

## A Taxonomic Review of the Japanese *Lecanorchis* (Orchidaceae)

By

Tamotsu HASHIMOTO\*

橋本 保\*: 日本産ムヨウラン属の検討

### Introduction

The genus *Lecanorchis* is peculiar to the Orchidaceae by having a combination of characters that the plant provided rudimental leaves (in consequence of the saprophytism throughout the life cycle) and the presence of a calyculus at the summit of ovary.

When Blume established the genus *Lecanorchis* in 1856 he recognized two species, i. e., *L. japonica* and *L. javanica*, of which the habitats were indicated by each specific epithet. In 1974, *L. japonica* was chosen for the generic lectotype by Garay and Sweet. Since Blume's second species, *L. javanica*, is a peloric form, and there exists no reliable identification with another named taxon for its normal state\*\*, no objection to their lectotypification has been declared. Any supraspecific taxon in the genus has never been proposed before this review is prepared. Detailed analyses on the floral morphology of the taxa in the genus had been seldom done, because they had been sporadically collected and their textures were fragile.

Twelve specific and four varietal names of the genus had been published from Japan. These numbers are fairly large among twenty-five specific and five varietal published names of the whole genus.

### *Lecanorchis* Blume

*Lecanorchis* Blume, Mus. Bot. Lugd. Bat. 2: 188, 1856; Fl. Jav. Ins. Adj., nov. ser. 1, 149, 1858; J. J. Smith, Orch. Java, 62, 1905; Schlechter in Fedde, Rep., Beih. 1: 32, 1914; Ibid. 4: 146, 1919; Holttum, Fl. Malaya, Orch., ed. 3, 100, 1964; Ohwi, Fl. Jap., Engl. ed. 335, 1965; F. Maekawa, Wild Orch. Jap. Col. 33 & 463, 1971; Garay & Sweet, Orch. South. Ryukyu Is. 49, 1974; Seidenfaden in Dansk Bot. Ark. 32: 125, 1978; Satomi in Satake et al., Wild. Fl. Jap., Herb. 1: 205, 1982.

\* Tsukuba Botanical Garden, National Science Museum, Tsukuba, 305. 国立科学博物館 筑波実験植物園.

\*\* J. J. Smith (1910) had treated *L. javanica* Blume as the correct name of *L. triloba* J. J. Smith, but the latter was revised and synonymously designated under the newly described "*L. multiflora* J. J. Smith" by himself (1918). It is curious because he did not quote Javanese specimens of 1910's *L. javanica* sensu J. J. Smith for 1918's *L. multiflora* J. J. Smith, despite his treatment on synonymy purposely shown by him.

Rather small saprophyte with scaly, rough, often J-shaped rhizomes. Ascending portion of rhizome often branched. Roots numerous, rather fleshy, somewhat winding, radiate, sometimes elongate to about 30 cm, usually simple, often occurring only from the downward portion of rhizome. Aerial stem simple or branched, erect or nearly so, hard, slender, with a few tubular sheaths, black or yellowish brown. Abbreviated juvenile stem of *L. nigricans*, white at the stage of several roots of 5 to 6 cm long. Normal leaf lacking. Inflorescence racemose, laxly few-flowered, terminal on the new shoot or lateral on the old stem of which survived since the preceding year. Flowers inconspicuous. Sepals and petals free, similar. Lip more or less adnate at the basal margins to the column and forming a basal tube, simple or three-lobed; anterior part of the disc with ribbon-like multicellular hairs; inside the posterior part with unicellular hairs. Column slender, elongate, more or less clavate, inconspicuously winged apically; clinandrium high; lateral stigma-lobes form an erect plate, covered with papilla; stigma hidden behind the lateral lobes. Anther incumbent, without distinct cell; pollen grains forming two friable masses. Ovary slender, elongate, with a shallow, campanulate, denticulate calyculus of which encircled the base of perianths. Seeds very slender, with the lateral micropyle and very small testa-cells (Tohda 1971, 1986). Chromosome numbers of four species in the genus were tentatively reported by Sawa and Torikoshi (1986) that *L. japonica* and *L. trachycaula* are '2n=38', *L. kiusiana* and *L. nigricans* were '2n=38/n=19', however, Aoyama et al. (1987) studied on *L. japonica* and concluded that the materials were '2n=36/n=18'.

About 15 species in Honshu of Japan and Sikkim (Seidenfaden 1978: 125) to Papua New Guinea, through Taiwan and Java. No record from continental China and Indochina except for Thailand, Burma and the Malay Peninsula. Rooting in leafmold in the evergreen forest with the exception of *L. kiusiana* var. *suginoana* and a certain population of *L. japonica* var. *japonica* of which are found in the deciduous broad-leaved forest. A northern population of *L. nigricans* inhabits the mixed forest.

Type Species: *Lecanorchis japonica* Bl., designated by Garay & Sweet, l. c. 1974.

#### Key to the species and varieties of Japanese *Lecanorchis*

- A. Lip with a pair of calli on the disc; column as long as or slightly exceeding the lateral lobes of the lip.....7. *L. triloba* (Trilobae)
- A. Lip without a callus on the disc; column apparently shorter than the lateral lobes of the lip ..... B
- B. Lip 3-lobed ..... D
- B. Lip entire ..... C (*Nigricantes*)
- C. Column glabrous .....6a. *L. nigricans* var. *nigricans*
- C. Column ventrally papillose .....6b. *L. nigricans* var. *yakusimensis*
- D. Major nerves of the lip even ..... E (*Lecanorchis*)
- D. Major nerves of the lip odd..... K (*Flavicantes*)
- E. Margins of the lip papillose ..... F
- E. Lip without marginal papilla..... G



- F. Multicellular hairs on the lip reddish or purplish at the apical portion, with apically congested unicellular branchlets .....2a. *L. kiusiana* var. *kiusiana*
- F. Multicellular hairs on the lip light yellow throughout, with scattering unicellular branchlets .....2b. *L. kiusiana* var. *suginoana*
- G. Aerial stem branched; anther pubescent around the dehiscent slits, with a median swelling above .....3. *L. trachycaula*
- G. Aerial stem simple; anther glabrous, with a more or less depression above ..... H
- H. Lip basally adnate to the column about halfway ..... I
- H. Lip basally adnate to the column about 1/3 length ..... J
- I. Midlobe of the lip nearly quadrate; column-wings with an apparent incision, thus forming a pair of triangular auricles .....1c. *L. japonica* var. *kiiensis*
- I. Midlobe of the lip transversely rectangular; column-wings nearly semicircular, with slightly erose-denticulate margins .....1d. *L. japonica* var. *tubiformis*
- J. Column-wings with an apparent incision, thus forming a pair of triangular auricles; ovary conspicuously scabrous .....1b. *L. japonica* var. *hokurikuensis*
- J. Column-wings nearly entire; ovary glabrous or less scabrous .....  
.....1a. *L. japonica* var. *japonica*
- K. Midlobe of the lip transversely rectangular with incurved margins ....5. *L. virella*
- K. Midlobe of the lip roundish, decurved at the front ..... L
- L. Column basally adnate to the lip about halfway; ovary with a ring-like excrescence below the calyculus .....4b. *L. flavicans* var. *acutiloba*
- L. Column basally adnate to the lip about 1/3 or 1/4 length; ovary ?without a ring-like excrescence below the calyculus .....4a. *L. flavicans* var. *flavicans*

#### Sect. *Lecanorchis*

Labellum trilobum, numeris nervorum aequalibus; lobis lateralibus inconspicuis vel obtusis, irregulariter denticulatis; lobo intermedio prope erecto vel leviter decurvato. Alae columnarum trapezoideae vel semicirculares.

Lip 3-lobed, with even numbered major nerves; lateral lobes inconspicuous or obtuse, irregularly denticulate; midlobe nearly erect or slightly recurved. Column-wings trapezoid or semicircular.

Three Japanese species are included in this section. The number of major nerves of the lip, i. e., even or uneven, is a newly recognized diagnostic character in orchid taxonomy in this paper. It is applicable to distinguish Sectt. *Lecanorchis* and *Trilobae* from the other sections. Since the previous contributions did not mention this point, it is difficult to review most of the exotic taxa, but illustrations of *L. malaccensis* Ridley by Seidenfaden (1978, fig. 77) from Thailand, *L. pauciflora* J. J. Smith by the original author (1922, t. 25-1) from Java and *L. cerina* var. *albidus* Lin by the original author (1987, p. 146) prove that they are belonging to this section.

1. ***Lecanorchis japonica*** Blume, Mus. Bot. Lugd. Bat. 2: 188, 1856; Fl. Jav. Ins. Adj., nov. ser. 1, 149, t. 62-fig. 1, 1858; Schlechter in Fedde, Rep., Beih. 4: 146, 1919;

Ohwi, Fl. Jap., Engl. ed., 335, 1965; F. Maekawa, Wild Orch. Jap. Col. 236, pl. 81, 1971; Hashimoto in Hashimoto & Kanda, Jap. Indig. Orch. in Col. 89, 1981; Satomi in Satake et al., Wild Fl. Jap., Herb. 1: 206, 1982.

1a. var. **japonica**.

Figs. 1~3.

*L. japonica* Bl., l. c. 1856; l. c. 1858; Schlechter, l. c. 1919; Ohwi, l. c. 1965; F.

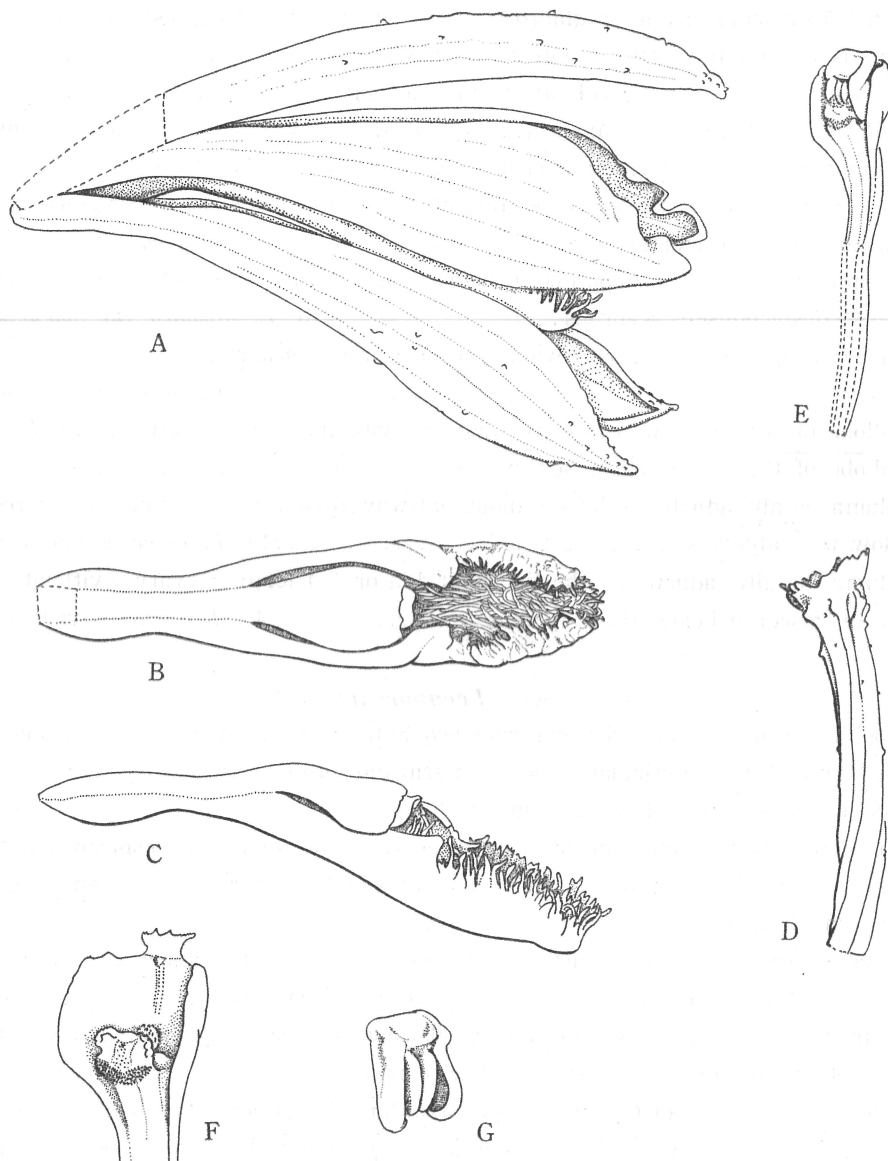


Fig. 1. *Lecanorchis japonica* var. *japonica* from Oseto-cho, Nagasaki Pref., collected by F. Momoshita. A, flower from side. B, lip and column from above. C, lip and column from side. D, pedicellate ovary. E, column, oblique view. F, anterior portion of column, anther removed, a portion of pollinium behind stigma-lobes left over. G, anther, oblique view. A~D & K,  $\times 5$ , material including L & M simultaneously collected with TNS 9504065 (cf. Fig. 3).

Maekawa, l. c. 1971; Hashimoto, l. c. 1981; Satomi, l. c. 1982.

Plant 30 to 45 cm high. Rhizome J-shaped at the bottom, with more or less ciliate scaly sheaths; ascending part elongate, somewhat crooked, with several branches; descending part short, 2 to 3 cm long, simple, radiate numerous roots. Roots rather thick, about 1.5 to 2.5 mm in diameter in dried specimen, horizontally elongate, to about 30 cm

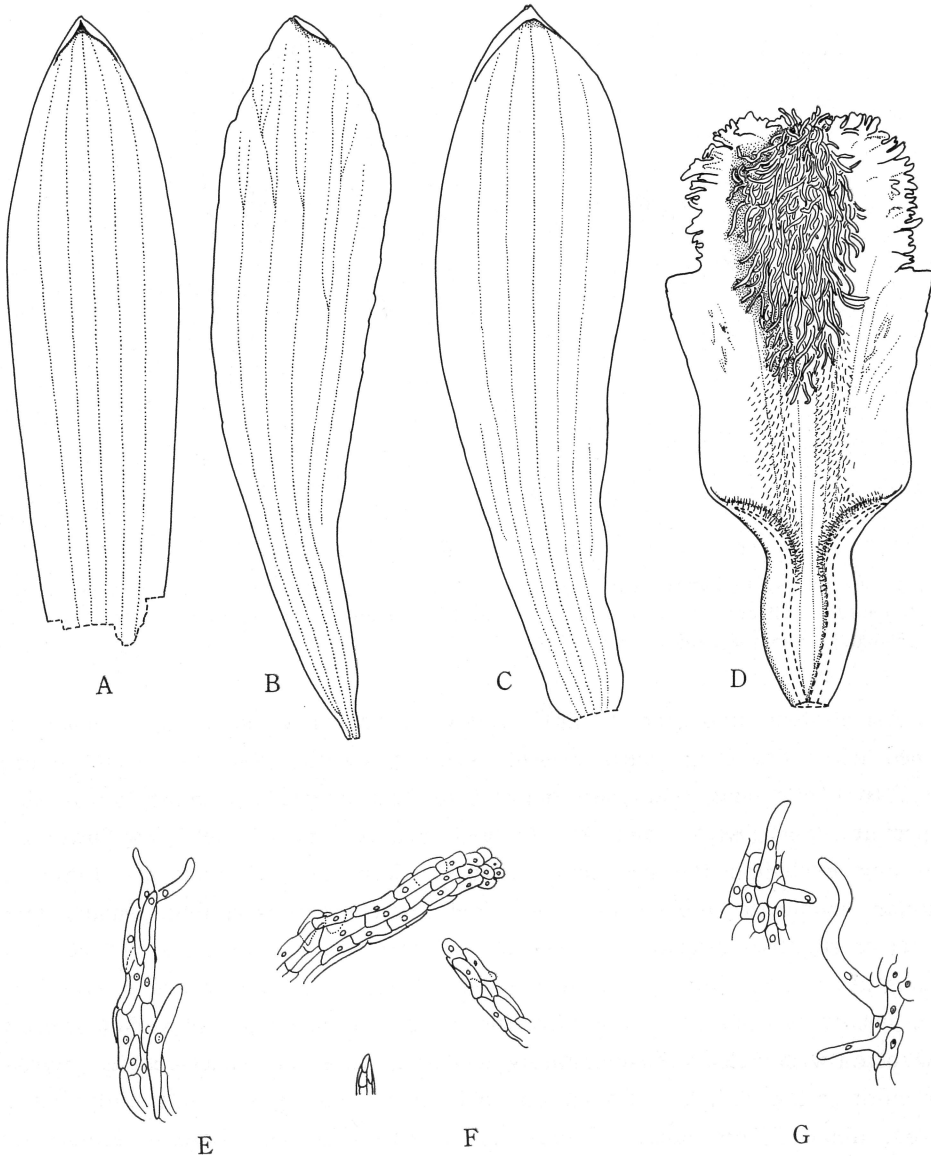


Fig. 2. *Lecanorchis japonica* var. *japonica*, depicted the material of Fig. 1. A, dorsal sepal, lacking a portion of the base, spread out. B, petal, spread out. C, lateral sepal, spread out. D, lip, free portion spread out. E, apical portions of multicellular hairs at posterior part of cluster on lip, showing unicellular branchlets. F, apical portions of multicellular hairs at anterior part of cluster on lip. G, unicellular hairs on posterior part of lip. A~D,  $\times 5$ . E~G,  $\times 50$ .

