

ORCHID GENERA, *ANOECTOCHILUS* AND *ODONTOCHILUS* OF TAIWAN

TSAN-PIAO LIN⁽¹⁾ and CHIEN-CHANG HSU⁽²⁾

Abstract: Two species of *Anoectochilus* and 3 species of *Odontochilus*, including a new species *O. candidus*, are treated. The stigma position is considered a sufficient character for generic distinction.

The study of the native orchids of Taiwan was initiated at the end of 19 century (Hance, 1884). Extensive work was done during the Japanese occupation (Hayata, 1911-1921; Schlechter, 1919; Fukuyama, 1934). Up to the present time a total of 94 genera including 362 species have been described (Masamune, 1954; Hsieh, 1955; Liu & Lai, 1972). Many significant changes are taking place in the study of Taiwan orchids. Hu has published an enumeration of all Chinese orchids which includes the Taiwan species (1971-1975). Hsu has made chromosome counts on 29 species belonging to 17 genera (1971, 1972), and has investigated the chromosomes of 29 terrestrial orchids (Hsu, 1976). In his study on cytology of Japanese orchids, Tanaka (1965) has referred to many Taiwan species. However with all that has been done, only a beginning has been made on the biosystematics of our native orchids (Chen, 1974; Hsu, 1974, unpubl.).

In this paper the two genera *Anoectochilus* and *Odontochilus* are discussed, these belong to the Subtribe Physurinae, Tribe Polychondreae (Schlechter, 1926). In Taiwan there are 12 genera in this subtribe, in addition to the two above mentioned genera, the following are also known from Taiwan: *Cheirostylis*, *Erythrodies*, *Goodyera*, *Hetaeria*, *Hylophila*, *Myrmechis*, *Pristiglotis*, *Vexillabium*, *Vrydagzynea* and *Zeuxine*.

Anoectochilus Bl. (1825) is usually known as the "jewel orchid", because of the beautiful markings on its leaves. Colorful leaves are also found in other genera of this subtribe, especially in some species of *Goodyera*, e.g. *G. biflora*, *G. daibuzanensis*, *G. matsumurana*, *G. nankoenensis*, *G. repens* and *G. schlechtendaliana* (Lin, 1975).

The genus *Odontochilus* Bl. (1858) is closely related to *Anoectochilus*. Usually these two genera are separated by such characters as: the color of its leaves and floral structure. *Anoectochilus* has a deep colored leaf and a distinct spur, while *Odontochilus* has a green leaf and a lip with a saccate base. The essential flower-structures of both genera are very similar, all the species have a remarkably curious flange on either side of the middle part of the lip. Many authors including Ridley (1908), Holtum (1957), Seidenfaden & Smitinand (1959), Dockrill (1969), Seidenfaden (1971) and Garay & Sweet (1974) contend that there is insufficient difference between these two genera to maintain them as separate genera. Although these two genera are closely related and are quite similar in floral morphology, yet we do not feel they should be combined. In Taiwan we have two species reported for the genus *Anoectochilus* and three species, including a new one, for the genus *Odontochilus*. These genera can easily be distinguished by characters given in Table 1.

In the course of our studies on these two genera, attention has been especially given to the structure and position of stigmas (Fig. 1). In *Anoectochilus*, there are 2 remote stigmas,

- (1) Tsan-Piao Lin (林讚標) A graduate of the Research Institute of Botany, NTU, presently an assistant in Silviculture Division, Taiwan Forestry Research Institute.
(2) Chien-chang Hsu (許建昌) Professor of Botany, National Taiwan University.

