there is little doubt that *Whytockia* is the most primitive representative of the whole tribe. Specialized features can be found particularly in the flower structure and these form a link to *Monophyllaea* as mentioned before.

GEOGRAPHICAL DISTRIBUTION

The present distribution of *Whytockia* is in Asia, north of 22° latitude, with most localities found near the Tropic of Cancer. Two species, *W. chiritiflora* and *W. tsiangiana,* occur in SW China and the third, *W. sasakii*, is separated by an enormous gap of about 1500km, in Taiwan (Fig. 1). The generally rare occurrence, the segregation of *W. tsiangiana* into three varieties related to distant and isolated localities, and the large disjunction just mentioned indicate clearly the relict position of the genus, and this is in good accordance with its having the most primitive morphological organization within the tribe.

The distribution of *Whytockia* on the northern border of the tropics and the occurrence on the Asiatic mainland in particular, is noteworthy in regard to the distribution of the nearest relative, *Monophyllaea*. The latter, like *Whytockia* (with the possible exception of its Taiwanese species, see below) is essentially confined to limestone and inhabits the entire Malesian Archipelago, ranging east and west from S Thailand and N Sumatra to New Guinea and north and south from Luzon to Java (Burtt, 1978). This leads me to the view that the origin of *Monophyllaea* was on the Asiatic continent, or at least in the western part of Malesia. This concept is, however, in conflict with the opinion of Burtt (1978), who, judging from the distribution of the two subgenera of *Monophyllaea* (both represented on the eastern Malesian islands, but subgen. *Moultonia* being absent from the Malay Peninsula, Sumatra and Java) favours an eastern origin (New Guinea?) and a westwards spread of the genus (subgen. *Moultonia* having not reached areas west of Borneo). I for my part find it easier to believe that *Monophyllaea* evolved on the Asiatic continent and then spread south- and eastwards. When reaching Borneo, subgen. *Moultonia* split off. Then both

subgen. *Monophyllaea* and subgen. *Moultonia* spread further eastwards, reaching the Philippines in the north* and finally New Guinea in the east.

This interpretation of the distribution pattern of *Monophyllaea* appears to have three merits:

1) Regarding subgen. *Moultonia*, the present centre of numerical and morphological diversity, Borneo, (7 species of a total of 12, some species with the most derived morphological organization), matches with the centre of origin. Thus the diversity can be related to the long time available from origin until now for evolutionary radiation. On the contrary, it is certainly more difficult to explain the diversity and species concentration in Borneo as a 'recent' explosive radiation of a newcomer from the east.
2) Regarding subgen. *Monophyllaea*, it conforms well with the fact that the western parts of Malesia hold many more species (Malay Peninsula, 4; Sumatra, 5 — one species in common) than the eastern ones (only one in New Guinea, none on Celebes and the Moluccas).
3) There is a reasonable relation to the distribution of the nearest relative of *Monophyllaea*, the morphologically primitive genus *Whytockia*.

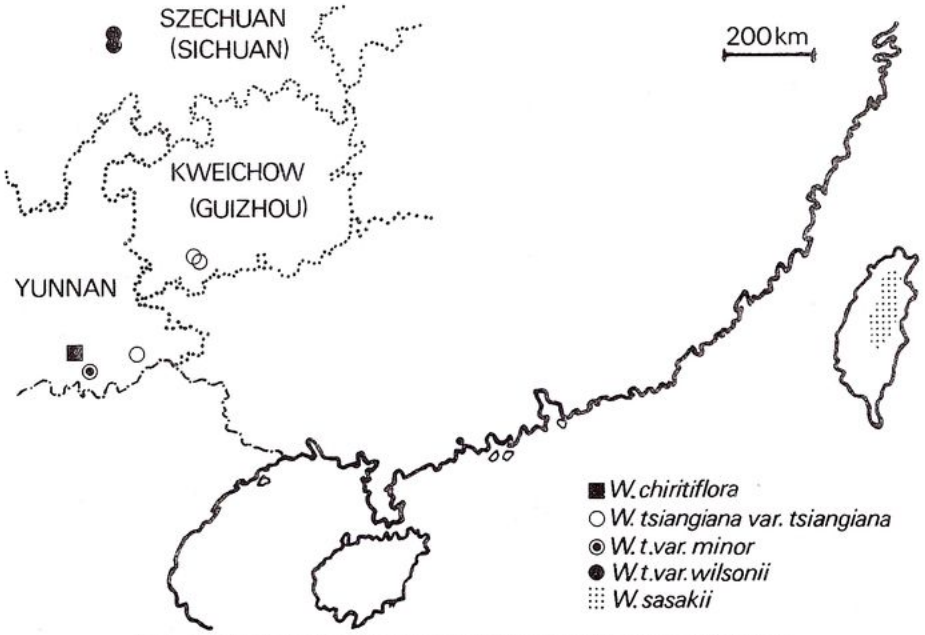

Fig. 1. Distribution of the genus *Whytockia* (China and Taiwan).