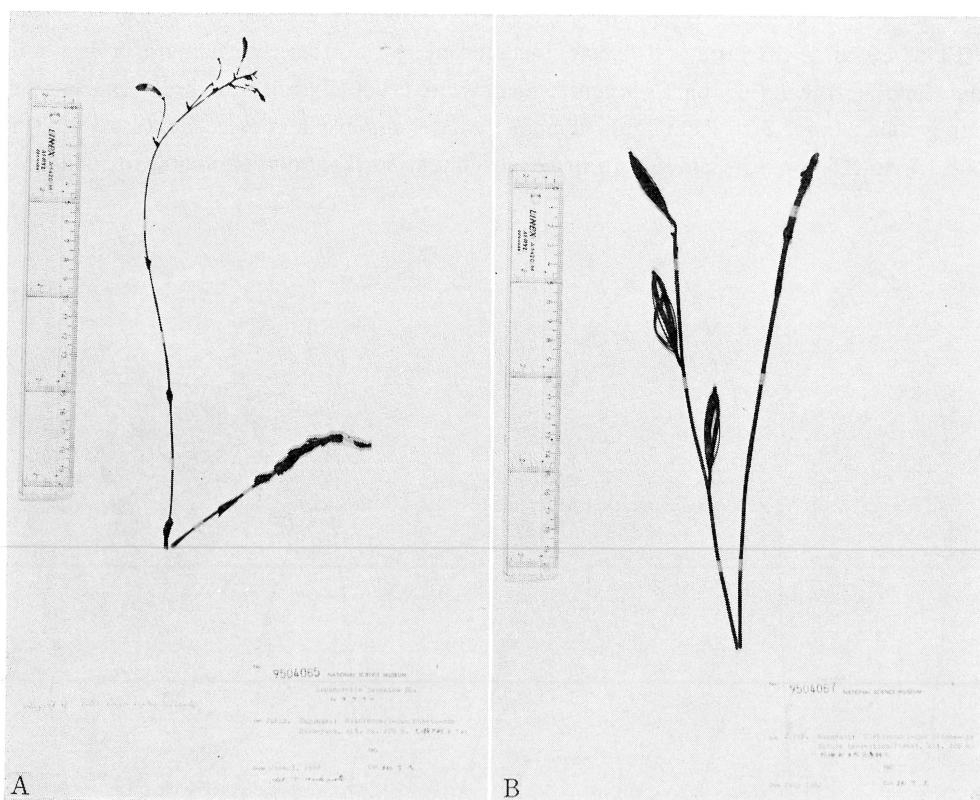


Fig. 3. *Lecanorchis japonica* var. *japonica*. A, specimen with flowers (TNS 9504065), simultaneously collected with the material of Figs. 1 and 2. B, specimen with fruits (TNS 9504067) from the same station of A.  $\times 1/4$ .

long. Aerial stem simple, erect, light yellowish brown when young, blackened and hardened after flowering, with several sheaths; sheaths glabrous, ovate to broadly ovate, 7 to 12 mm long, acuminate and at 6 to 7 cm intervals in upper two or three in the specimen from Oseto, Nagasaki. Inflorescence terminal, loosely few-flowered, 6 to 10 cm long excluding the peduncle, to about 15 cm long in fruiting. Floral bracts triangular, acuminate, about 6 mm long. Pedicellate ovary ascending, usually deflexed, glabrous or slightly muricate, to about 25 mm long, with a calyculus at the summit; calyculus about 1 mm high, with an irregularly denticulate margin and uneven surface. Flower basally surrounded by the calyculus, somewhat nodding, pale yellow or brownish yellow, often with violet suffusion, rarely whitish with a pale violet centre. Sepals and petals more or less deflexed. Dorsal sepal oblanceolate-oblong, cucullate, entire, subacute, 5-nerved, about 20 mm long, 4.5 mm wide when spread out. Lateral sepals obliquely oblanceolate, cucullate, entire, subacute, 5-nerved, about 20 mm long, 5.5 mm wide when spread out. Petals obliquely oblanceolate, slightly and microscopically erose, obtuse, with 4 major and 1 light nerves; major nerves branched above. Lip 3-lobed, nearly erect, canaliculate, adnate about 1/3 length to column from the base, with 6 major nerves, about 15.5 mm long, 7 mm wide when spread out, 3.5 mm wide in natural

position; disc dense hairy; hairs yellow, 1 to 1.5 mm long, multicellular, ribbon-like, simple, rarely branched near the anterior margin of midlobe, sometimes with unicellular branchlets; posterior half of the disc except for the base microscopically papillose; lateral lobes exceeding the column, indistinct, demarcated by a difference which forms an anterior margin about 1 mm high and sometimes subdenticulate, with a few, longitudinal, uneven, small excrescences or calli inside; midlobe subquadrate, subtruncate at the apex, irregularly erose-lacerate along the sides, 4 mm long and 6.5 mm wide when spread out. Column white, glabrous except for stigma-lobes, 10 mm long, about halfway adnate to the lip, with semicircular-trapezoid wings at the top; column-wings nearly entire. Anther white, glabrous, with a pan-like depression above. Fruit black, fusiform, erect or nearly erect, about 5 cm long together with the pedicel and the persistent calyculus. Flowering in late May to August.

ETYMOLOGY. Named for the locality of plant.

JAPANESE NAME. ムヨウラン, スケロクラン

DISTRIBUTION. Reported from Honshu, Shikoku and Kyushu.

TYPE. Honshu. 'Mino: in montibus oppido Gunsjo v. Takasu vicinis querceta inter saxa incolens' (holotype in L?; not found there in June 1990 according to M. Nakajima).

SPECIMENS EXAMINED. HONSHU. Ibaraki Pref.: Nishikanasa-san (Mt.), Kuji-gun, June 14, 1970, M. Suzuki (Herb. Ibaraki Univ.), fls.; Ibid. Mt. Tsukuba, June 16, 1979, H. Tasaki (Herb. Ibaraki Univ.), fls.; Tokyo: Takao-san (Mt.), June 25, 1922, A. Kimura (TUS 26499). KYUSHU. Nagasaki Pref.: Nuku-yama, Seto-cho, Nishisonoki-gun, alt. ca. 200 m, June 3, 1982, F. Momoshita (TNS 9504065), fls.

1b. var. **hokurikuensis** (Masamune) Hashimoto, comb. & stat. nov. Figs. 4~6.

*L. hokurikuensis* Masamune in J. Geobot. 12: 69, 1963; Col. Illustr. Fl. Nippon 8: 183, 1969; Satomi, *ibid.* 205. 1982.

Stem often with reddish violet suffusion. Pedicellate ovary obtuse or nearly right angled with the axis, slightly muricate together with the anterior halves of sepals. Flowers suffused with reddish violet, more or less pendulous. Lip basally adnate about 1/3 length to the column, about 15 mm long, with obtuse lateral lobes; lateral lobes minutely and irregularly erose-incised at the apical margin; major nerves 4. Column white; column-wings with an incision. Fruit nearly erect or ascending. Flowering in June and July.

ETYMOLOGY. Aftered for the district name HOKURIKU, where the plant was believed to be an endemic taxon by the original author.

JAPANESE NAME. ホクリクムヨウラン

DISTRIBUTION. Reported from south of Tohoku, Hokuriku & other districts of Japan. The reported localities except for the specimens from Honshu are needed the re-examination.

TYPE. Toyama Pref.: 'ca. Oiwabudo', Masamune, June 16, 1963 (n. 16067, holotype in KANA).

SPECIMENS EXAMINED. HONSHU. Miyagi Pref.: Sankyō, Sendai, June 12, 1956, S.

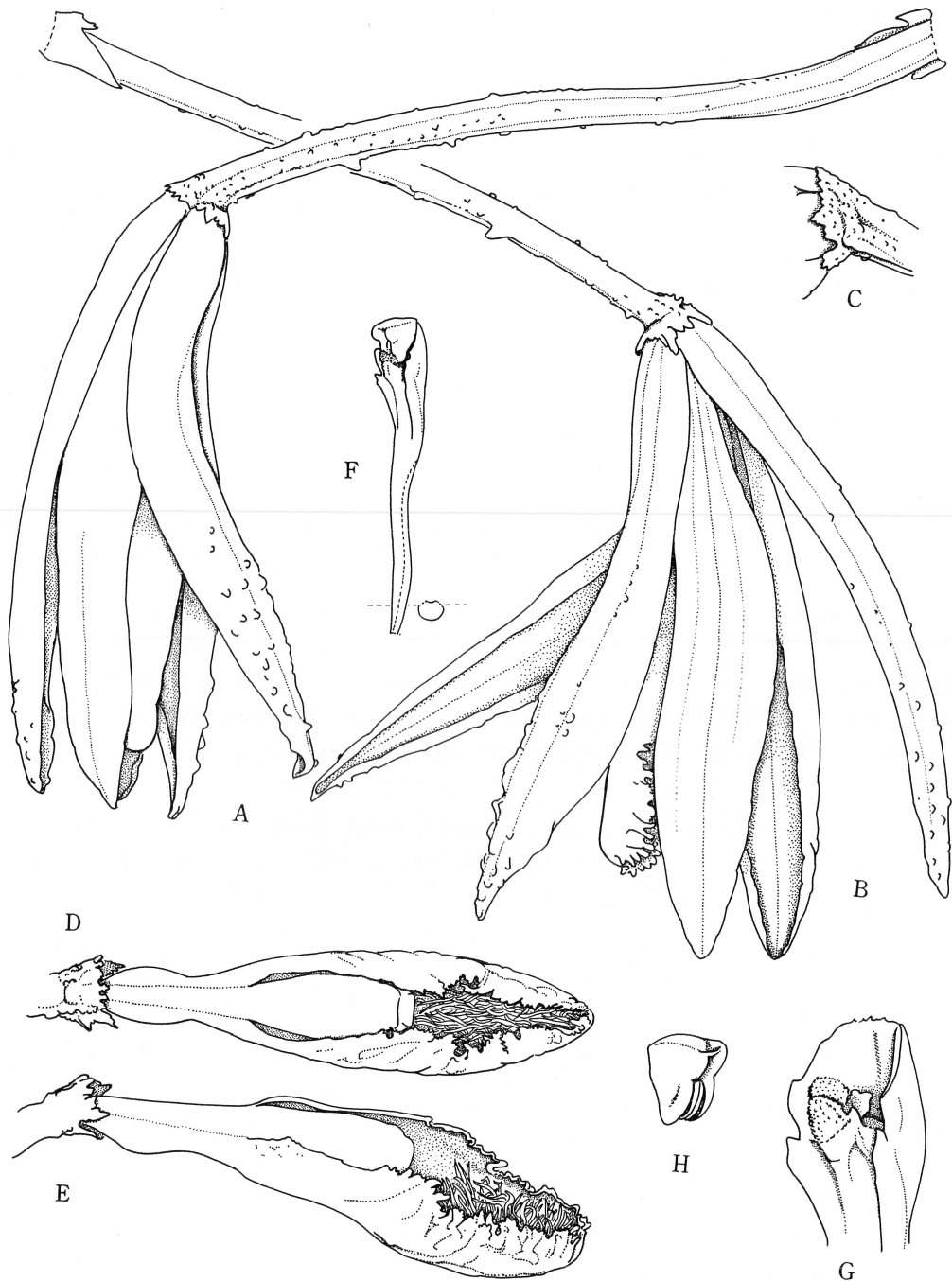


Fig. 4. *Lecanorchis japonica* var. *hokurikuensis* from Kanazu-cho, Fukui Pref., collected by T. Wakasugi (TNS 9504062). A, flower from side. B, flower from side, slightly spread out. C, calyx. D, lip and column with calyx from above. E, lip and column with calyx from side. F, column, oblique view. G, anterior portion of column, anther removed, a portion of pollinium behind stigma-lobes left over. H, anther. A, B & D~F,  $\times 5$ . C & H,  $\times 9$ .

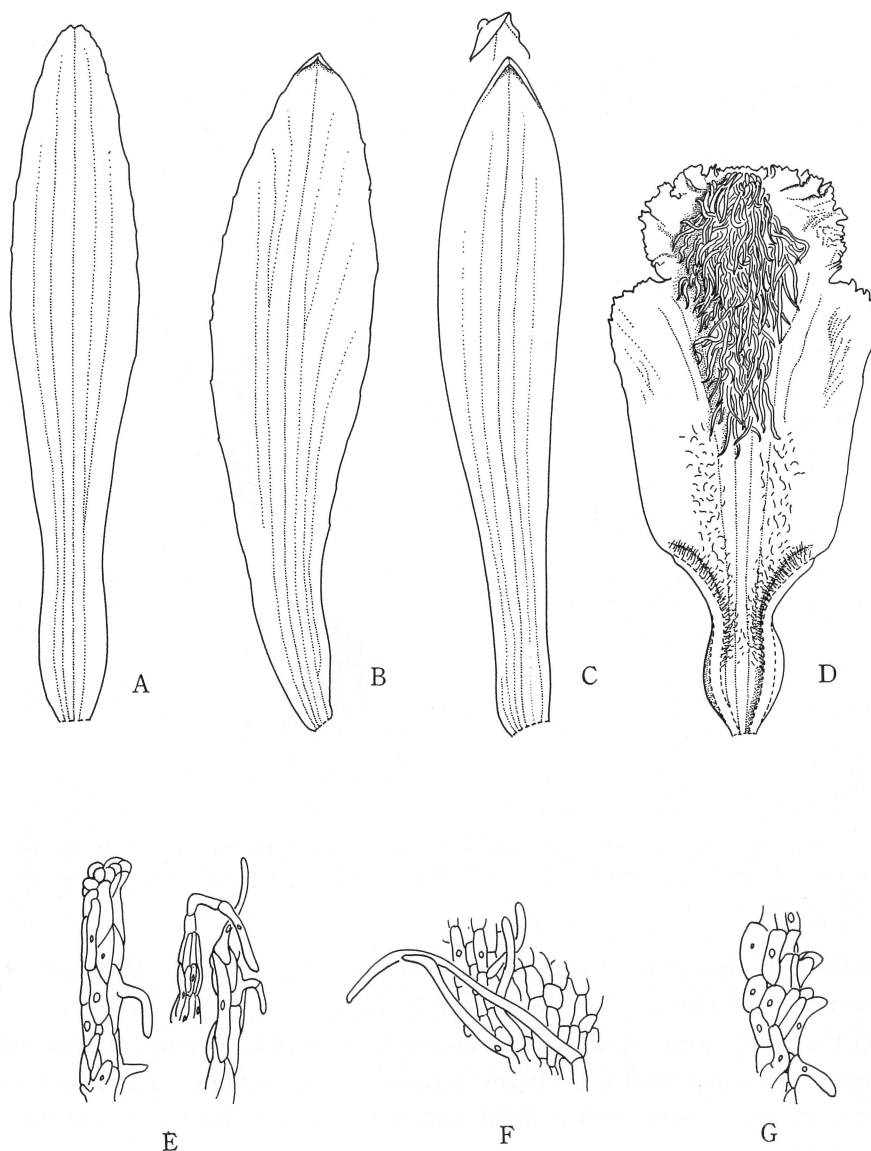


Fig. 5. *Lecanorchis japonica* var. *hokurikuensis*, depicted the material of Fig. 4. A, dorsal sepal, spread out. B, petal, spread out. C, lateral sepal, spread out. D, lip, free portion spread out. E, apical portions of multicellular hairs at posterior part of cluster on lip. F, unicellular hairs on outer surface near free portion of tubular hypochil. G, unicellular hairs on inner surface of mesochil. A~D,  $\times 5$ . E & F,  $\times$  ca. 65. G,  $\times 125$ .

Sugaya (TUS 26488), fls.; Ishikawa Pref.: Kita Shrine, Hata-gun, Sept. 20, 1955, N. Satomi (TNS 123812), fr.; Fukui Pref.: Sawa, Kanazu-cho, Sakai-gun, June 21, T. Wakasugi (TNS 9504062), pl. w. underground organs; Ibid. (TNS 9504063), pl. w. good condition of fls.; Hyogo Pref.: Yamamoto, Feb. 7, 1953, M. Togashi (TNS 102609), pl. w. fr. & subterranean organs.

When Masamune (1963) described *L. hokurikuensis*, perhaps he had a false idea of

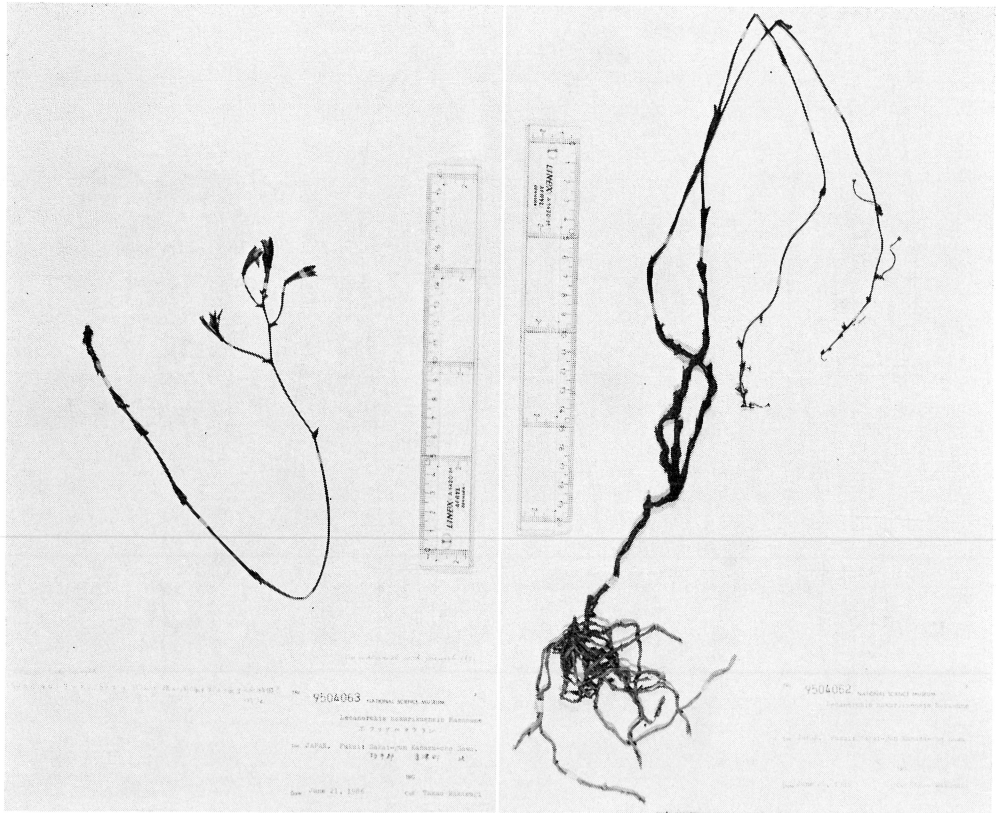


Fig. 6. *Lecanorchis japonica* var. *hokurikuensis*. A, plant with flowers (TNS 9504063), simultaneously collected with the material of B, Figs. 4 and 5. B, plant with subterranean organs (TNS 9504062).  $\times 1/4$ .

*L. japonica*. At that point of time, there were only Blume's (1856, 1858) and Tuyama's (1955) works to be thought reliable to identify *L. japonica*. While Blume's (l.c.) delineations on the entity were insufficient to compare these two concepts, it was difficult to have access to those books in Japan because of the rarities. The figure shown by Tuyama (l.c.) was drawn from a dried material and was too hairy on the anterior portion of lip.