Table 1. A comparison of the characters of the genera *Anoetochilus* and *Odontochilus*

	<i>Anoetochilus</i>	<i>Odontochilus</i>
1. blade color	dark velvet-green with white markings; purplish underneath	green on both surfaces
2. leaves	several aggregated at the base of the stem in a rosette	evenly spaced on the upper stem
3. base of lip	distinctly spurred, extruding beyond the lateral sepals	saccate and enclosed by the lateral sepals
4. gland in spurred sac	shortly but broadly peltate	not peltate
5. rostellum	not twisted	usually twisted
6. stigma position	lateral	ventral

one on either side of the rostellum base, these are convex and rounded. This is in complete agreement with the *Anoetochilus* of Blume (*pl.* 12, 1858), Hooker (*pl.* 2158—2160, 1894), Smith (*figs.* 65—66, 1908), Dockrill (1969) and Seidenfaden (*figs.* 11—17, 1971). In *Odontochilus* there are several variations with reference to the location and structure of the stigma. *O. inabai* (Fig. I: 4, 5) has one wide and contiguous stigma below which is a pair of horn-like calli. *O. bisaccatus* (Fig. I: 6, 7) has one stigma but it has a constriction separating it into 2 parts and below this stigma there is a pair of cylindrical calli. In *O. candidus*, (Fig. I: 8, 9) there are two distinct stigmas and these are devoid of any protuberance such as ones present in the above two species.

All species of *Odontochilus* have a stigma or stigmas located on the ventral side of the column, while in *Anoetochilus* the stigmas are separate and lateral in position (Fig. I-1, 2). This character seems stable in all Taiwan species and is also confirmed by the illustrations of Blume (*pl.* 29, 1858), Hooker (*pl.* 2165—2168, 1894), Smith (*fig.* 71, 1908) and Seidenfaden (*figs.* 2-10, 1971).

According to Willis (1966), there are 25 species of *Anoetochilus* distributed mainly in the tropical regions of Asia, Australia and Polynesia and 21 species of *Odontochilus* found in China, Indo-Malaysia and Fiji. The characters listed in Table 1 can be used to divide all known species into 2 groups. The following list is compiled from published data. Type materials have not been examined and this list does not include all the known species.

Species with the characters referred to the genus *Anoetochilus*. *A. albolineatus*, *A. burmannicus*, *A. elatior*, *A. geniculatus*, *A. griffithii*, *A. longicalcaratus*, *A. lylei*, *A. regalis*, *A. reinwardtii*, *A. roxburghii*, *A. setaceus*, *A. siamensis*, *A. sikkimensis*, *A. tetrapterus*⁽¹⁾, *A. yatesae*.

Species with the characters referred to the genus *Odontochilus*. *O. brevistylis*, *O. calcaratus*, *O. clarkei*, *O. crispus*⁽²⁾, *O. elwesii*⁽²⁾, *O. flavescens*, *O. grandiflorus*, *O. lanceolatus*, *O. moultmeinensis*⁽²⁾, *O. pectinatus*⁽²⁾, *O. repens*, *O. tortus*, *O. yunnanensis*.

From the above facts it is concluded that *Anoetochilus* seems to be a highly stable natural group, while *Odontochilus* has a wide range of variations with respect to vegetative as well as reproductive characters.

KEY TO TAIWAN SPECIES OF ANOETOCHILUS AND ODONTOCHILUS

1. Lip spurred and the spur protruding between the lateral sepals; leaves dark velvet-green, with a distinct white network..... *Anoetochilus*

(1) gland conical.

(2) The rostellum does not seem to be twisted.

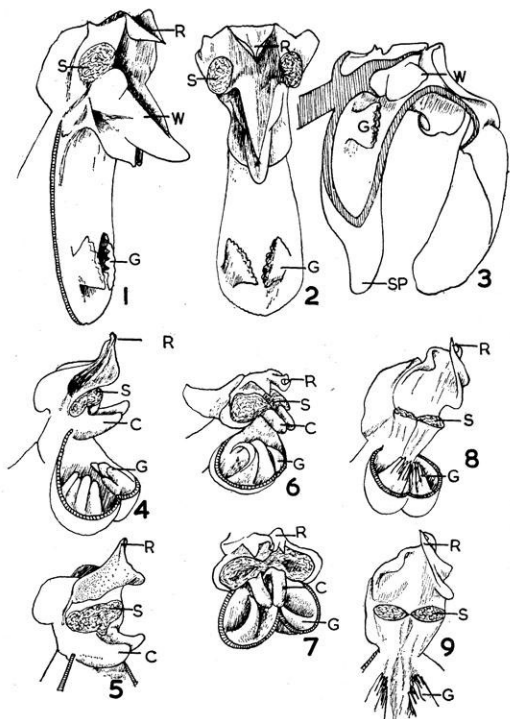


Fig. I. Various columns, showing the stigma position and base of lip 1-2. *Anoetochilus formosanus*; 3. *A. koshunensis*; 4-5. *Odontochilus inabai*; 6-7. *O. bisaccatus*; 8-9. *O. candidus*. C, callus of column; S, stigma; G, gland; SP, spur; R, rostellum; W, column wing.