With reference to the last point, it should be noted that there is a remarkably similar situation in the genus *Rhynchoglossum* (cf. Burtt, 1962; Weber, 1978): most of the palaeotropical species are distributed in the southernmost part of Asia (from S India and Ceylon over the Malay Archipelago to New Guinea) and thus parallel roughly the distribution of

* The only Philippine species of subgen. *Moultonia* is even identical with a widespread Bornean one, *M. merrilliana*. It seems much more probable that this species 'jumped' from Borneo to the (southern) Philippines than that it originated in the Philippines (its ancestors and relatives being now extinct) and invaded Borneo from there.

Monophyllaea. The most primitive species, however, *R. lazulinum*, occurs on mainland Asia in NE India (Assam) near the border of Tibet. Another species found in Assam, *R. ampliatum,* is presumably related to *R. lazulinum,* and the same holds true for the northernmost outlier of the genus, *R. omeiense* W. T. Wang from Mt Omei in Szechuan (Wang, 1982). It is noteworthy that Mt Omei holds *Whytockia* as well (see below).

ECOLOGY

Information about the ecology of *Whytockia* is very scarce and can be traced only from the herbarium labels. From these it appears that *Whytockia* occupies similar habitats to those favoured by many other members of the tribe. It is a forest herb, growing in deep shade and on moist, usually sloping, ground, on wet rocks, in ravines and on banks near streams. The mainland species, *W. chiritiflora* and *W. tsiangiana*, are confined to mountain forests from about 1000 to 1500m; according to Kao & De Vol (1978) the Taiwan *W. sasakii* occurs also at lower altitudes.

No collector's note suggests that *Whytockia* grows on limestone or calcareous soil, but this must be assumed, at least for the mainland species, for on the underside of the leaves there are frequently chalk grains (cf. Weber, 1976b: Fig. 4a) produced by sessile glands with a globose, two-celled head. There is, however, never such a heavy encrustation as in many species of *Monophyllaea*, in which particularly the undersurface of the macrocotyledon may be covered by a continuous chalk crust. In *Whytockia* the chalk grains are very scattered and only visible by the aid of a strong lens; sometimes (e.g. on *Henry* 11232) they seem to be altogether lacking.

The localities of *W. tsiangiana* in Kweichow (around Chen-feng) are found in the famous Chinese karst landscape with limestone towers, caves etc., and this fits well with the chalk excretion. Also in Yunnan, and in the wider surroundings of Mengzi in particular (where *W. tsiangiana* and *W. chiritiflora* occur) limestone formations are well represented. In fact, both provinces are 'classic examples of karst topography' (Hsieh & Salter, 1973, p. 16), and thus there is little doubt that the mainland species grow over limestone.

Unfortunately, I have no adequate information about the substrate for *W. sasakii,* nor were chalk grains observed on the specimens investigated. Generally, the mountain ranges in Taiwan are composed of ancient metamorphic rocks, apparently with little limestone. Nevertheless, some of the localities (e.g. Wulai, Chitou, Taipingshan) hold other gesneriads from genera which are known for their limestone preference (e.g. *Boea, Rhynchoglossum*) and thus it may well be that these localities contain at least small limestone outcrops which are inhabitated by calcicolous species, including *W. sasakii*.

TAXONOMY

Whytockia W. W. Smith in Trans. Bot. Soc. Edinb. 27: 338 (1919); Burtt in Kew Bull. 1941: 31 (1941); Kao & De Vol in Taiwania 17: 167 (1972); Kao & De Vol in Li et al., Fl. Taiwan 4: 684 (1978).

Syn.: *Oshimella* Masamune & Suzuki in J. Soc. Trop. Agr. 6: 571 (1934), nom. non valide publ. (Art. 41).
Type species: *W. chiritiflora* (Oliv.) W. W. Smith.