These facts possibly led Masamune's idea to another species. The author can not find any right character of this entity for the specific independency of *L. japonica*, though he described as the above. *L. japonica* var. *hokurikuensis* occurs in the northernmost range of the genus.

1c. var. **kiiensis** (Murata) Hashimoto, comb. & stat. nov.

Figs. 7 & 8.

*L. kiiensis* Murata in Acta Phytotax. Geobot. **26**: 145, 1975; Satomi, *ibid.* 206, 1982.

Flowers brilliant yellow. Lip about halfway adnate to the column, 17 mm long, with 6 major nerves; free portion of lateral lobes subacute, minutely and irregularly erose; midlobe subquadrate; multicellular ribbon-like hairs on the midlobe usually simple, without a unicellular branchlet but with margins more or less uneven. Column-wings



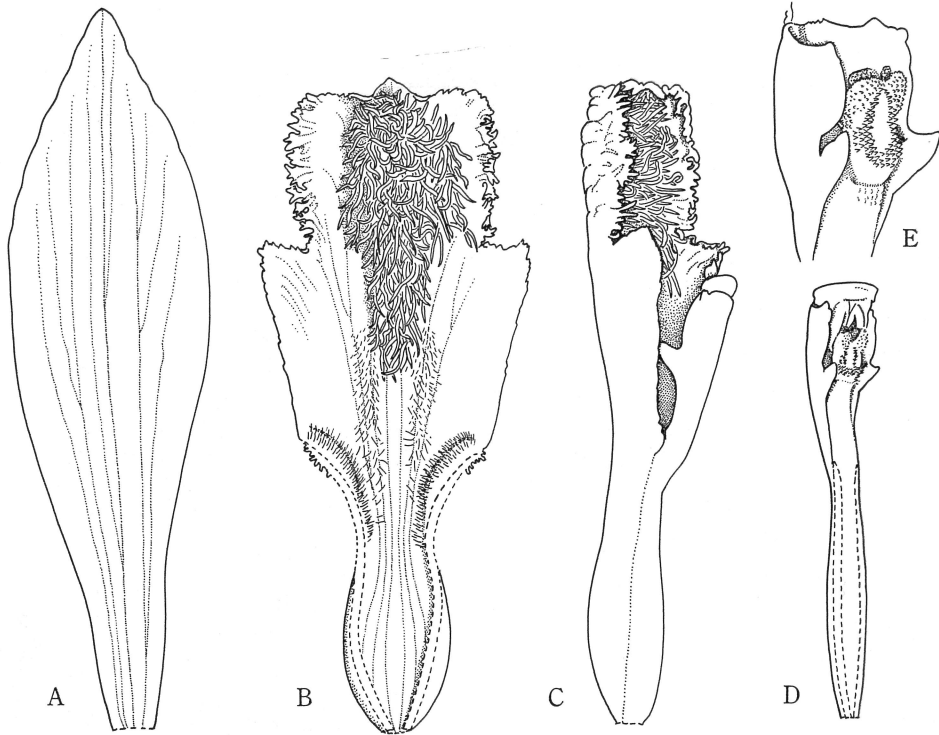


Fig. 7. *Lecanorchis japonica* var. *kiiensis*, boiled and dissected a flower from the type specimen of *L. kiiensis* Murata. A, petal, spread out. B, free portion spread out. C, lip and column from side. D, column, quarter view. E, anterior portion of column, anther, portions of pollinia left over behind stigma-lobes. A~D,  $\times 5$ . E,  $\times 10$ .

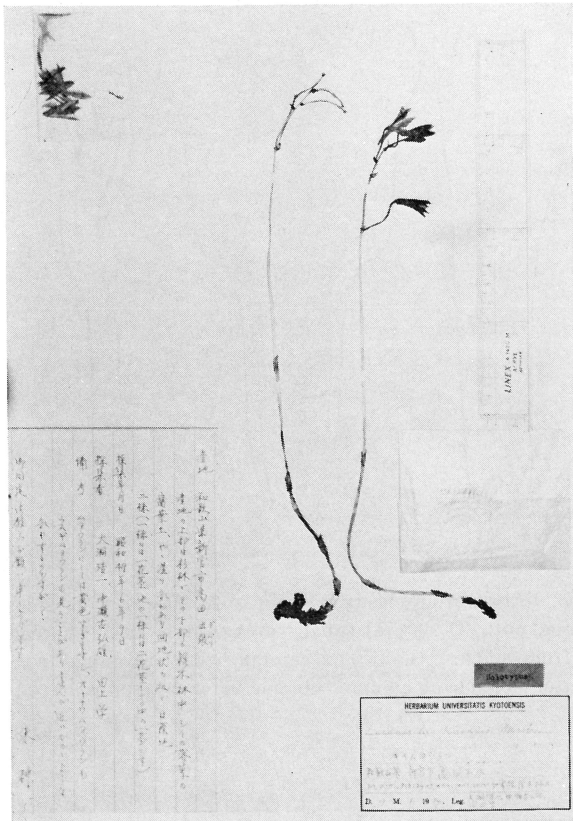


Fig. 8. *Lecanorchis japonica* var. *kiiensis*, holotype specimen (KYO) of *L. kiiensis* Murata.  $\times 1/4$ .

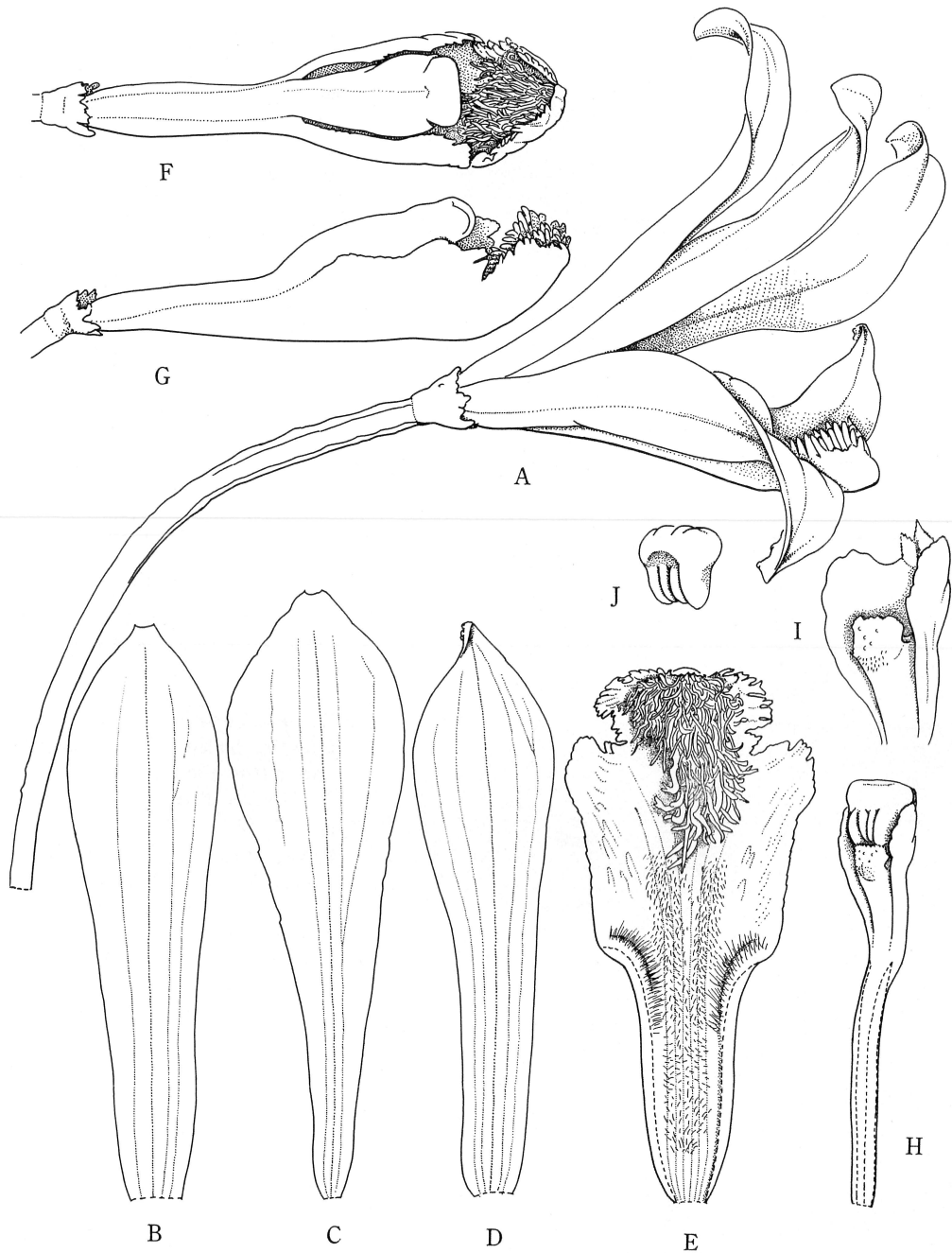


Fig. 9. *Lecanorchis japonica* var. *tubiformis*, drawn from the type plant. A, flower from side. B, dorsal sepal, spread out. C, petal, spread out. D, lateral sepal, spread out. E, lip, spread out. F, lip and column with calyculus from above. G, lip and column with calyculus from side. H, column, oblique view. I, anterior portion of column, oblique view, anther removed. J, anther, oblique view. A~H,  $\times 5$ .

with an apparent incision. Flowering in ?June.

ETYMOLOGY. Given for the former provincial name KII, where the taxon was discovered.

JAPANESE NAME. キイムヨウラン

DISTRIBUTION. Honshu; authentic specimen collected only from the type locality.

TYPE. Wakayama Pref.: Debari, Shingu-shi, June 9, 1974, Ohora, Nakaseko & Tanoue (holotype in KYO).

Specimens recorded from other localities than the type locality are not reliable. Because, the characteristic of this taxon had been thought to be a primarily brilliant-yellow-flowered plant and other features had been ignored by most students.

1d. var. **tubiformis** Hashimoto, var. nov.

Fig. 9

Sepalum dorsale oblanceolatum, 3-(~4) nervosum, ca. 16 mm longum, 4 mm latum. Sepala lateralia leviter obliqua, 5-nervosa. Petala oblanceolata, leviter obliqua, marginibus irregulariter et microscopicue crenulatis, ca. 17 mm longa, 5 mm lata. Labellum in dimidio inferiore adnatum, 15 mm longum, 7 mm latum; lobis lateralibus obtusis, irregulariter eroso-denticulatis; lobo intermedio transverse rectangulari vel depresso obovati, 3 mm longi, 4.5 mm lati. Alae columnarum semicirculatim trapezoideae, leviter eroso-crenulatae.

Dorsal sepal oblanceolate, with 3 major and 1 light nerves, about 16 mm long, 4 mm wide, with about 1 mm wide base. Lateral sepals similar to the dorsal sepal but slightly oblique, 5-nerved. Petals larger than the sepals, oblanceolate, slightly oblique, with irregularly and microscopically crenulate margins, about 17 mm long, 5 mm wide. Lip basally halfway adnate to the column, about 15 mm long, 7 mm wide when spread out; lateral lobes obtuse, irregularly erose-denticulate, about 2 mm high; midlobe transversely rectangular or depressly obovate, with irregularly erose-lacerate margins, about 3 mm long, 4.5 mm wide. Column-wings semicircularly trapezoid, slightly erose-crenulate. Flowering in June to July.

ETYMOLOGY. Named for the inferior half of lip of which adnates to the column and forms a rather longer tube than many other taxa.

JAPANESE NAME. ヤエヤマスケロクラン

DISTRIBUTION. Known only from the type locality.

TYPE. Okinawa Pref.: Iriomote Isl.; along the upper stream of the Urauchi River, July 1, 1985, M. Hashizume (holotype in TNS).

As described and illustrated here this taxon is apparently related to *L. japonica* var. *kiiensis* but differs from it by having a shorter midlobe and obtuse lateral lobes of the lip, the column-wings with slightly erose-crenulate margins etc. Since the type material was made from the FAA-preserved flower, the colouration of the living state and vegetative morphology are unknown. As to the specific category, this is newly reported from south of Yaku Island.

2. *Lecanorchis kiusiana* Tuyama in J. Jap. Bot. 30: 182, 1955; Ohwi, Ibid. 335, 1965;

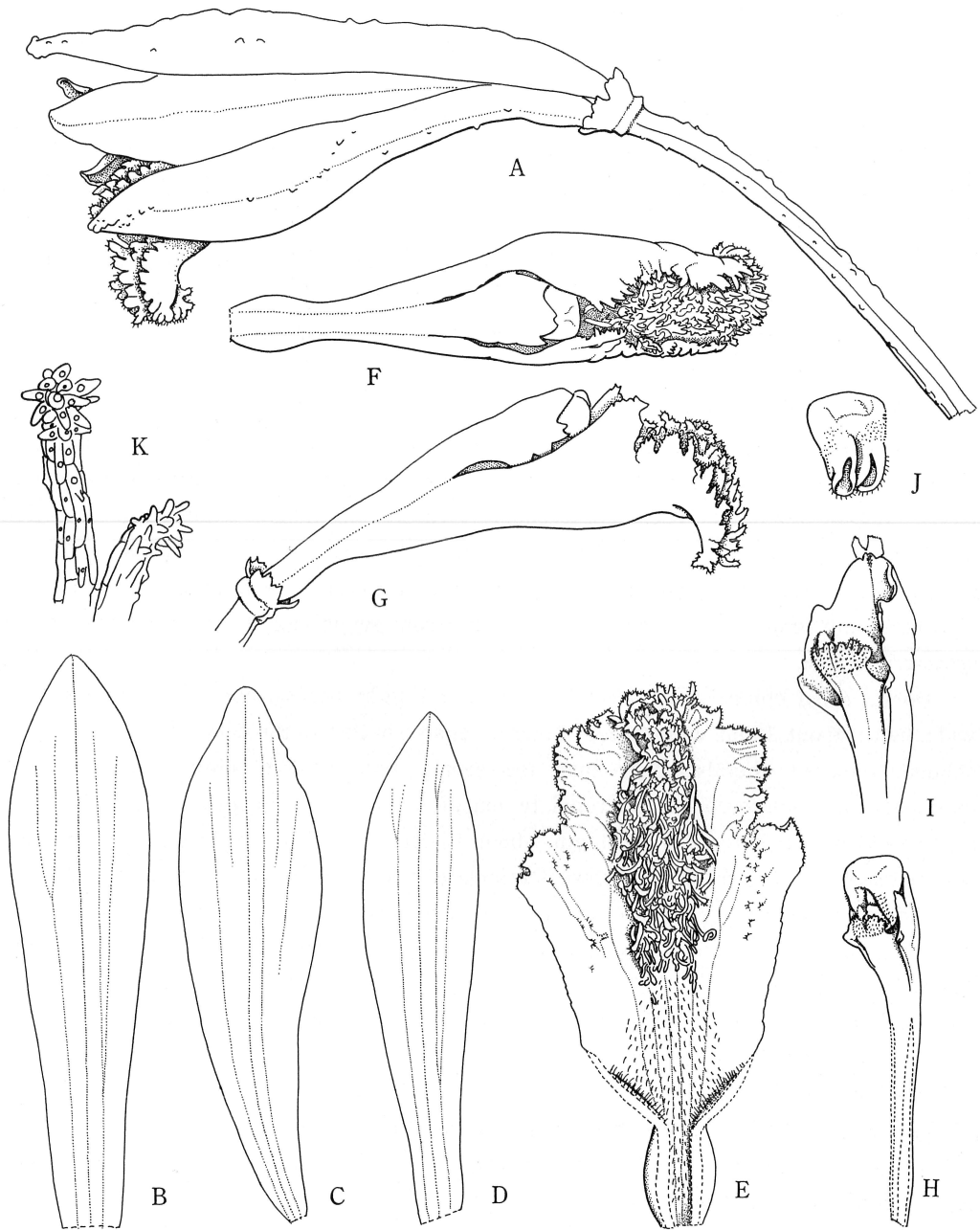


Fig. 10. *Lecanorchis kiusiana* var. *kiusiana* from Yaku-shima, Kagoshima Pref., collected by Y. Hanei. A, flower from side. B, dorsal sepal, spread out. C, petal, spread out. D, lateral sepal, spread out. E, lip, free portion spread out. F, lip and column from above. G, lip and column from side. H, column oblique view. I, anterior portion of column, anther removed, portions of pollinia left over. J, anther, oblique view. K, apical portions of multicellular hair on midlobe of lip. A~H,  $\times 5$ . K,  $\times$  ca. 83.

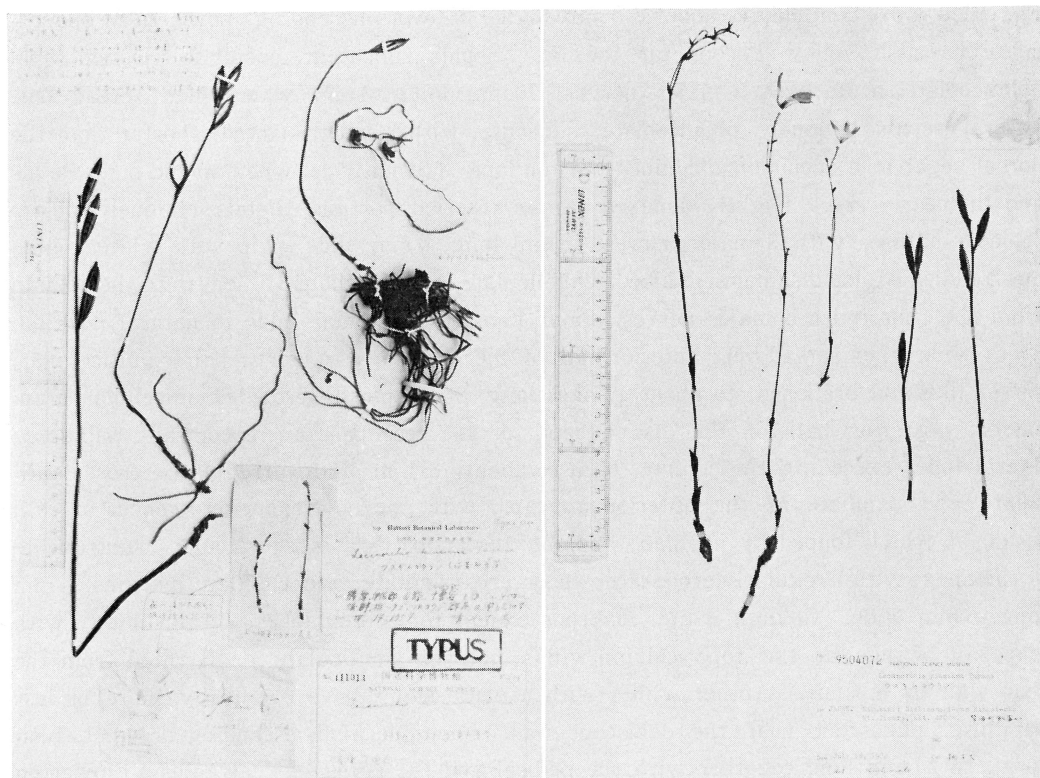


Fig. 11. *Lecanorchis kiusiana* var. *kiusiana*. A, holotype specimen (TNS 111013). B, specimen with flowers and fruits, collected by F. Momoshita (TNS 9504072) from Kinkai-cho, Nagasaki Pref.  $\times 1/4$ .