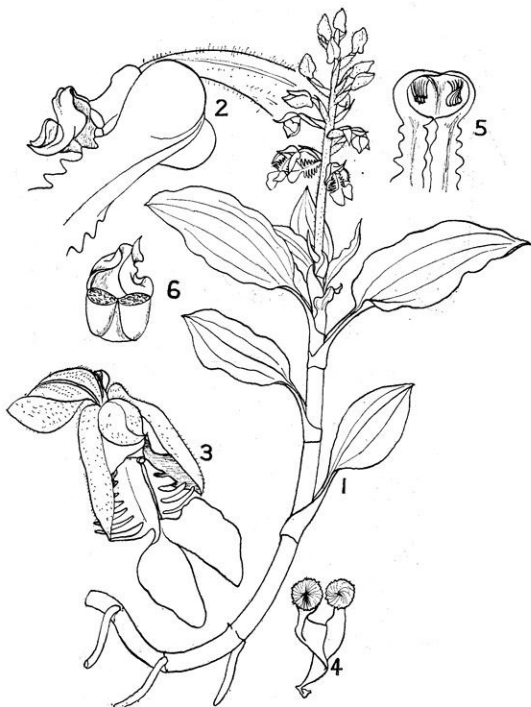


Fig. II. *Odontochilus candidus*, sp. nov. 1. Plant body with an inflorescence; 2. Lip-base and bottom view of column; 3. A flower, top view; 4. Androecium, showing 2 granular pollinia attach on wide stipe and disc; 5. Lip-base, showing glands inside the sac; 6. Column, ventral view, showing 2 closely arranged stigmata.

2. Middle part of lip with fimbriate margins 1. *A. formosanus*
 2. Middle part of lip with a pair of triangular flanges but without
 fimbriate margins 2. *A. koshunensis*
 1. Lip saccate at base and covered by the bases of the lateral sepals; leaves green..... *Odontochilus*
 3. Lip yellow; midrib of leaf gray 3. *O. bisaccatus*
 3. Lip white; midrib of leaf not gray
 4. Sepals marked with dark green 4. *O. inabai*
 4. Sepals greenish throughout 5. *O. candidus*

1. *Anoetochilus formosanus* Hay., Icon. Pl. Form. 4: 101. fig. 53. 1914; Schlechter in Fedde, Rep. Beih. 4: 176. 1919; Masamune in Journ. Geobot. 14(1): pl. 26. 1965, Col. Ill. Fl. Nippon 8: 214. 1969; Nackejima, Enum. Orch. Ryukyus 2: 77-79. pl. 15-17. 1971; Garay & Sweet, Orch. South. Ryukyu Isl. 86. 1974; Sib. Nat. Orch. Taiwan 53-54. fig. 4-1. 1974. 金線蓮

Anoetochilus roxburghii sensu Rolfe in Journ. Linn. Soc. 36: 42, non Lindl.

Anoetochilus tetuoi Ohwi ex Hatusima et Amano, Fl. Okinawa Isl. 148. 1958, nom. nud.

Specimens examined: Central range, *T. Kawakami* & *S. Sasaki* s. n., Jan. 1926, about 1,600 m; Hsinchu Co.: Wutzushan, *T. Kawakami* 1307.

Distribution: Taiwan and Ryukyus.

This is a common species distributed throughout the island, growing in shaded and humid forests or bamboo stands at altitudes from 500 to 1,600 m.