Herb; stem base decumbent or creeping, rooting from the nodes, flowering stem erect or ascending; rarely branched or branches from the creeping part (from the axils of fallen leaves). *Leaves* membranous, pubescent, with scattered, sessile chalk glands on the underside, opposite, one leaf of each pair large (plus-leaf), the other small (minus-leaf), both sessile or the plus-leaf with a short petiole, ovate to oblong, strongly unequal at base, apex acute, margin serrate. *Inflorescences* pair-flowered cymes, emerging from the axils of the plus-leaves, ebracteolate, with several pedicellate flowers. *Sepals* 5, connate at base, aestivation descending imbricate, slightly striate (caused by presence of secretory canals), chalk glands on inner side. *Corolla* white or pink to light violet-purple, tubular-infundibuliform, bilabiate, upper lip 2-lobed, lower lip longer than upper lip, 3-lobed, aestivation descending. *Stamens* 4, didynamous, inserted at corolla base; filaments hairy in the upper part; anthers coherent, thecae divaricate. *Ovary* ovate, glabrous, bilocular throughout or for the most part; stigma bilobed or capitate. *Capsule* globose, 2-valved or opening irregularly; seeds numerous, small.

KEY TO THE SPECIES

1a. Plus-leaves large, c.15cm long, 6cm broad, sessile; internodes (in the flowering region) rather short (up to 2cm); flowers c.25mm long, pink, stigma bilobed; China ..... **1. chiritiflora**

1b. Plus-leaves up to 11cm long, less than 6cm broad, petiolate or sessile; internodes more extended; flowers at most 18mm long, pink, light violet-purple or white, stigma bilobed or capitate 2

2a. Leaves 7–11cm long, at least lower ones with distinct petiole (c.0.5cm); flowers 14–18mm, corolla somewhat pouched; ovary bilocular throughout*, stigma slightly bilobed; plant usually not branched; China **2. tsiangiana**

2b. Leaves 5–8cm long, sessile or subsessile, flowers 12–15mm long, corolla scarcely pouched, white; upper part of the fertile region of the ovary unilocular, with protruding T-like placentae†, stigma capitate; plant usually with branches from the creeping base; Taiwan .. **3. sasakii**

1. Whytockia chiritiflora (Oliv.). W. W. Smith in Trans. Bot. Soc. Edinb. 27: 338 (1919); Iconogr. Cormophyt. Sin. 4: 121 (1975).
Basionym: *Stauranthera chiritaeflora* Oliv. in Hook. Ic. Pl., t. 2454 (1896).
Type: China, Yunnan: at Meng-tzu (Mengzi), in a dark glen under shady precipices, rare, sine dat., *Hancock* 51 (K).
Known only from the type specimen.

* This character has been ascertained for all varieties by preparing microtome sections from the following specimens: var.*tsiangiana*: *Feng* 11982, *Expedition of Kweichow* 8608; var. *minor*: *Henry* 11232; var. *wilsonii*: *Wilson* 3292.

A series of sections of var. *minor* is depicted in Weber (1976b) Fig. 6 (as *W. chiritiflora* var. *minor*).

† For illustration (photographs of microtome sections) see Weber (1976b) Fig. 5d, e (from *Kao* 7738).

2. Whytockia tsiangiana (Hand.-Mazz.) A. Weber, **comb. nov.**
Basionym: *Stauranthera tsiangiana* Hand.-Mazz. in Sinensia 5: 19 (1934).
Type: Kweichow (Guizhou), Na-ken, Chen-feng (Zhenfeng), in ravine, herb, flower white, 17 x 1930, *Tsiang* 4613 (holo. W[1], iso. IBSC).