Masamune, *Ibid.* 185, 1969; Chuma in *J. Jap. Bot.* **55**: 306, pl. 5, 1980; Hashimoto, *Ibid.* 90, 1981; Satomi, *Ibid.* 206, 1982.

2a. var. **kiusiana**.

Figs. 10 & 11.

*L. kiusiana* Tuyama, l. c. 1955; Ohwi, l. c. 335, 1965; Masamune, l. c. 1969; Chuma, l. c. 1980; Hashimoto, l. c. 1981; Satomi, l. c. 1982.

Plant about 12 to 30 cm high. Rhizome J-shaped at the bottom, with more or less ciliate scaly sheaths; ascending part a little longer than the descending part, scarcely crooked or nearly straight, simple or a few-branched; descending part short, 1 to 1.5 cm long, usually simple. Roots usually radiate from the descending part of the rhizome, flexuose, horizontal, winding-elongate, to about 30 cm (78 cm, Chuma 1980), 0.6 to 1.2 mm thick in dried specimen. Aerial stem simple, erect, pale blueish purple, often yellowish or brownish, with 1 to 3 or without sheath(s); sheath glabrous, ovate to broadly ovate, subacute or subacute with an acumine, 5 to 20 mm long; uppermost sheath distant, 5 to 8 cm from the lowermost bracteole. Inflorescence terminal, loosely 3- to 5- (7-, Chuma 1980) flowered, 4 to 9 cm long excluding the peduncle. Floral bract, i. e., bracteole triangular or broadly triangular, 3 to 6.5 mm long. Pedicellate ovary ascending by acute angle, slightly contorted and inflexed, glabrous (Tuyama 1955, Chuma 1980) or slightly muricate, to about 2 cm long, with a ring-like excrescence below the calyculus;

calyculus erose-denticulate, about 1.5 mm high. Flowers ascending, never fully opened, pale brownish yellow except for the lip. Sepals subpatent, cucullate. Dorsal sepal oblanceolate, acute with 3 major nerves, 16 mm long, 4 mm wide when spread out. Lateral sepals obliquely oblanceolate, subacute, with 3 major nerves, shorter than the dorsal sepal in a specimen examined, 14 mm long, 3.5 mm wide, when spread out. Petals and lip nearly erect, slightly deflexed at the anterior portion. Petals obliquely oblanceolate, obtuse, with 3 major nerves, 15 mm long, 4 mm wide. Lip with white lamina and reddish violet disc-hairs, 3-lobed, canaliculate, adnate about 1/3 length to the column from the base, with 6 major nerves, about 15 mm long, 4 mm wide in natural position, 8 mm wide when spread out; anterior half of the disc densely hairy; hairs multicellular, ribbon-like and branched, to about 1.5 mm long, with apically crowded unicellular branchlets; posterior half of the disc except for the very base microscopically papillose; lateral lobes exceeding the column, obtuse, about 1.5 mm high, irregularly erose-denticulate and papillate at the anterior margins, with uneven small excrescences or calli inside of which topped by papillae; midlobe rectangular or semiorbicular, subtruncate at the apex, with irregularly erose-lacerate or erose-dentate, and papillate margins, 4 mm long, 6 mm wide. Column white, glabrous except for stigma-lobes, 10 mm long, with trapezoid wings at the top; column-wings obtusely denticulate, demarcated from the rear wall by a sinus. Anther white, with a depression above, ventrally more or less papillose, pubescent near the dehiscent slits. Fruit blackish, ascending or erect, fusiform, to 24 mm long together with the pedicel and the persistent calyculus. Flowering in early May to mid-July.

ETYMOLOGY. Named for the district name KIUSIU (KYUSHU) where this species was discovered.

JAPANESE NAME. ウスキムヨウラン

DISTRIBUTION. Known from Honshu (Ibaraki, Shizuoka, Aichi and Wakayama Prefs.), Shikoku (Kochi Pref.) and Kyushu (Nagasaki and Kagoshima Prefs., south to Amami-oshima Isl.).

TYPE. 'Satsuma' (Kagoshima Pref.): 'Isa-gun, Yamano, Zissodani, alt. 400 m in humis secundum rivulo', Apr. 14, 1954, D. Shimizu (holotype in TNS 111013).

OTHER SPECIMENS EXAMINED. HONSHU. Ibaraki Pref.: Mt. Sashiro, Kasama-shi, Aug. 8, 1955, K. Osamoto (TNS 123421), w. fruits & subterranean organs; Ibid. June 28, 1983, T. Ami (TI), fls.: Mie Pref.: Ise Shrine area, July 23, 1980, C. Chuma (TI), fls.; Wakayama Pref.: Katada-machi, June 4, 1958, S. Sugaya & T. Kyogoku (TUS 26465), fls. KYUSHU. Nagasaki Pref.: Mt. Iimori, Kinkai-cho, Nishisonoki-gun, ca. 240 m alt., July 16, 1982, Dai Momoshita (TNS 9504072), w. flowers & fruits; Ibid. Shiro-dake (Mt.), Saikai-cho, June 3, 1982, Dai Momoshita (TNS 9504071), fls.: Kagoshima Pref.: Along the Hanaage River, Yaku Isl., May 6, 1986, Yoshie Hanei (TNS 9504074), fls.

This plant is characterized by having the papillate marginal zones of the lip, an apparent ring-like excrescence below the calyculus and rather slenderer roots than those of *L. japonica*. The author has been unable to study the authentic materials of Javanese *L. pauciflora* J. J. Smith, Taiwanese *L. cerina* Fukuyama var. *cerina* and *L. c. var. albid*

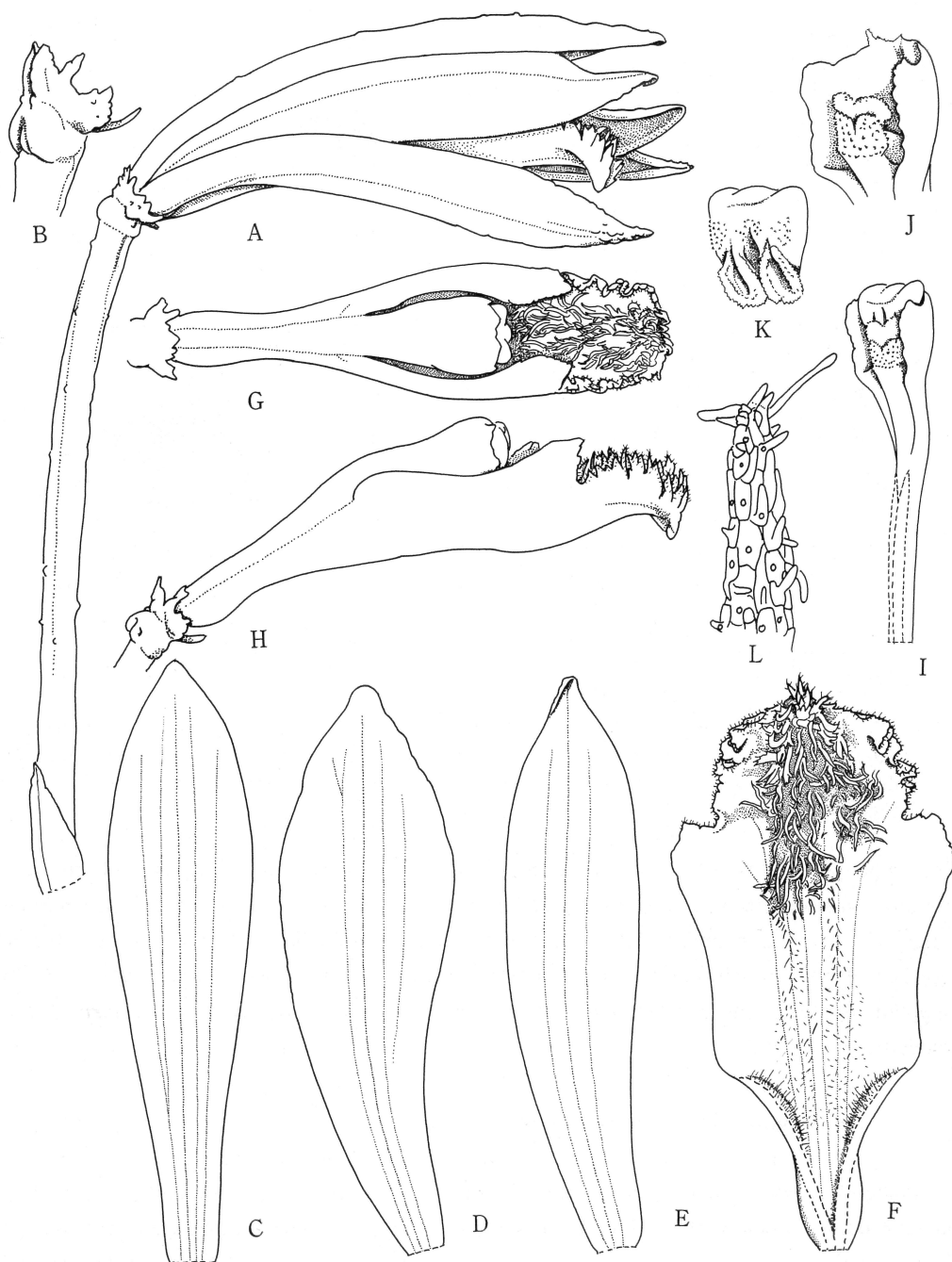


Fig. 12. *Lecanorchis kiusiana* var. *suginoana* from the type locality, collected by Y. Hanei. A, flower from side. B, apical portion of ovary, showing a ring-like excrescence below calyculus. C, dorsal sepal, spread out. D, petal, spread out. E, lateral sepal, spread out. F, lip, partially spread out. G, lip and column from above. H, lip and column from side. I, column, oblique view. J, anterior portion of column, anther removed, portions of pollinia left over. K, anther, oblique view. L, apical portion of multicellular hair at central part of cluster on lip, showing unicellular branchlets; branchlets somewhat increasing at posterior part of cluster. A & C~I,  $\times 5$ . L,  $\times 100$ .



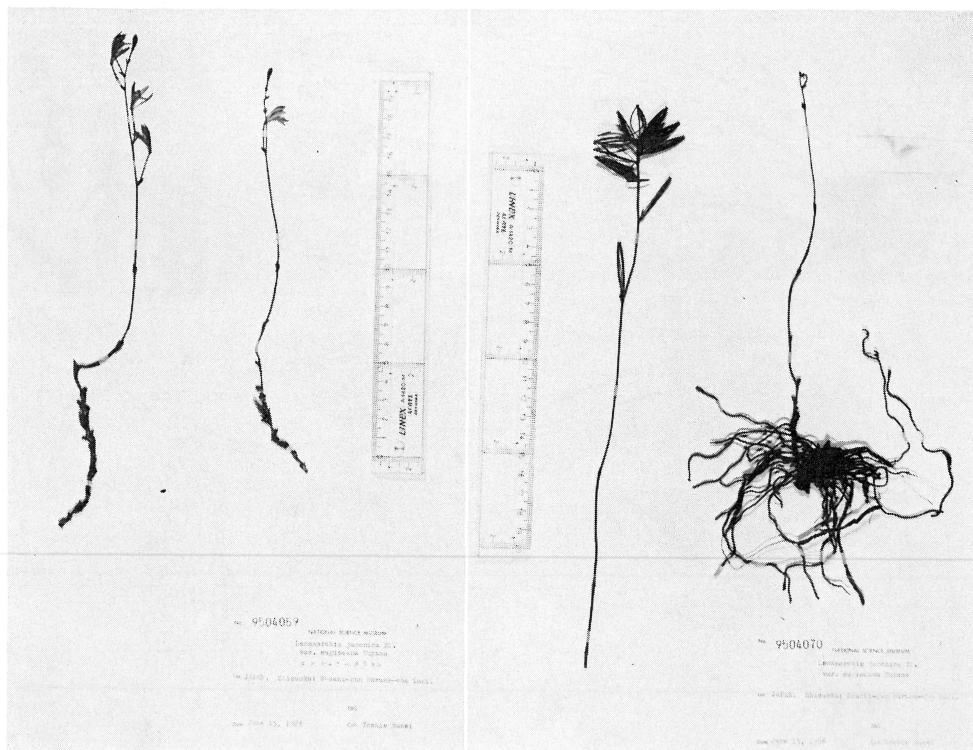


Fig. 13. *Lecanorchis kiusiana* var. *suginoana*. A, specimen with flowers (TNS 9504069), simultaneously collected with Fig. 12. B, specimen with fruits and subterranean organs, flowers kept in an envelope (TNS 9504070), simultaneously collected with the material of Figs. 12 and 13-A.  $\times 1/4$ .

Lin. They seem to be conspecific with this entity, but the descriptions had not been provided appropriately. Their original illustrations show 6 nerves of the lip, notched wings of the column and a ring-like excrescence below the calyculus of the former together with the similarities of general appearance in flowers and others. If this suspicion is right, the correct name of this entity should be chosen for *L. pauciflora* as a specific category.

2b. var. **suginoana** (Tuyama) Hashimoto, comb. nov.

Figs. 12 & 13.

*L. japonica* Bl. var. *suginoana* Tuyama in J. Jap. Bot. **57**: 211, 1982.

Pedicellate ovary hardly resupinate, glabrous or slightly scabriduous, with a ring-like excrescence below the calyculus of which irregularly erose-denticulate at the margin, 15 to 18 mm (20 to 30 mm in Sugino, 1985) long, 1 mm in diameter. Flowers dull yellow. Dorsal sepal oblanceolate, obtuse, dorsally muricate at the anterior portion, 5-nerved, 17 mm long, 4 mm wide when spread out. Lateral sepals obliquely oblanceolate, subacute, 3-nerved, 16 mm long, 4 mm wide when spread out. Petals as long as lateral sepals, 5 mm wide, obtuse, with 3 major and 1 obscure nerves. Lip somewhat light coloured than other floral segments except for the anterior portion, sometimes tinted with violet at the sides, 3-lobed, canaliculate, basally adnate about 1/3 length to the column, with



6 major nerves, about 15.5 mm long, 8 mm wide when spread out; anterior 1/3 of the disc hairy; hairs light yellow, multicellular, ribbon-like, more or less branched in the anterior ones, usually 10 to 14 mm long, with scattered unicellular branchlets; posterior portion of the disc except for the base microscopically papillose; lateral lobes obtuse, about 1.5 mm high, with the papillose and inconspicuously denticulate margins in front, with an obscure median callus inside; midlobe semiorbicular, slightly deflexed at the front, with an irregularly erose-dentate or erose-undulate and papillate margin, about 3 mm long, 3.5 mm wide in natural position, 4 mm long, 5.5 mm wide when spread out. Column 10 mm long, with apical wings; wings rather obtuse by a shallow sinus, obscurely and obtusely denticulate. Anther with a depression above, ventrally more or less papillose; mouth of the dehiscent slits papillose. Fruits blackish, ascending or right-angled with the rhachis, 22 to 30 mm long, together with the pedicel and the persistent calyculus. Flowering in late May to late June.

ETYMOLOGY. Named in honor of its discoverer, Mr. Takao Sugino of Kakegawa City, Shizuoka Prefecture.

JAPANESE NAME. エンシュウムヨウラン

DISTRIBUTION. Reported from several sites in the eastern province of Shizuoka Prefecture; Undergrowth of the deciduous broad-leaved forest.

TYPE. 'Totomi' (Shizuoka Pref.): 'Sugi in oppido Haruno-cho, Tuyama' Jun. 8, 1980, (holotype in TI).

OTHER SPECIMENS EXAMINED. HONSHU. Shizuoka Pref.: Sugi, Haruno-cho, Shu-chi-gun, June 15, 1987, Yoshie Hanei (TNS 9504069 & 9504072).

This entity had been considered to be an infraspecific taxon of *L. kiusiana* rather than *L. japonica* because of their common characters, i. e., plants rather small; lips with marginal papilla and more conspicuous branchlets of disc-hairs; ovaries with an apparent ring-like excrescence below the calyculus; fruits rather short. The colouration of the fresh lip is one of the practical key-characters of this variety within the species, although it probably liable to make a misidentification with *L. japonica*.

3. ***Lecanorchis trachycaula*** Ohwi, Fl. Jap., rev. ed. 1438, 1965; Hashimoto, Ibid. 91, 1981; Satomi, Ibid. 206, pl. 185-2, 1982; Ohwi (rev. Kitagawa), New Fl. Jap. 479, 1983. Figs. 14~16.