2. *Anoetochilus koshunensis* Hay., Icon. Pl. Form. 4: 104. fig. 54. 1914; Schlechter in Fedde, Rep. Beih. 4: 176. 1919; Masamune, Col. Ill. Fl. Nippon 8: 215. 1969; Garay & Sweet, Orch. South. Ryukyu Isl. 87. 1914; Su, Nat. Orch. Taiwan 55. fig. 4-2. 1974. 恒春金線蓮

Specimens examined: Hualien Co.: Losao, *T. P. Lin* 252, alt. about 1,700 m. Pingtung Co.: Wutai, *T. P. Lin* 266.

Distribution: Endemic to Taiwan.

This has the same habitat as in *A. formosanus*.

3. *Odontochilus bisaccatus* Hay., Icon. Pl. Form. 4: 99. pl. 15. 1914; Lin, Nat. Orch. Taiwan 1: 214. fig. 215, colored photo 135 on page 197, photo of dissected fl. 57 on page 258. 1975. 二囊齒唇蘭

Anoetochilus bisaccatus Hay., Icon. Pl. Form. 4: 99. pl. 15. 1914; Schlechter in Fedde, Rep. Beih. 4: 174. 1919.

Pristiglotis bisaccata (Hay.) Nackejima in Biol. Mag. Okinawa 13: 33. 1975.

Specimen examined: Hualien Co.: Lintienshan, *T. P. Lin* 95, at about 900 m.

Distribution: Endemic to Taiwan.

It grows in the humid rain forests or on humid rocks at altitudes between 800 m and 1,500 m. It is usually found in mountains of the eastern and central range.

4. *Odontochilus inabai* Hay., Icon. Pl. Form. 4: 102. pl. 16. 1914; Kitamura, Murata & Koyama, Col. Ill. Herb. Pl. Jap. 3: 42. 1964; Masamune, Col. Ill. Fl. Nippon 8: 217. 1969; Ohwi, Fl. Jap. 342. 1965; Lin, Nat. Orch. Taiwan 1: 216. f. 217, 218. color photos nos. 136, 137, on page 197 and photo of dissected flower no. 56. on page 258. 1975. 單囊齒唇蘭

Anoetochilus inabai Hay., Icon. Pl. Form. 4: 102. pl. 16. 1914; Schlechter in Fedde, Rep. Beih. 4: 175. 1919; Garay & Sweet, Orch. South. Ryukyu Isl. 87. 1974.

Specimens examined: Taipei Co.: Fushan, *T. P. Lin* 245, alt. about 700 m; Pingtung Co.: Wutai, *Hosokawa* 5415b; Isl. Lanyu, *S. Sasaki* 223, *G. Masamune* 4145; Ilan Co.: Oobishan, *G. Masamune s. n.*, Apr. 26, 1936.

Distribution: Taiwan, the Ryukyus and Japan.

This species occurs from Wulai southwards to Liu-kuei in Kaohsiung Co. at altitudes of about 700 m, and grows in dense rain forests, usually mixed with other herbs or shrubs.

5. *Odontochilus candidus*, *sp. nov.* 白齒唇蘭

Fig. II

Terrestris. Caulis cum racemis circiter 18 cm longus, teres, purpureusfuscus. Folia pauca, plerumque 5, inferioribus noddis cum foliatis breviter vel defoliatis, unicoloribus; lamina oblique ovata versus ovato-elliptica, apice acuta, basi rotundata; petiolis angusta, cum vaginatis 1.5—2 cm longis, conduplicata, basi dilatatis et vaginas expantibus, obscure virida. Inflorescentiae terminalibus, racemi hirsuti, 6—8 cm longa, circ. 13 flora; bracteis floriferis sub floribus ovata-lanceolata, hirsutis, 10—12 mm longis 4.5 mm latis; pedicellis cum ovaris circ. 9 mm longis, hirsutis. Flores deflexi post florescentiam; sepalum posticum ovatum, circ. 7 mm longum 5 mm latum, hirsutum exteriorum, concavum, apice caudatum; sepala lateralia oblique ovata, virida, 8 mm long 5 mm lata, apice acuminata, duo basi se connata saccum 2-lobatum formantia saccum; petala rhombia, 7 mm longa 4 mm lata, acuminata-aristata, alba, virida tinctoria, hirsuta exteriora cum sepala posteriore connata galeam formantia. Labellum Y-forme, basi bisaccatum; sacco globoso circ. 1.8 mm diametre, latere oris sacci utroque 1-appendiculatum, appendiculis glandulosum, torulosum vel erectum, pectinatum; mesochilo angusto unguiculis glandulosum, margine pectinato, dentibus pectinis utroque latere circ. 6, superioribus longioribus linearibus 3 mm longis apice obtusia, inferioribus dentibus brevioribus; epichile lamina 2-lobata, lobis semi-rotundatis, 8 mm longis 5 mm latis; columna brevissima, sine prae alatae; rostellum contortum; stigma sub rostellum 2; pollinia 2, stipitata.