KEY TO THE VARIETIES

1a. Flower white, with two yellow lines in the throat ..... var. **tsiangiana**
1b. Flower pink to light violet-purple 2

2a. Leaf margin with short teeth (0.5mm) ..... var. **minor**
2b. Leaves more coarsely serrate (teeth ± 2mm); lower surface sometimes purple ..... var. **wilsonii**

var. **tsiangiana**
Flower white, with two yellow lines (yellow glandular hairs) in the throat.
Type: As for species.
KWEICHOW (GUIZHOU). Type: Hsing jen hsien (Xingren xian), Chen-feng (Zhenfeng), Wan mang na mu, 1300m, medium mountain zone, in dense forest, herb, flower white, edge of lip crenate, two yellow lines in the throat, fruit cover[2] outside striate, 27 viii 1960, *Expedition of Kweichow (Guizhou)* 8608 (PE)[3]. Xingren, along streams in dense forest, fl. white, 24 viii 1960, *Expedition of Kweichow* 8387 (PE)[4]. Yinjiang, 870m, along streams, fl. white, 14 viii 1963, *Jien et al.* 30671 (PE)[4].
YUNNAN. Hsi-ch'ou hsien (Xichou xian), Faa-dou (Fa-dou), on rock in mixed forest, herb, 1ft, fl. white, common, 3 ix 1947, *Feng* 11 982 (PE).

var. **minor** (W. W. Smith) A. Weber, **comb. nov.**
Syn.: *Whytockia chiritaeflora* W. W. Smith var. *minor* W. W. Smith in Trans. Bot. Soc. Edinb. 27: 338 (1919).
Flowers pink or light violet-purple.
Type: Yunnan, Feng Chen Lin (Feng Zhen Lin), mountain forest, 7000ft, flower pink, sine dat., *Henry* 11 232 (holo. E, iso. K).
YUNNAN. Ping-pien (Pingbian), Shih shan (Shi shan), 1300m, flowers light violet purple, 7 vii 1934, *Tsai* 60 706 (PE)[3]. Ping-pien, 1400m, in ravine, fl. dull purple, vii 1934, *Tsai* 60 926 (PE)[4]. Ping-pien, 1500m, in valley, fl. pink, 5 vii 1953, *Mao* 2379 (PE).[4]

The type locality, Feng Chen Lin, and Ping-pien, are very close together and are shown by a single symbol on the map (Fig. 1).

var. **wilsonii** A. Weber, **var. nov.**
A var. *minore* foliis margine multo magis dentato et in facie inferiore interdum purpureis differt.

[1]The specimen at W is regarded as holotype, because it bears Handel-Mazzetti's handwritten designation 'sp.n.'.
[2]This apparently means persisting sepals (which are striate through the presence of secretory canals).
[3]Texts on the label in Chinese. Translation by Dr R. Trappl.
[4]Not seen. Det. Dr W.-T. Wang (PE).

Type: W Szechuan (Sichuan), sine loc., side of streams, fl. pink, ix 1903, *Wilson* 3292 (holo. BM; iso. E, K).
W SZECHUAN (SICHUAN). Sine loc., ix 1908, *Wilson* 2265 (K). O-pien (Obian), ?1942, *Chao* 508 (PE)[1]. Mt Omei (Emeishan), sine dat., *Chou & Hsü* 299 (Jiangsu Inst. of Botany)[1]. Mt Omei, on slopes, fl. lilac, 21 viii 1957, *Chen et al.* 4173 (Jiangsu Inst. of Botany)[1].

Until now *Whytockia* has not been recorded in the literature for Szechuan province. Indeed this new variety proves a remarkable outlying occurrence of the genus in the north. The localities of Wilson's collections are not indicated on the label, but according to Rehder (1930), Wilson collected in the area of Kiating (now Luoshan) both in 1903 and 1908, and in 1903 also around Tchienlu (now Kangding, not far W from Luoshan). Luoshan, O-pien and Mt Omei are close together. It has been mentioned already that Mt Omei is also inhabited by another isolated northern outlier of Klugieae: *Rhynchoglossum omeiense* W.-T. Wang.

3. Whytockia sasakii (Hayata) B. L. Burtt in Kew Bull. 1941: 33 (1941); Kao & De Vol in Taiwania 17: 167 (1972); Kao & DeVol in Li et al., Fl. Taiwan 4: 684 (1978).
Basionym: *Rhynchoglossum sasakii* Hayata, Icon. Pl. Formos. 6: 34 (1916); Sasaki, List Pl. Form. 373 (1928).
Syn.: *Oshimella formosana* Masamune & Suzuki, J. Soc. Trop. Agr. 6: 571 (1934), nom. non valide publ. (Art. 43).
Oshimella sasakii (Hayata) Masamune & Suzuki, J. Soc. Trop. Agr. 6: 571 (1934), comb. non valide publ. (Art. 43).
Type: Taihoku Uraisha (Wulai), 18 ix 1915, *Sasaki* s.n. (TI).
TAIWAN. Wulai, 10 xi 1928, *Suzuki* s.n. (TAI); Chitou, wet mountain slope, 17 x 1970, *Kao* 7738 (TAI); Nokoshan, 23 viii 1929, *Sasaki* s.n. (TAI); Tapansha, S of Arisan (Alishan), forest, 3000ft, 17 x 1912, *Price* 923 (K). About ten more collections at TAI from the following localities are cited in Kao & De Vol (1972): Honhonshan, Soulanshan, Muhkwashan, Bonbonshan, Sakahen and Taipingshan. All these are situated in the central to northeastern part of the island.