Plant 20 to 50 cm high. Underground stem usually J-shaped, often branched and rooted at the descending portion. Roots radiate, somewhat tortuous, rather slender, horizontally elongate to about 50 cm long, 1 to 1.5 mm thick while they alive. Aerial stem blackish, more or less tuberculate, with several scaly sheaths and usually one to several branches; branch nearly erect by very acute angle with an axis of the previous year of which often perishable upwards; terminal branch floriferous. Inflorescence subdensely several-flowered, to about 3 cm long excluding the peduncle. Pedicellate ovary variously angled with the axis, straight or somewhat contorted, more or less tuberculate, slender, about 20 mm long, about 0.6 mm thick; calyculus oblique, about 1 mm high, rather densely tuberculate, with the irregularly obtuse-denticulate margin. Flowers light

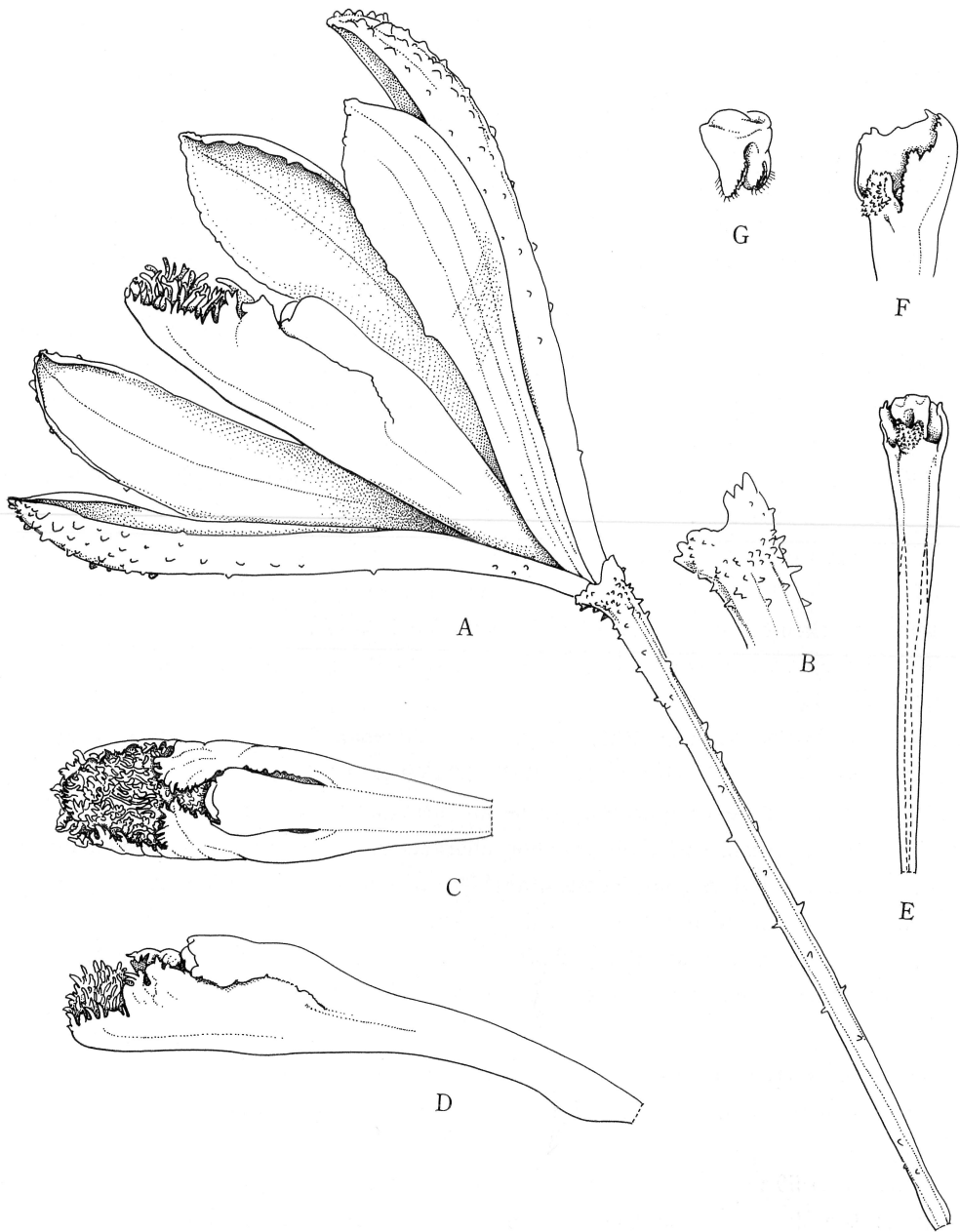


Fig. 14. *Lecanorchis trachycaula* from Yaku-shima, Kagoshima Pref., collected by Y. Hanei. A, flower from side. B, anterior portion of ovary. C, lip and column from above, basal portion partially missing. D, lip and column from side. E, column, ventral view. F, anterior portion of column, anther and pollinia removed, oblique view. G, anther, oblique view. A & C~E,  $\times 5$ .

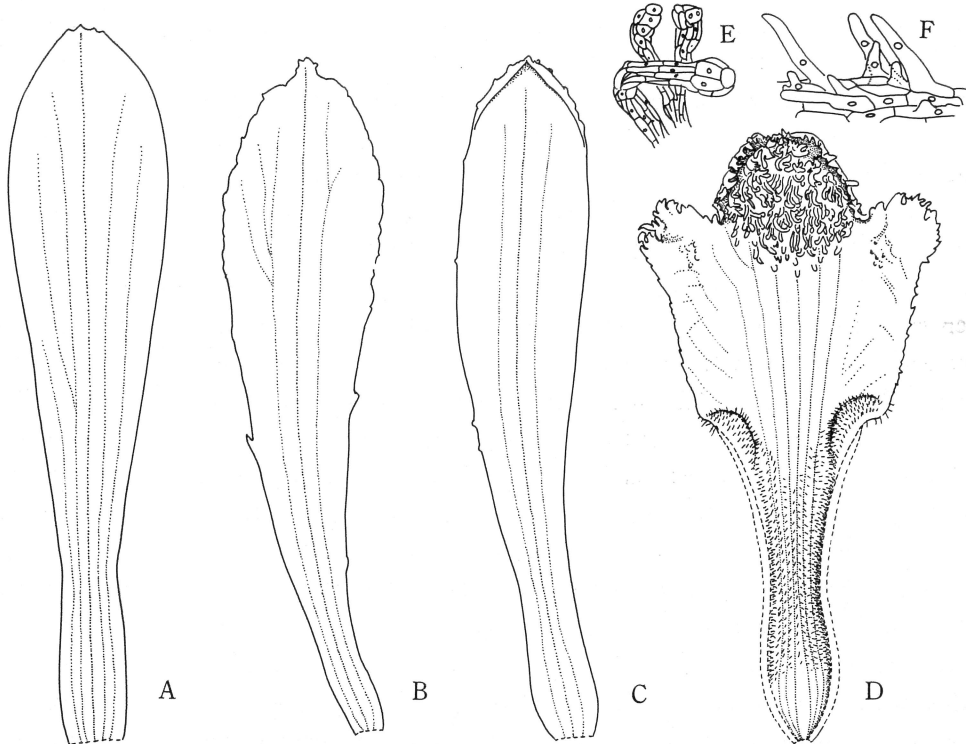


Fig. 15. *Lecanorchis trachycaula*, depicted the material of Fig. 14. A, dorsal sepal, spread out. B, petal, spread out. C, lateral sepal, spread out. D, lip, spread out. E, anterior portions of multicellular hair on lip. F, unicellular hairs on thickening near the basal portion of lateral lobe of lip. A~D,  $\times 5$ . E,  $\times$  ca. 67. F,  $\times 135$ .

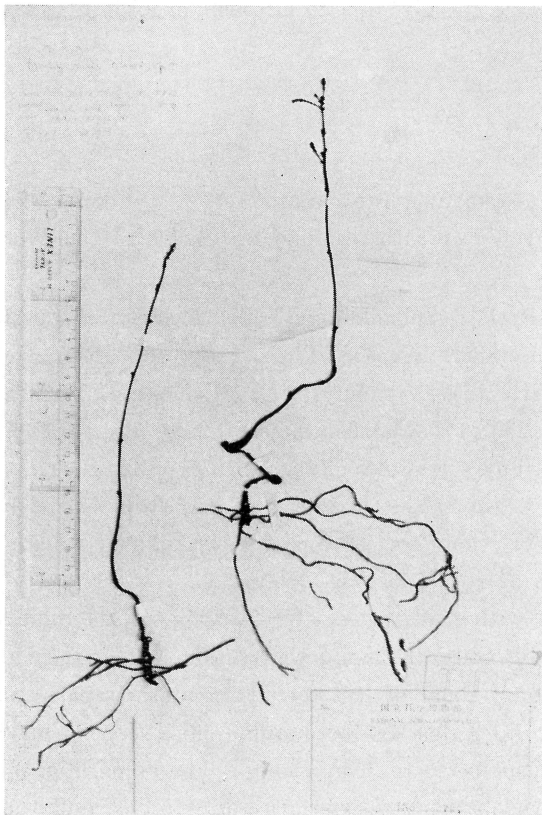


Fig. 16. *Lecanorchis trachycaula*, holotype specimen (TNS 381701),  $\times 1/4$ .

brownish yellow except for the lip. Dorsal sepal oblanceolate, cucullate, obtuse, with 5 major nerves, dorsally muricate or tuberculate, about 18 mm long, 3.5 mm wide when spread out. Lateral sepals obliquely oblanceolate, cucullate, obtuse, 3-nerved, dorsally muricate or tuberculate, about 17 mm long, 3 mm wide when spread out. Petals obliquely oblanceolate, shallowly cucullate, obtuse with an apicule, narrower than the sepals, microscopically denticulate or crenulate, with 3 major nerves. Lip white with purplish tints, 3-lobed, nearly erect, canaliculate, basally about halfway adnate to the column, with 6 major nerves, about 16 mm long, 4 mm wide in natural position, 8 mm wide when spread out; lateral lobes exceeding the column, semiorbicular with the obtuse apex and the irregularly erose-dentate margin in front, serrulate in back, about 2 mm high; midlobe semiorbicular, with the undulatory erose-lacerate margin, about 2 mm long, 4 mm wide when spread out, densely hairy inside; hairs multicellular, tortuous, clavate, sometimes branched, usually 0.7 mm long, without the unicellular branchlet, spreading on the neighbouring disc; hypochil tubular, hardly expanded at the base, somewhat swelling ventrally at the twin intermediate areas between the free portion, with about 0.1 mm long papilla inside except for the very base. Column slender, with inconspicuous wings, 13 mm long, about 0.5 mm thick at the base; column-wings minutely erose-denticulate; clinandrium with a median excrescence behind the stigma. Anther white, with a median swelling above, pubescent around the dehiscent slits. Fruit blackish, ellipsoid when dehiscent, about 20 mm long together with an inconspicuous pedicel and a calyculus. Flowering in June to July, and to October (according to the note by S. Takahuji on KYO-specimen).

ETYMOLOGY. From the Greek *trachy-*, "rough", and Latin *caulis*, "stemmed", in reference to the more or less tuberculate stem.

JAPANESE NAME. アワムヨウラン

DISTRIBUTION. Reported from Honshu (Wakayama Pref., Satomi 1982), Shikoku (Tokushima Pref.) and Kyushu (Kagoshima Pref.); in rather humid leaf-molds of the evergreen broad-leaved forest.

TYPE. SHIKOKU. 'Awa' (Tokushima Pref.): Shishikui-cho (miscalled as Shishikui-machi by Ohwi), June 18, 1964, C. Abe, n. 15387 (TNS 381701).

OTHER SPECIMENS EXAMINED. HONSHU. Wakayama Pref.: Nishiakagi, Ogawa, Kozagawa-cho, Higashimuro-gun, Oct. 25, 1987, H. Matsushita (KYO), w. fl.-buds, det. by G. Murata; SHIKOKU. Ibid. Ooyama-jinja, Shiofuka, June 6, 1976, Shigeru Takahuji (KYO). KYUSHU. Kagoshima Pref.: Along the Hanaage River, Yaku Isl., July 25, 1986, Y. Hanei, (TBG FAA-preserv. fls.): Along the stream in Kinsakubaru, Amami-oshima (Isl.), Feb. 24, 1990, T. Hashimoto (TNS 940462), w. fruits.

As Ohwi (1965) compared this species with *L. kiusiana*, they are apparently related than other Lecanorchids by their common features among the section, such as: roots slender, usually 1 mm thick; pedicellate ovary more or less tortuous; lateral sepals and petals 3-major-nerved; lateral lobes of the lip rather distinct; anther pubescent around the dehiscent slits; fruits rather short, usually 20 to 30 mm long. The colouration of the lip seems to be transitional or reciprocal between *L. kiusiana* var. *kiusiana* and var.

*suginoana*. *Lecanorchis trachycaula* is distinguishable from *L. kiusiana* by its branched and more or less tuberculate aerial stems, slender and tuberculate ovaries, about halfway adnate lip to the column with semiorbicular anterior portions of the lateral lobes, tortuous and clavate hairs on the disc, very slender column without a ring-like excrescence and anther with a median swelling and marginal hairs of the dehiscent slits. The plant without a flower is somewhat resembling *L. triloba*.

Sect. **Flavicantes** Hashimoto, sect. nov.

Labellum trilobum, numeris nervorum inaequalibus; lobis lateralibus prope triangularibus, irregulariter denticulatis; lobo intermedio valde decurvato; pilis disci conspicuis, ramosis et ramulosis. Alae columnarum trapezoideae.

Lip 3-lobed, with odd-numbered major nerves; lateral lobes nearly triangular, irregularly denticulate; midlobe strongly decurved; disc-hairs conspicuous, with branches and branchlets. Column-wings trapezoid.

TYPE. *Lecanorchis flavicans* Fukuyama in Trans. Nat. Hist. Soc. Formosa, **32**: 241, 1942.

Only two species can be recognized in this section. Rather small flowers and a short column with entire column-wings of this taxon may be additional characteristics.

4. **Lecanorchis flavicans** Fukuyama in Trans. Nat. Hist. Soc. Formosa, **32**: 241, 1942; in Acta Phytotax. Geobot. **14**: 123, 1952; Garay & Sweet, Orch. South. Ryukyu Is. 50, 1974, specim. tantum typ.; Hatusima, Fl. Ryukyus, add. & corr. 808, 1975, excl. pl. ex Ins. Ishigaki.

4a. var. **flavicans**.

*L. flavicans* Fukuyama, Ibid. 241, 1942; Ibid. 123, 1952; Garay & Sweet, l. c. 1974; Hatusima, l. c. 1975.

"*L. cerina* Fukuyama" Nackejima in Biol. M. Okinawa no. **13**: 29, 1975, p. p.

Plant erect, about 30 cm tall. Rhizome short, sub-erect, becoming woody. Roots many, elongate, spreading, filiform, angled-sulcate in a dry state, about 1 to 1.5 mm in diameter. Stems commonly simple, sometimes scarcely branched from the base, very straight, gradually narrower upward, somewhat rigid, terete, blackish yellow in a living state, glabrous, with few scales of which 4 to 8 cm distant, blackish, deltoid, entire, somewhat thick, persistent, semi-amplexicaul, acute, 2 to 3 mm long and glabrous. Raceme short, remotely (1- to 2-) flowered below, flower-buds subdensely clustered toward the top. Floral bracts much shorter than the pedicels (pedicellate ovary?), deltoid, 1 to 1.5 mm long, glabrous. Flowers semi-open, ascending, in several directions, long-subcampanulate, yellowish. Pedicellate ovaries spreading at an angle of about 45 degrees with the axis, slender, terete, almost 1.5 to 2 cm long, glabrous, with a cupshaped calyculus at the tip of which margined by irregularly erose-denticulations in 1/2 to 1/3 mm high. Dorsal sepal oblanceolate, concave, with the obtuse and recurved apex, narrowed toward the base, about 14 mm long, about 3.5 mm wide below the apex, alabrous, 3-nerved. Lateral sepals similar to the dorsal sepal but slightly acute at the apex. Petals oblanceolate-oblong, flat, with the extremely obtuse apex, narrowed toward the base,

nearly as long as the sepals but slightly wider, glabrous, obsolete 5-nerved. Lip somewhat shorter than the sepals, about 12 mm long, adnate to the columnar margins toward the base, distinctly 3-lobed at the anterior half; lateral lobes short (small?), exceeding the column, with the erose interior sides of which about 2 mm long; midlobe many times larger, about 5 mm long, semiorbicular, recurved toward the apex, ciliate-denticulate at the margin, with long, flexuose and dense soft-hairs on the anterior half. Column about 7 mm long, sub-erect, glabrous, gradually enlarged upwards, connate with the lip by a 1/3 or 1/4 portion from the base. Flowering in May.

ETYMOLOGY. From the Latin *flavicans*, "yellowish", in allusion to the colouration of the flower.

JAPANESE NAME. サキシマスケロクラン

DISTRIBUTION. Reported from Iriomote Island, Ryukyu.

TYPE. 'Ryukyu. Ins. Iriomote; in laurisilvis praeter flumen Nakara-gawa, Maio 30, 1938, N. Fukuyama, n. 7120 (TAI)'.

The above description is nearly a literal translation from the original paper. According to Fukuyama's description, it obviously distinguishable from other members of the genus by having rather small flowers with erose side-lobes and a large decurved midlobe of the lip of which provided flexuose and dense soft-hairs on the disc, though

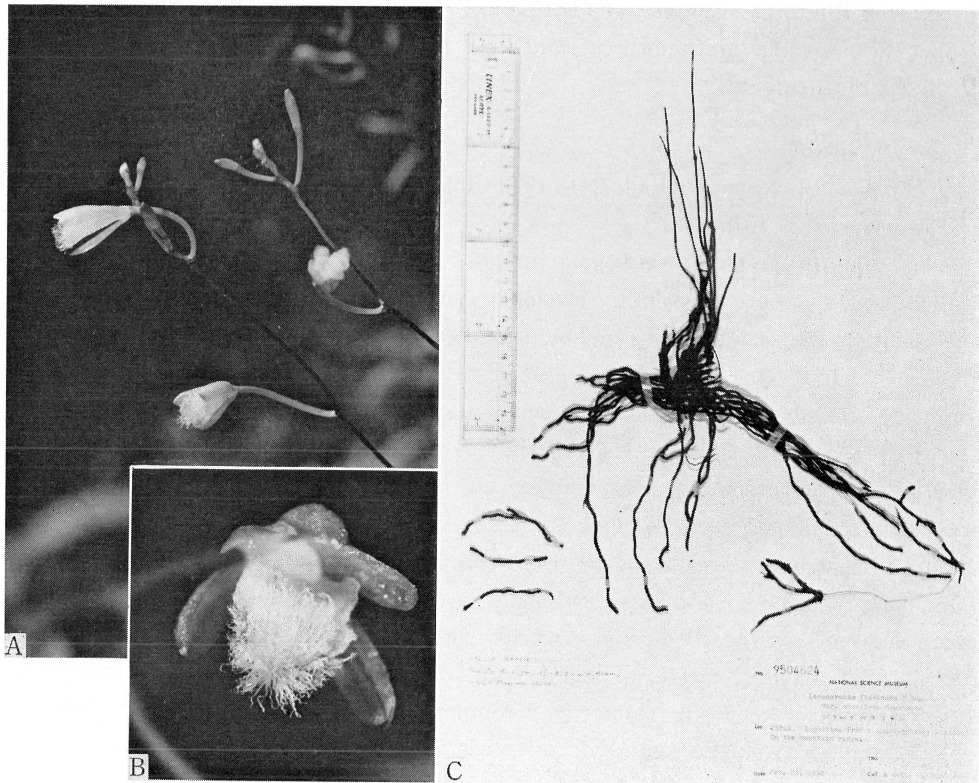


Fig. 17. *Lecanorchis flavicans* var. *acutiloba*. A, inflorescences. B, flower from front. C, specimen from Amami-oshima, Kagoshima Pref., collected by T. Hashimoto (TNS 9504624). A & B, courtesy of Mr. K. Kanda. C,  $\times 1/4$ .

the author has not seen this entity. The other specimens of this species than the type, previously recorded by many authors, are needed re-examinations and often misidentified with *L. triloba*.