Odontochilus brevistylis HK. f. ut videtur affinis.

Distribution: Kaohsiung Co.: Nanfengshan (高雄縣南鳳山) *T. P. Lin* 167 (Holotypus, TAI); Nantou Co.: Hsin-sheng (南投縣新生) *T. P. Lin* 80.

This species was first found in a humid forest in the southern part of Taiwan at about 700 m altitudes. It flowers from August to September. The specific epithet "candidus" means "very pure white", referring to the color of the lip. It has also found in the central mountain in Nantou County.

Terrestrial. Stems with a raceme about 18 cm long, terete, purplish-brown. Leaves several, usually 5, lower nodes with shorter leaves or leafless, concolorous; blades obliquely ovate to ovate-elliptical, apex acute, base rounded; petioles narrow, including sheath 1.5—2 cm long, conduplicate, base broadly expanding into the sheath, obscurely green. Inflorescences terminal, racemes hirsute, 6—8 cm long, about 13-flowered; floral bracts ovate-lanceolate, hirsute, 10—12 mm long by 4.5 mm wide; pedicels with ovaries about 9 mm long, hirsute. Flowers deflexed after flowering; posterior sepal ovate, about 7 mm long by 5 mm wide, hirsute outside, concave, apex caudate; lateral sepal obliquely ovate, green, 8 mm long by 5 mm wide, apex acuminate, both sides of the base connate into a sac, thus forming a 2-lobed sac; petal rhomboid, 7 mm long by 4 mm wide, acuminate-aristate, white, flushed with green, hirsute outside, connate with posterior sepal forming a hood. Lip Y-shaped, the base bisaccate; the sacs globose, about 1.8 mm in diameter, lateral opening of the sac with 1 appendage on each side, the appendage glandulate, tortuous, erect, comb-like; middle part of the lip narrowed into a claw, margin pectinate, lateral teeth of the comb about 6, upper ones longer, 3 mm long, the apex obtuse, the lower tooth shorter; upper part of the lip 2-lobed, the lobe semi-circular, 8 mm long by 5 mm wide; column very short, without a wing in front; rostellum twisted; stigma 2 under rostellum; pollinia 2, with stipe.

O. candidus is closely related to *O. brevistylis* of Malaya and Thailand, but differs in that the margins of lip-blade are entire and not toothed.