ACKNOWLEDGEMENTS

I wish to thank the authorities of the herbaria listed on p. 359 for the loan of specimens and to the curators of numerous herbaria, particularly in the People's Republic of China, for correspondence and information. In particular I am indebted to Dr Wang Wen-tsai (Academia Sinica Peking), who generously helped in many aspects and who identified Chinese collections not available to me. I further thank my colleagues Prof. Dr W. Titz and Dr W. Gutermann for advice in nomenclatural questions. I owe special gratitude to Dr R. Trappl and Dr E. Pilz (Institute of Sinology, University of Vienna) for help with Chinese texts and maps, and for the Pinyin transcription of Chinese names. Last but not least I wish to express my gratitude to Mr B. L. Burtt (Royal Botanic Garden, Edinburgh) for critical reading of the manuscript, and stylistic improvement of the English text.

[1]Not seen. Det. Dr W.-T. Wang (PE).

REFERENCES

BURTT, B. L. (1941). Whytockia and Oshimella. *Kew Bull.* 1941: 31–33.
—— (1962). Studies in the Gesneriaceae of the Old World XXIII. Rhynchoglossum and Klugia. *Notes RBG Edinb.* 24: 167–171.
—— (1978) Op. cit. XLV. A preliminary revision of Monophyllaea. *Ibid.* 37: 1–60.
HANDEL-MAZZETTI, H. (1934). Plantae novae tsiangianae II. *Sinensia* 5: 17–22.
HSIEH, C.-M. & SALTER, C. L. (1973). *Atlas of China.* New York: McGraw-Hill.
KAO, M.-T. & DE VOL, C. (1972). The Gesneriaceae of Taiwan. *Taiwania* 17: 142–169.
—— (1978). Gesneriaceae, in LI, H.-L. et al., *Flora of Taiwan*, 4. Taipei: Epoch Publ. Co.
MASAMUNE, G. & SUZUKI, S. (1934). Oshimella, a new genus of Gesneriaceae from Formosa. *J. Soc. Trop. Agr.* 6: 571.
OLIVER, D. (1896). Stauranthera chiritaeflora, in HOOKER, W. J., *Icones Plantarum*, t. 2454.
REHDER, A. (1930). Ernest Henry Wilson. *J. Arnold Arbor.* 11: 181–192.
SMITH, W. W. (1919). Whytockia, a new genus of Gesneriaceae. *Trans. Bot. Soc. Edinb.* 27: 338–339.
WANG, W.-T. (1982). Notulae de Gesneriaceis sinensibus III. *Bull. Biol. Research* 2: 121–152.
WEBER, A. (1975). Beiträge zur Morphologie und Systematik der Klugieae und Loxonieae (Gesneriaceae). I. Die Spross-und Infloreszenzorganisation von Monophyllaea R. Br. *Bot. Jahrb. Syst.* 95: 174–207.
—— (1976a). Op. cit. II. Morphologie, Anatomie und Ontogenese der Blüte von Monophyllaea R. Br. *Ibid.* 95: 435–454.
—— (1976b). Op. cit. III. Whytockia als morphologische und phylogenetische Ausgangsform von Monophyllaea. *Beitr. Biol. Pflanzen* 52: 183–205.
—— (1976c). Op. cit. IV. Wuchsform, Infloreszenz- und Blütenmorphologie von Epithema. *Pl. Syst. Evol.* 126: 287–322.
—— (1977). Op. cit. VI. Morphologie und Verwandtschaftsbeziehungen von Loxonia und Stauranthera. *Flora* 166: 153–175.
——′(1978). Op. cit. VII. Spross-, Infloreszenz- und Blütenbau von Rhynchoglossum. *Bot. Jahrb. Syst.* 99: 1–47.