4b. var. **acutiloba** Hashimoto in Ann. Tsukuba Bot. Gard. no. 8: 8, fig. 3, 1989. Fig. 17.

Rhizome usually branched, crooked. Roots many, brown, 1.5 to 2 mm thick while alive, grayish in a dry state. Stems usually branched near the base, 20 to 30 cm tall, blackish, slender, less than 1 mm in diameter; branch upright, with an inflorescence at the tip. Raceme loosely few-flowered, somewhat flexuose; axis to about 5 cm long, yellowish when young. Pedicellate ovary to 25 mm long, more or less tortuously and adaxially incurved, with a ring-like excrescence below the calyculus; apical portion including calyculus somewhat rugose. Sepals light brownish yellow, semiopen. Dorsal sepal cucullate, oblanceolate, obtuse, 13 mm long, 3 mm wide when spread out, 3-nerved. Lateral sepals cucullate, obliquely oblanceolate, subacute with the obtuse apex, 13 mm long, 3 mm wide when spread out. Petals light yellow, rather flat, obliquely oblanceolate-oblong, obtuse, obscurely and sparsely crenulate at the anterior margins, 12.5 mm long, 3.5 mm wide, with 3 major nerves. Lip rather whitish, basally adnate less than 1/3 of the length to the column, 3-lobed, slightly longer than the other segments, 14 mm long, 9 mm wide when spread out, 5-nerved, with uni-, rarely 2- or 3-cellular microscopic hairs inside the posterior portion; lateral lobes about 2 mm exceeding the column, about 1.5 mm high, triangular, acute, irregularly denticulate at the anterior margins, ciliate at the posterior margins; midlobe roundish, decurved, erose-lacerate, 2.5 mm long, 3 mm wide when spread out, with dense, whitish, suffused by pale purple, flexuose, branched, up to about 2.5 mm long, ribbon-like, tapered, multicellular hairs on the disc. Column 6 mm long, gradually enlarged upwards, adnate about halfway to the lip, with obtuse-trapezoid wings, obscurely carinate at the back. Anther white, pubescent around the dehiscent slits. Flowering in May to August.

ETYMOLOGY. From the Latin *acutus*, "acute" and *-lobus*, "-lobed", referring to the acute lateral lobes of the lip.

JAPANESE NAME. シラヒゲムヨウラン

DISTRIBUTION. Known from the Islands of Yaku and Amami-oshima, Kagoshima Pref., Kyushu.

TYPE. KYUSHU. Kagoshima Pref.: Yakushima (Isl.); Mt. Motchomu, ca. 400 m alt., July 24, 1979, Yoshie Hanei (TNS 9504531).

ANOTHER SPECIMEN. KYUSHU. Kagoshima Pref.: Kinsakubaru, Amami-oshima, Feb. 24, 1990 (TNS 9504624), sterile.

This variety is distinguished from the type variety by its lip of which is longer than the sepals and about halfway adnate column to the lip. Further examinations on the specimens are needed, because, if Yamashita's observation (1982)\* is right, it can be

\* Yamashita gave his opinion that *L. nigricans* sensu Sawa (1980) was nearly coincidental with a photograph of *L. nigricans* by Kanda (1977, in *Asahi Encyclopedia/Plants of the World*, 85: 1988). However, the author identifies Kanda's plant with *L. flavicans* var. *acutiloba* Hashimoto.





Fig. 18. *Lecanorchis virella*. A, living plants at the type locality. B, flowers.  
Courtesy of Mr. K. Kanda.

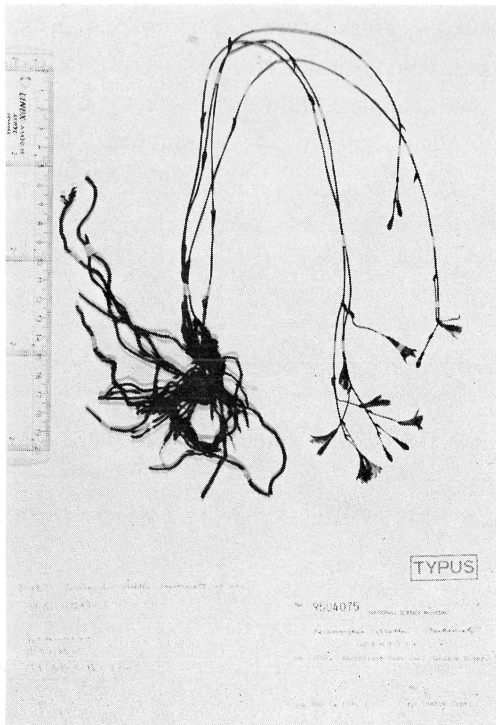


Fig. 19. *Lecanorchis virella*, holotype specimen (TNS 9504075).  $\times 1/4$ .

noted that this taxon also inhabits in Kochi, Shikoku.

5. ***Lecanorchis virella*** Hashimoto in Ann. Tsukuba Bot. Gard. no. 8: 1, 1989.

Figs. 18 & 19.

Plant about 30 cm tall. Primary rhizome J-shaped, branched. Roots many, flexuose, rarely branched, radiate from the descending portion, about 1.3 to 1.8 mm thick in a dry state. Aerial stem brownish yellow, somewhat greenish, nearly erect, simple, about 1 mm thick in a dry state, provided with 3 to 5, purplish, loose, 7 to 10 mm long scaly sheaths of which lower ones tubular and pubescent inside near the margin. Inflorescence loosely 2- to 6-flowered, with a somewhat flexuose and 2 to 7 cm long axis. Floral bract glabrous, triangularly ovate, acuminate or obtuse, 3 to 6 mm long. Pedicellate ovary brownish yellow, somewhat tortuose, incurvingly



upward in the early flowering, nearly horizontal in the middle flowering, nearly erect in later, 13 to 25 mm long, with a purplish, denticulate calyculus at the summit of which provided an obscure ring-like excrescence below. Flowers semiopen. Sepals and petals hardly cucullate, deflexed at the tip, brownish green or greenish brown at the anterior half, chestnut at the tip. Dorsal sepal oblanceolate, subacute, slightly irregular-margined, with 3 major and 2 obscure nerves, 17 mm long, 3.5 mm wide. Lateral sepals obliquely lanceolate, subacute in natural position, obtuse when spread out, slightly irregular-margined, with 3 major and a few obscure nerves, 17 mm long, 3.5 mm wide. Petals more evidently deflexed than the sepals at the apical portion, obliquely oblanceolate, obtuse, with slightly irregular margins, with 3 or 4 major nerves, 16.5 mm long, 4 mm wide. Lip erect, adnate more than halfway by its basal margins to basal 2/3 of the column, shorter than other floral segments, 13 mm long, with 7 major nerves; free portion purple or purplish, greenish underneath, 3-lobed, concave in natural position, about 6 mm long and wide when spread out; side lobes exceeding the column, erect, triangular-dentiform, with the margins erose-lacerate at the anterior part, finely erose at the posterior part near the column, about 1.5 mm high; midlobe with incurved margins, transversely rectangular, nearly truncate at the front, erose-lacerate at the sides, 2 to 2.5 mm long, 4 to 5 mm wide when spread out, with dense, yellow, multicellular, occasionally branched, retrorse hairs on the disc; blade behind the multicellular hairs dispersed minute unicellular hairs. Column white or purplish white, clavate, with slightly sinuate apical wings ventrally, 10 mm long. Anther purplish. Flowering in early May.

ETYMOLOGY. From Latin *virellus*, "somewhat green", referring to the colouration of the flowers.

JAPANESE NAME. ミドリムヨウラン

DISTRIBUTION. Known only from Yaku Island.

TYPE. KYUSHU. Kagoshima Pref.: Yakushima (Isl.); near Hirano, along the Hanaage River, ca. 100 m alt., May 6, Yoshie Hanei (TNS 9504705).

As the author pointed out in the previous paper this species is remarkable for its greenish flowers and other floral morphologies. An emended description for the species is provided here.

Sect. *Nigricantes* Hashimoto, sect. nov.

Labellum simplex, spathulatum, non lobatum, cucullatum, erectum, numeris nervorum inaequalibus. Alae columnarum obscure formantes.

Lip simple, spathulate, not lobed, cucullate, erect, with odd-numbered major nerves. Column-wings indistinct.

TYPE. *Lecanorchis nigricans* Honda in Bot. Mag. Tokyo **45**: 470, 1931.

No other species is known in this section than the type species.

6. *Lecanorchis nigricans* Honda in Bot. Mag. Tokyo **45**: 470, 1931; emend. Tuyama in J. Jap. Bot. **30**: 184 (fig. 3-A & -B), 1955; Ohwi, Fl. Jap., Engl. ed. 336, 1965;

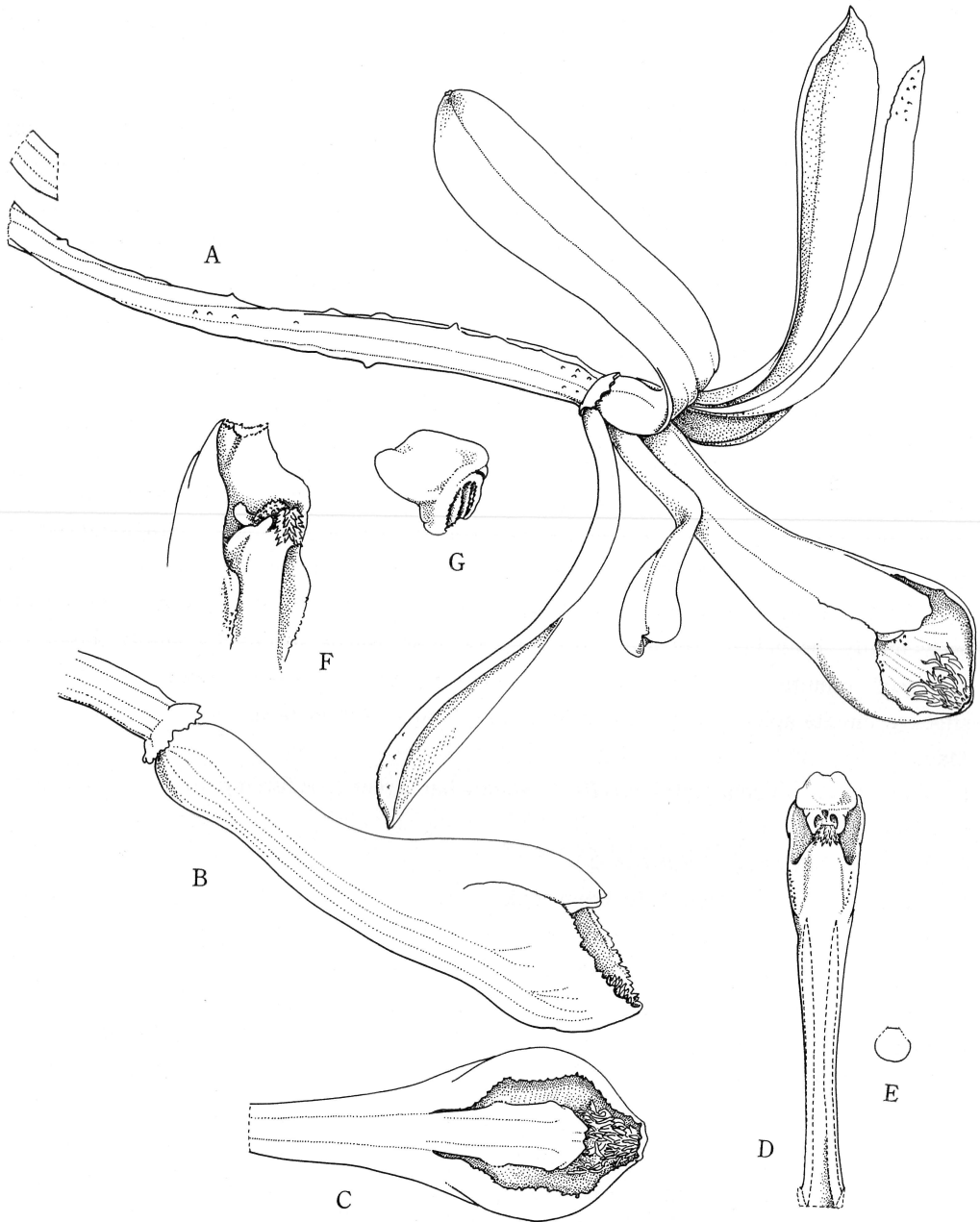


Fig. 20. *Lecanorchis nigricans* var. *nigricans* from Shimoda, Shizuoka Pref., collected by Y. Hanei. A, flower, oblique view. B, lip and column with calyculus from side. C, lip and column from above, basal portion partially excluded. D, column, ventral view. E, transversal section of column. F, anterior portion of column, anther removed, a portion of pollinium left over. G, anther, oblique view. A~D,  $\times 5$ .

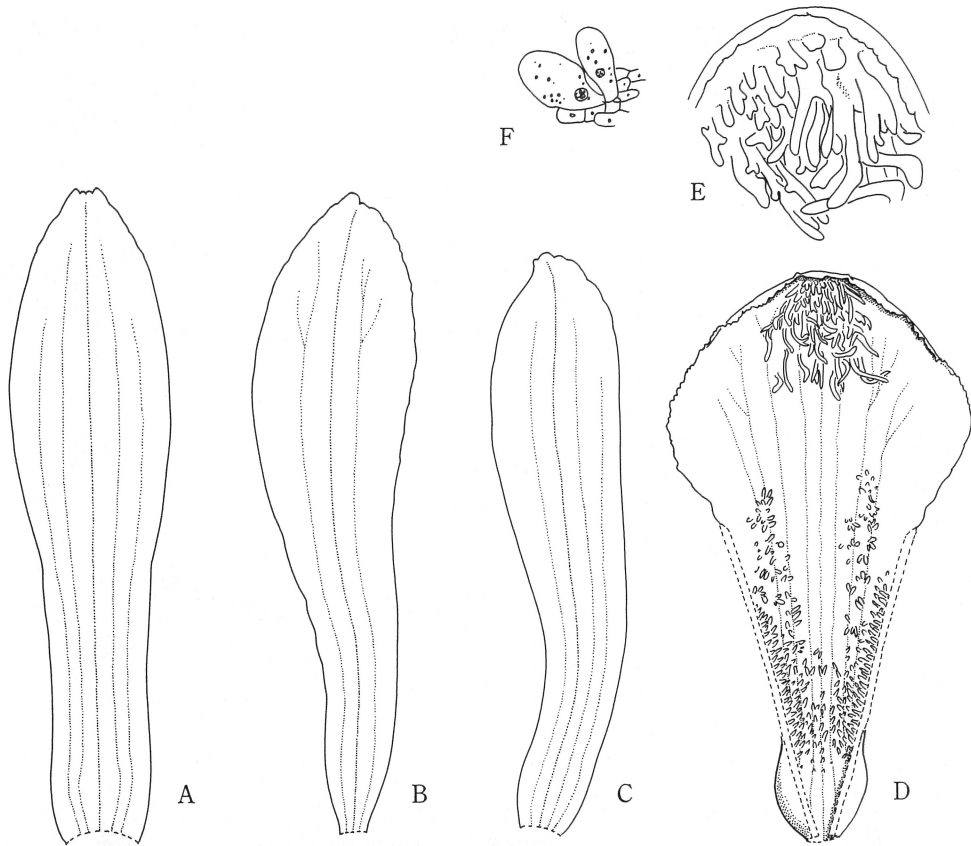


Fig. 21. *Lecanorchis nigricans* var. *nigricans*, depicted the material of Fig. 19. A, dorsal sepal, spread out. B, petal, spread out. C, lateral sepal, spread out. D, lip, partially spread out. E, multicellular hairs at anterior disc of lip. F, unicellular hairs on posterior part of lip. A~D,  $\times 5$ . E, ca.  $\times 10$ . F,  $\times 65$ .

F. Maekawa, *Ibid.* 239, pl. 82, 1971; Garay & Sweet, *Ibid.* 49, 1974.

*L. oligotricha* Fukuyama in *Trans. Nat. Hist. Soc. Formos.* 32: 242, 1942; in *Acta Phytotax. Geobot.* 14: 124, 1952.

6a. var. **nigricans**.

Figs. 20~22.

*L. nigricans* Honda var. *patipetala* Sawa in *Research Rep. Kochi Univ.* no. 29: 66, 1980, syn. nov.