LITERATURE

- BLUME, C. L., 1858. Collection des Orchidees de l'Archipel Indien et du Japon. Amsterdam.
- CHEN, S. H., 1974. Systematic studies on the Subtribe Blettiinae (Orchidaceae) of Taiwan. Master's Thesis. Inst. Botany, NTU., Taipei.
- CHOW, C., 1968. Formosan Orchid. Author's Press.
- DOCKRILL, A. W., 1969. Australian Indigenous Orchids. I. Sydney.
- FUKUYAMA, N., 1934. Orchidacearum Formosanarum Prodomus. Thesis. Taihoku Imp. Univ. (now National Taiwan Univ.)
- GARAY, L. A., & SWEET, 1974. Orchids of Southern Ryukyu Islands. Cambridge, Mass.
- HANCE, H. F., 1884. Orchidaceae epiphyticas binas novas describit. Journ. Bot. 22: 364.
- HAYATA, B., 1911-1921. Icones Plantarum Formosanarum. I-X. Civil Government Press, Taihoku (now Taipei)
- HOLTUM, R. E., 1957. Flora of Malaya 1: Orchids. Singapore.
- HOOKER, J. D., 1890. The Flora of British India. Vol. 6. London.
- _____, 1894. Icones Plantarum 4. ser. 2. London.
- HU, S. Y., 1971. *Anoetochilus yungianus*, a new species of Orchidaceae. Quart. Journ. Taiwan Mus. 24(3-4): 257-262. fig. 1, 2.
- _____, 1971-1975. The Orchidaceae of China. I-VIII. Quart. Journ. Taiwan Mus. 24: 67-104, 181-256; 25: 41-68, 199-230; 26: 131-165, 373-406; 27: 155-189, 419-467; 28: 125-182.
- HSIEH, A. T., 1955. An enumeration of the Formosan Orchidaceae. Quart. Journ. Taiwan Mus. 8(3): 213-282.
- Hsu, C., 1971. Preliminary chromosome studies on the vascular plants of Taiwan. IV. Counts and systematic notes on some Monocotyledons. Taiwania 16: 123-136.
- _____, 1972. ibid. V. Cytotaxonomy on some Monocotyledons. I. c. 17: 48-65.
- _____, 1974. Biosystematic studies on the native *Cymbidium* of Taiwan. Unpubl.
- _____, 1976. Cytological studies on the economically promising wild orchids found on Taiwan. Proc. Nat. Sci. Council 9(2): 61-79.
- KITAMURA, S., G. MURATA, & T. KOYAMA, 1964. Coloured Illustrations of Herbaceous Plants of Japan. Hoikusha Publ. Co., Osaka, Japan.
- LIN, T. P., 1975. Native Orchids of Taiwan, 1. Author's Press, Chiayi, Taiwan.
- LIU, T. S., & M. J. LAI, 1972. A census of genera of plants native to Taiwan. Exp. Forest. Bull., No. 55.
- MASAMUNE, G., 1954. A list of vascular plants of Taiwan. Kanazawa, Japan.
- _____, 1965. *Anoetochilus formosanus* Hay. Journ. Geobot. 14(1): f. 26.
- _____, 1969. Color Illustrated Flora of Nippon. Vol. 8. Tokyo.
- NACKEJIMA, C., 1971. An Enumeration of Orchids of the Ryukyus. Vol. 2. Okinawa.
- _____, 1975. Preliminary notes on the noteworthy Orchidaceae from Formosa, Ryukyus, Bonin Islands and southern Japan (4). Biol. Mag. Okinawa 13: 24-37.
- OHWI, J. 1965. Flora of Japan. Washington.
- RIDLEY, H. N., 1908. Materials for a Flora of the Malayan Peninsula. I. Singapore.
- ROLFE, R. A., 1903. An enumeration of all the plants known from China proper, Formosa, Hainan, the Corea, the Luchu Archipelago and the island of Hongkong. Journ. Linn. Soc. London. 36: 42.
- SCHLECHTER, R., 1919. Orchideologiae Sino-Japonicae Prodomus. Fedde Rep. Beih. 4.
- _____, 1926. Das System der Orchidaceen. Notizblatt des Botanischen Gartens U. Museum. Zu Berlin-Dahlem 88 Band 9.
- SEIDENFADEN, G., & T. SMITINAND, 1959. The Orchids of Thailand. Bangkok.
- SEIDENFADEN, G., 1971. Contributions to the Orchid flora of Thailand. Bot. Tidsskr. 66.
- SMITH, J. J., 1908. Die Orchideen von Java, Fig.-atlas. Leiden.

- SU, H. J., 1972. *Orchidaceae* in Liu, T.S. (ed.): "Chungshan Natural Science Encyclopaedia" Vol. 8. Botany, pp. 874-899. Hsangwu Press, Taipei.
- _____, 1974. Native Orchids of Taiwan. 138 pp. Fungnien Press, Taipei.
- WILLIS, J. C., 1966. A Dictionary of the Flowering Plants and Ferns. Cambridge, England. (revised by H. K. A. Shaw).