Plant 15 to 30 cm high. Rhizome erect, J-shaped or complex, simple or branched, hairy; root-bearing rhizome abbreviated, to about 2 cm long, with closed scales; upper rhizome of which interconnected between the root-bearing rhizome and the aerial stem erect or nearly horizontal, usually elongate to more than 5 cm long, occasionally to about 15 cm long. Roots horizontally radiated, flexuose, yellowish brown and 2 to 2.5 mm in diameter while they are alive, about 1.5 to 2 mm thick in a dry state. Aerial stem nearly erect, black, stiff, often branched near the ground, with several scaly sheaths. Sheath triangular, subacute, about 3 mm long. Inflorescence 5- to 10-flowered, loose

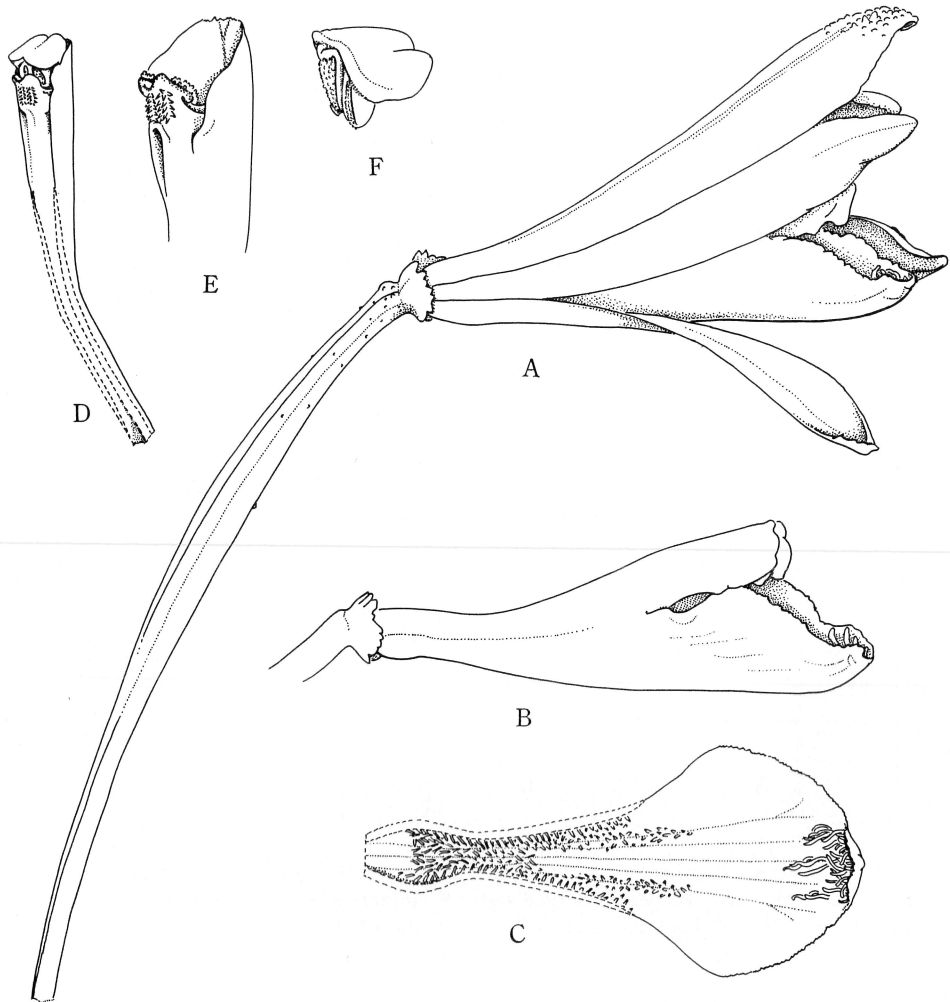


Fig. 22. *Lecanorchis nigricans* var. *nigricans*, boiled and dissected a flower from holotype specimen of *L. nigricans* var. *patipetala* Sawa. A, flower from side. B, lip and column with calyculus from side. C, lip, spread out. D, column, oblique view. E, anterior portion of column, anther removed, portions of pollinia left over. F, anther, A~D,  $\times 5$ .

below, subdense above. Floral bract triangular, acute, 1 to 2 mm long. Pedicellate ovary yellowish brown, somewhat tortuose, suberect before flowering, obtuse-angled with axis while flowering, 15 to 27 mm long, sparsely tubercular-processed, with an irregularly denticulate calyculus at the summit of which less than 1 mm high. Sepals and petals patent in the morning probably under the limited condition, cucullate, whitish yellow-brown. Dorsal sepal oblanceolate-oblong, praemose, about 17 mm long, 4 mm wide when spread out, 5-nerved, somewhat scabriduous at the anterior outside. Lateral sepals oblique, obtusely praemose, somewhat shorter than the dorsal sepal, about 15 mm long, 3.5 mm wide, 4-nerved, somewhat scabriduous at the anterior outside. Petals obliquely oblanceolate, obtuse or subacute, irregularly and slightly crenulate at the anterior margin, about 17 mm long, 4 mm wide when spread out, 3-nerved. Lip white

with a purple front, erect, basally adnate a little more than half length to the column, simple, obovate-spathulate, cucullate, 13 to 15 mm long, about 5 mm wide in natural position, about 8 mm wide when spread out, with 7 major nerves; free portion with the incurved and irregularly denticulate or somewhat erose-denticulate margins, hairy at the anterior part of the disc; hairs purple, multicellular, subdense, ribbon-like, obtuse, simple or branched, without a unicellular branchlet, 0.2 to 1 mm or more long, about 0.2 mm wide at the terminal branch; adnate portion microscopically papillose inside except for the very base of which somewhat saccate and the anterior half of the disc; papilla ellipsoid, usually 0.2 mm long. Column white, tinted with pale-purple, 11 to 13 mm long, 1.8 mm wide; dorsally grooved with indistinct wings; wing-edges somewhat papillose in the specimen from Mt. Nesugata, Shimoda, glabrous in the type specimen of *L. nigricans* var. *patipetala* from Ikku, Kochi. Anther white, glabrous, depressed above. Fruits blackish, sub-erect or very obtuse-angled with the axis, 21 to 33 mm long including the pedicel and calyculus, dehiscent in a cylindrical-fusiform frame. Flowering in mid-July to mid-September.

ETYMOLOGY. From the Latin *nigricans*, "blackish" referring to the colour of the plant of which rather blackish than *L. japonica*.

JAPANESE NAME. クロムヨウラン

DISTRIBUTION. Honshu, Shikoku, Kyushu and Ryukyu.

TYPE. 'Hondo' (Honshu). 'Iwada, Prov. Kii. anno 1931, K. Kashiyama' (TI).

SELECTED SPECIMENS. HONSHU. Ibaraki Pref.: Near Umegaoka Hospital, Ookubocho, Hitachi, ca. 170 m alt., Aug. 25, 1990, T. Hashimoto (TNS 9504082), fls. Shizuoka Pref.: Mt. Nesugata, Shimoda City, ca. 170 m alt., Aug. 12, 1989, Y. Hanei (TNS 9504537); Ibid., Mar. 18, 1990, T. Hashimoto (TNS 9504625), fr.; Mie Pref.: In the precinct of Ise Shrine, July 23, 1980, C. Chuma (TI), fls. SHIKOKU. Kochi Pref.: Mt. Hachibuse, Kera, Kochi City, Mar. 29, 1990, T. Hashimoto (TNS 9504641); Ibid. Ikku, Kochi City, Aug. 5, 1979, Y. Sawa, n. 0-101 (Herb. Makino Bot. Gard.), holotype of *L. nigricans* var. *patipetala* Sawa. RYUKYU. Iriomote (Isl.), 'in laurisilvis montis Tedo', June 4, 1938, N. Fukuyama, n. 7127 (TAI), holotype of *L. oligotricha* Fukuyama, not seen.

*L. nigricans* was taxonomically clarified and emended by Tuyama (1955) as a result of the observation on the lip with the column of the plant from the type locality, since Honda's original description was insufficiently provided. The plant illustrated and identified under the name of *L. nigricans* by Lin (1987) from Taiwan is a perolic form of some *Lecanorchis* but seems to be another species, because it has a thick rhizome with larger scales, a different shape of column-wings and very short pedicellate ovaries of which become dark brown in mature. An examination of the type specimen of var. *patipetala* elucidates as it is illustrated as in this paper (Figs. 21 & 22B) that is synonymous of this taxon.

6b. var. **yakusimensis** Hashimoto, var. nov.

Figs. 23 & 24.

Differt a typo labello profunde cucullato; columna ventraliter puberulo. Sepala et

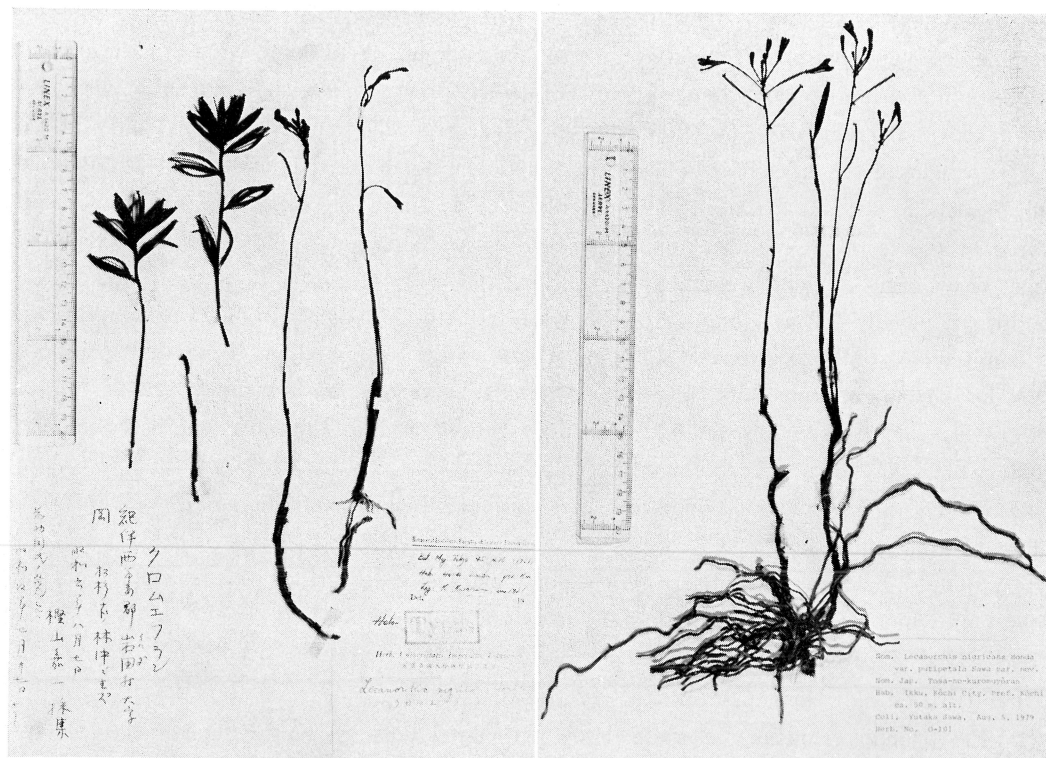


Fig. 23. *Lecanorchis nigricans* var. *nigricans*. A, holotype specimen (TI) of *L. nigricans* Honda. B, holotype specimen of *L. nigricans* var. *patipetala* Sawa (Herb. Makino Bot. Gard.).  $\times 1/4$ .

petala trinervia. Anthera brunneo-luteola.

Sepals and petals 3-nerved. Lip deeply cucullate with rather scarce multicellular hairs on the anterior disc. Column ventrally puberulent. Anther brownish pale-yellow. Flowering in late July to late September.

ETYMOLOGY. Named for the island of Yaku, i. e., Yaku-shima where the variety was found. The orthography, *yakusimensis*, is a conventional manner for the epithet of the botanical name.

JAPANESE NAME. ヤクムヨウラン

DISTRIBUTION. Known only from Yaku-shima.

TYPE. KYUSHU. Kagoshima Pref.: Along the Hanaage River, Yaku-shima (Isl.), July 21-27, 1986, Y. Hanei (TNS).

ANOTHER SPECIMEN EXAMINED. Ibid., Hirano, Sept. 26, 1979, Y. Hanei (TNS).

There are some doubts on the identification of this variety. As pointed out by Garay and Sweet (1974), Masamune's *L. purpurea*, nom. nud., from Yaku-shima had been treated as a synonym of *L. nigricans* Honda by Ohwi (1953) and by Masamune himself (1964), however, Masamune (1970) illustrated it by an apparently different figure of the lip from that of *L. nigricans*. The Japanese text of *L. purpurea* by Masamune (1970) also disagrees with *L. nigricans* for having '3 to 5 cm long and ascending capsules'.

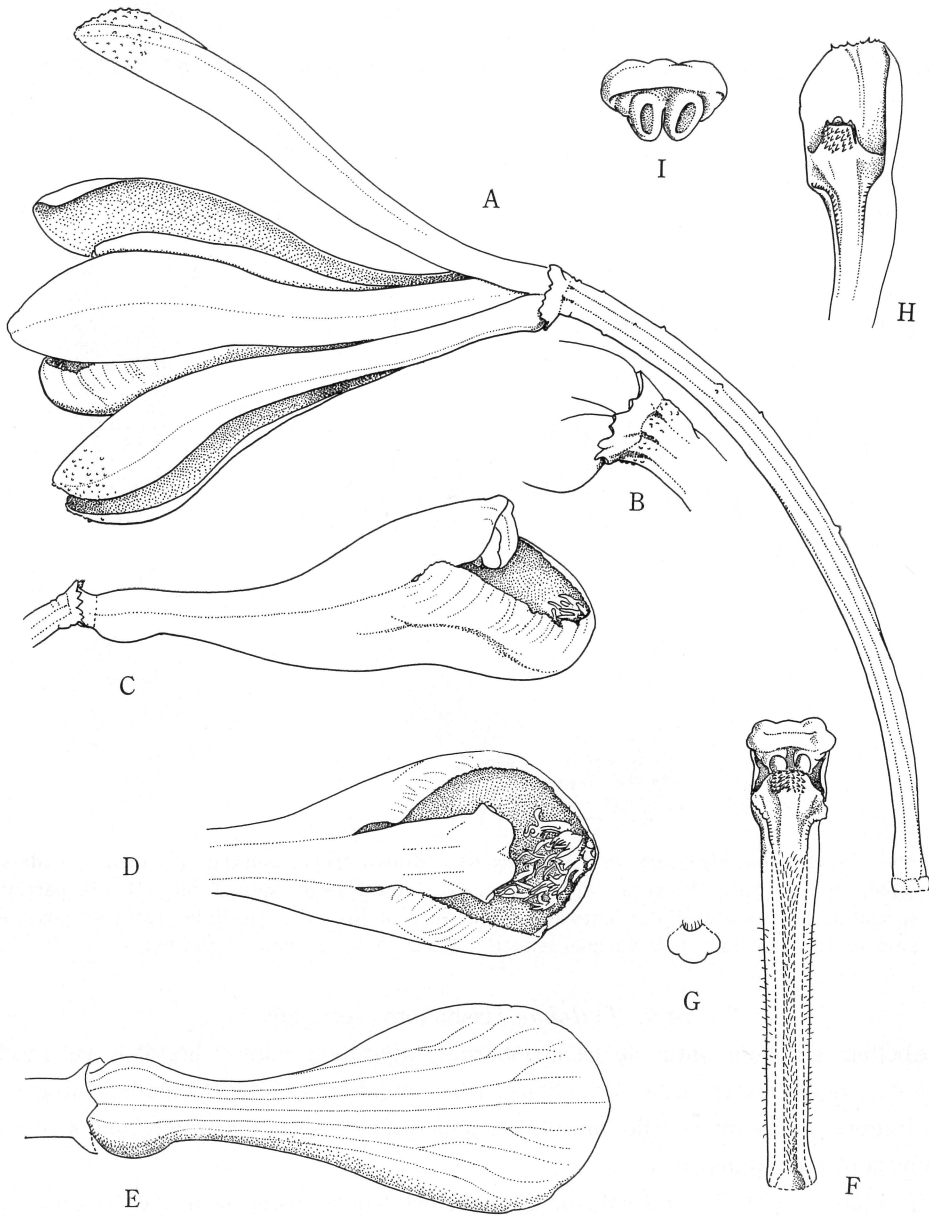


Fig. 24. *Lecanorchis nigricans* var. *yakusimensis* from type locality, collected by Y. Hanei. A, flower from side. B, calyculus. C, lip and column with calyculus from side. D, lip and column from above, basal portions excluded. E, lip with calyculus or portion of column, anther removed, oblique view. I, anther. A~G,  $\times 5$ . C~I, drawn from holotype specimen.

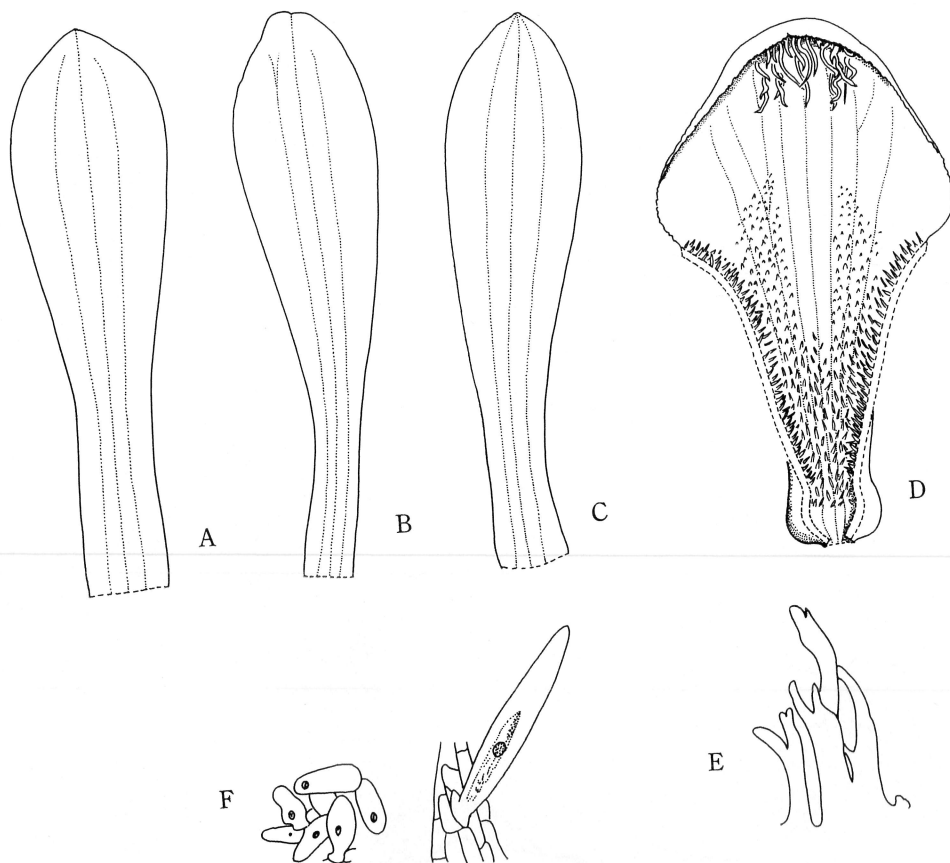


Fig. 25. *Lecanorchis nigricans* var. *yakusimensis*, drawn from holotype specimen. A, dorsal sepal, spread out. B, petal, spread out. C, lateral sepal, spread out. D, lip, partially spread out. E, multicellular hairs at anterior disc of lip. F, unicellular hairs on posterior part of lip, showing their various length. A~D,  $\times 5$ . E, much enlarged. F,  $\times 80$ .

Sect. *Trilobae* Hashimoto, sect. nov.

Labellum trilobum, intus ad basin loborum lateralium callis 2 brevibus vel fasciis 2 incrassatis, numeris nervorum aequalibus; lobis lateralibus semiorbicularis, integris vel prope integris; lobo intermedio conspicuo; pilis disci densis, aliquantum longis, ramosis. Columna alis rectangularibus.

Lip 3-lobed, with 2 small calli or 2 thickened bands inside near the base of lateral lobes and even-numbered major nerves; lateral lobes semiorbicular, with nearly entire margins; midlobe conspicuous; disc-hairs dense, rather long, branched. Column with rectangular wings.

TYPE. *Lecanorchis triloba* J. J. Smith in Bull. Dép. Agric. Indes Néerl. 19: 26, 1908.

The species of this section is characterized by having semiorbicular lateral lobes with entire or nearly entire margins and having or having an aptitude to form a pair of small calli on the disc of the lip. *L. papuana* Schltr., *L. bicarinata* Schltr. and *L. ciliolata* J. J. Smith, they are all New Guinean, may be members of this section. *L. thalassicus* Lin from Taiwan is suspected as an additional species for this section,



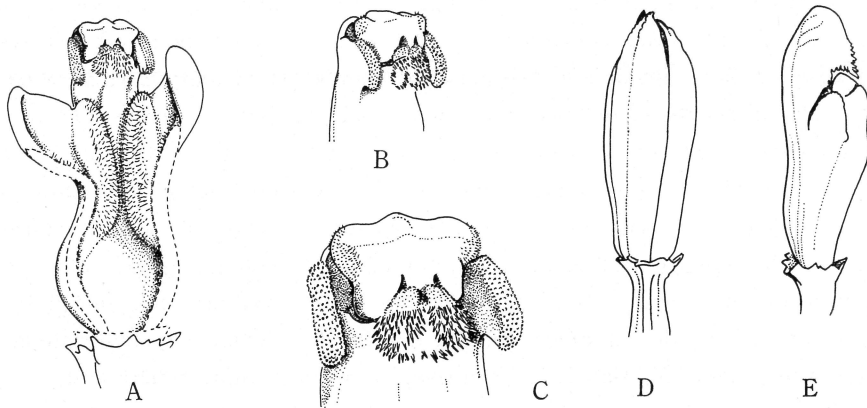


Fig. 26. *Lecanorchis triloba* from Yayeyama Is., Okinawa Pref. A, column with the lateral lobes of lip. B & C, anterior portion of column. D, flower bud with calyculus. E, lip and column of D, side view. A, D & E,  $\times 5$ . A~C, material from Iriomote Isl., collected by M. Hashizume. D & E, material from Ishigaki Isl., collected by T. Hashimoto, boiled and dissected a portion of TNS 9504618.

but, unlike the other members, it did not mentioned the callosity in the lip and illustrated as an apparently shorter column than the lateral lobes of the lip in Lin's original publication.

7. ***Lecanorchis triloba*** J. J. Smith in Bull. Dép. Agric. Indes Néerl. **19**: 26, 1908.

Figs. 25 & 26.

*L. multiflora* J. J. Smith in Bull. Jard. Bot. Buitenz. 2<sup>e</sup> sér. **26**: 8, 1918; Ibid. 3<sup>e</sup> sér. **5**(4), t. 25-II, 1923, syn. nov.

*L. brachycarpa* Ohwi in Acta Phytotax. Geobot. **7**: 35, 1938; Tuyama, Ibid. **30**: 184 (fig. 3-C & -D), 1955; Garay & Sweet, Ibid. 51 (fig. 3-k) & 52, 1974, excl. pl. ex Taiwan.

"*L. cerina* Fukuyama" Nackejima, l. c. 1975, p. p.

*L. multiflora* J. J. Smith var. *brachycarpa* (Ohwi) Hashimoto in Ann. Tsukuba Bot. Gard. no. **8**: 6, fig. 2, 1989, syn. nov.

Plant 15 to 40 cm high. Rhizome blackish, simple, rarely with rudimental branches, J-shaped at the bottom; upward part somewhat flexuose, longer than the downward part, 6 to 10 cm long, with usually spaced scales of which persistent, thick, triangular. Roots brownish cream-coloured, somewhat flexuose, horizontally radiate from the downward rhizome, occasionally from the upward rhizome, 3 to 4 mm in diameter while alive, about 2 mm thick in the herbarium specimen. Aerial stem blackish, simple or few-branched, with a few, spaced, amplexicaule, triangular, acute, 3 to 4 mm long scales. Inflorescence subdense, several-flowered, with the 1 to 5 cm long axis. Flowering upward. Floral bract orbicular-deltoid, acute, subacute or rounded with an apicule, 1 to 2.5 mm long. Pedicellate ovary nearly erect, slightly arched, about 11 mm long together with a topped calyculus of which irregularly denticulate and about 1 mm high. Flower brownish purple with white lip and column in Japanese specimens, nearly patent. Dorsal sepal

cucullate, narrowly oblong, rounded at the apex, with 3 major and 1 or 2 obscure nerves, 9 mm long, 2.8 mm wide when spread out. Lateral sepals cucullate, obliquely oblanceolate-oblong, obtuse, with 3 major and few obscure nerves, 9 mm long, 2.8 mm wide when spread out. Petals cucullate, oblanceolate-oblong, obtuse, with 3 major nerves, 9 mm long, 3.8 mm wide when spread out. Lip 3-lobed, adnate about halfway to the column, basally gibbose, about 11 mm long, 6-nerved, with two low small calli below base of the midlobe; calli elliptic, with the ovate free portion forward of which lapped over the lamina, with dense unicellular hairs; lateral lobes cucullate, semicircular, rounded at the apex, entire or nearly entire, about 1.5 mm high, swelling and unicellular-hairy at the base of the inside; midlobe decurved, orbicular, irregularly fimbriate-lacerate, with white (informed by Y. Hanei), ribbon-like, branched, multicellular hairs,  $7 \times 7$  mm when spread out. Column about 6.5 mm long, with obtuse-rectangular wings; margin of the column wing minutely pubescent. Anther with an obscure median ridge, minutely pubescent at the sides. Fruit ascending, blackish, dehiscent in globose rims, 14 to 20 mm long together with a persistent calyculus, subsessil. Flowers collected in January, April to June and October.

ETYMOLOGY. From the Latin *tri-*, "three", and *loba*, "lobed", in reference to the apparently three-lobed lip.

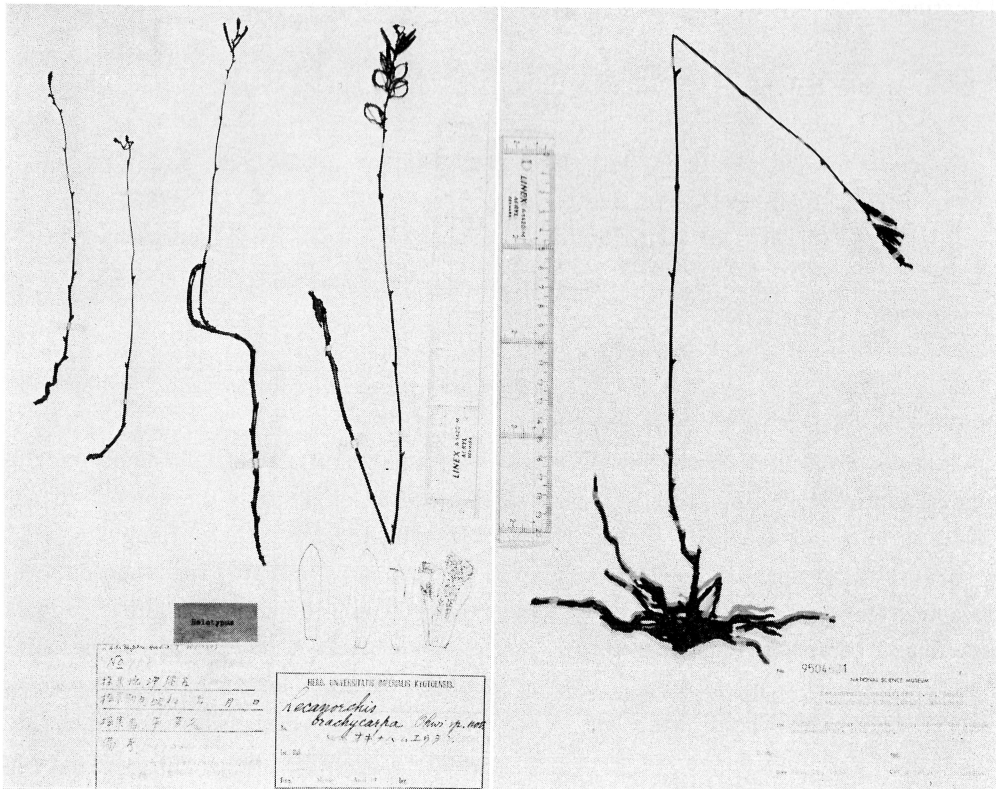


Fig. 27. *Lecanorchis triloba*. A, holotype specimen of *L. brachycarpa* Ohwi (KYO). B, specimen with subterranean organs, from Iriomote Isl., collected by T. Hashimoto (TNS 9504621).

JAPANESE NAME. オキナワムヨウラン

DISTRIBUTION. Known from Ryukyus, Borneo, Java and New Guinea, ?also from Thailand, Peninsular Malaya and Sumatra.

TYPE. NEW GUINEA. IRIAN JAYA: 'Resi-rücken an dem Steen-Bach, am Boden im Urwalde in 300 m Meereshöhe', Aug. 1907, G. M. Versteeg n. 1676 (?BO), w. fl., not seen.

OTHER SPECIMENS EXAMINED. RYUKYU (Okinawa Pref.). Okinawa-honto (Isl.), Mt. Onna, Jan. 22, 1938, Y. Taira (KYO), type of *L. brachycarpa* Ohwi. Ishigaki Isl., along the stream for the Maesato Dam, the foot of Mt. Omoto, Feb. 19, 1990, T. Hashimoto (TNS 9504618), w. fl.-buds; Ibid. (TNS 9504619), w. frs. Iriomote Isl., along the upper stream of the Urauchi River, May 29, 1989, Y. Hanei (TNS 9504456), w. fl. & frs.; Ibid. along the middle course of the Aira River, Feb. 20, 1990, T. Hashimoto (TNS 9504621), w. fl.-buds & frs. BORNEO. Brunei, Batu Melintang to Sungei Pasir, along Sungei Ingei, Jan. 5, 1989, E. F. de Vogel n. 8891 (in alcohol: L 10319). JAVA. Bantam, G. Karang, 400 m alt., Mar. 15, 1913, C. A. Backer n. 7150 (L); Ibid. G. Malang, 400 m alt., Mar. 1913, C. A. Backer n. 7158 (L), syntype of *L. multiflora* J. J. Smith.

J. J. Smith (1908, t. 9-f) illustrated *L. triloba* with a 3-nerved lip. The author suspects that the illustration is incorrect, because the careful observation on the flowers of above-cited specimens ascertained that they were 6-nerved. Several specimens of related taxa at the Herbarium of Leiden were dissected and observed by M. Nakajima who carried out the work on request of the author. These results led author's conclusion that the above cited synonyms were conspecific with this species which had been studied and determined by previous students under inadequate introductions of characters.

### Summary

The Japanese taxa, seven species including five varieties, of *Lecanorchis* Blume are taxonomically revised with special reference to the floral dissections. The number of major nerves of the lip is applied in Lecanorchid taxonomy, and it had never been mentioned by previous students.

The supraspecific taxa, i. e., four sections, in the genus are newly proposed.

Two new varieties, *L. japonica* var. *tubiflora* Hashimoto and *L. nigricans* var.

Table 1. Sectional diagnoses in *Lecanorchis*

section	lip				column
	number of major nerves	twin calli	lateral lobes	margin of lateral lobe or its homologous part	column-wings
Trilobae	even	present		entire	rectangular
Lecanorchis			present		trapezoid or semi-circular
Flavicantes	odd	absent		irregularly denticulate	indistinct
Nigricantes			absent		

*yakusimensis* Hashimoto, are described.

“*L. hokurikuensis* Masamune” is given a varietal status for the species *L. japonica* Blume.

“*L. japonica* var. *suginoana* Tuyama” is proven to be a variety within the species *L. kiusiana* Tuyama.

“*L. nigricans* var. *patipetala* Sawa” is identical to the type variety. “*L. brachycarpa* Ohwi”, previously considered as a variety of “*L. multiflora* J. J. Smith” by the author, is reduced to a synonym of *L. triloba* J. J. Smith.

### Acknowledgements

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### 摘 要

*Lecanorchis* (ムヨウラン属) は小形の腐生ランで、宮城県以南の日本、台湾、およびシッキムからニューギニアにかけて分布が確かめられている。これまで発表された学名は新組合せと命名上の新名を除き24種5変種であるが、それらのうち11種3変種が日本からのものであった。これらは主として常緑林の林床に生え、個体数が比較的少なく、開花株に出合う例も少なく、花や株の色も目立ち難く、姿も単純で、開花株以外はあたかも樹木のひこ生えが立ち枯れているようにみえる。これらの条件がおそらく主な理由で、これまで本属の分類研究は極めて不十分であった。そこで日本産の材料を主として用い、本属における植物体全体の特徴を含め、花部を解剖して種類の特徴の詳細を明らかにしようと試みた。

日本産の *Lecanorchis* をここでは7種6変種認識し、これらの種類への検索表を作り、記載を行った。すでに示した3種類 (Hashimoto 1989) を除く、すべての分類群の花部を図解した。またこれらを4節に大別した。唇弁の大脈の数については、これまで注目されることがなかったが、ここではじめて分類形質としてとりあげた。*Lecanorchis* および *Trilobae* 両節の大脈が偶数であることは注目に値する。唇弁の緑の単細胞毛、葯の裂開口周辺の毛などはこれまで分類上の特徴とされたことがなかったが、ここでは種の異同を認識する形質として取り上げた。

## Literature Cited

- Aoyama, M., R. Tanaka & T. Itoh, 1987. Karyomorphological observations on saprophytic *Lecanorchis japonica* Bl. J. Orch. Soc. India 1: 51-55.
- Blume, C.L., 1856. Museum botanicum Luguduno-Batavum Vol. 2: 177-192 (=pars 12). Brill, Leiden.
- , 1858-1859. Florae Javae et insularum adjascentium, nova series 1. i-viii, i-vi, 1-162, pls. 1-66. Auct., Leiden, Sulpke, Amsterdam, bibliographical datas after F. A. Stafleu & R. S. Cowan, Taxonomic Literature, 2nd ed. Vol. 1, 1976.
- Chuma, C., 1980. Saprophytic plants of the Ise Shrine area (1). On *Lecanorchis kiusiana* Tuyama. J. Jap. Bot. 55: 306-309, pl. 5, in Japanese with English summary.
- Fukuyama, N., 1935. Studia orchidacearum Japonicarum IV. Bot. Mag. Tokyo 49: 290-297, 340-342.
- , 1942. Orchidaceae Liukienses novae vel minus cognitae I. Trans. Nat. Hist. Soc. Formosa 32: 241-244.
- , 1952. Contributions to the orchid flora of the Ryukyu Archipelago I. Acta Phytotax. Geobot. 14: 123-126.
- Garay, L. A. & H. R. Sweet, 1974. Orchids of southern Ryukyu Islands. i-xii, 1-180. Bot. Mus., Harvard Univ., Cambridge-Mass.
- Hashimoto, T., 1989. Taxonomic miscellanies of orchidaceous plants (4). Ann. Tsukuba Bot. Gard. no. 8: 1-9, in Japanese, Latin diagnoses and English descriptions.
- & K. Kanda, 1981. Japanese indigenous orchids in colour. 1-246. Ienohikari Asoc. Tokyo.
- Holtum, R. E., 1964. A revised flora of Malaya, Vol. 1. Orchids of Malaya, 3rd ed. (1st ed. 1953). i-v, 1-759. Govt. Print. Office, Singapore.
- Honda, M. (misprinted as H.), 1931. Nuntia ad Floram Japoniae XIV. Bot. Mag. Tokyo 45: 469-471, 493-494.
- Lin, T. P., 1987. Native orchids of Taiwan, 3, 1-300. Southern Materials Center, Taipei, in Chinese with English descriptions.
- Maekawa, F., 1971. The wild orchids of Japan in colour. i-xiv, 1-497. Seibundo-shinkosha, Tokyo, in Japanese with English summary.
- Masamune, G., 1929. A preliminary report on the vegetation of the island of Yakushima. 1-172, 3 pls, 1 map. Kagoshima-ken, Kagoshima.
- , 1934. Florestic and geobotanical studies on the island of Yakushima, Province Osumi. Mem. Fac. Sci. Agr. Taihoku Univ. 11. Bot. 4: 1-637, pl. 1-7, f. 1-13, 1 map.
- , 1969. Color Nippon no shokubutsu (Color illustrated flora of Japan) 8. viii, 1-295, iv. Koyo Shoin, Tokyo.
- Murata, G., 1975. Taxonomical notes 11. Acta Phytotax. Geobot. 26: 144-148, in Japanese with Latin description and nomenclature.
- Nackejima, C., 1975. Preliminary notes on the noteworthy Orchidaceae from Formosa, Ryukyus, Bonin Islands and southern Japan (4). Biol. Mag. Okinawa no. 13: 24-37, in Japanese with Latin nomenclatures.
- Ohwi, J., 1938. Symbolae ad floram Asiae orientalis (16). Acta Phytotax. Geobot. 7: 29-41.
- , 1953. Flora of Japan. i-v, 1-1383, pl. 1-6. Shibundo, Tokyo, in Japanese with Latin nomenclature.
- , 1965. Flora of Japan, rev. ed. i-xii, 1-1560, pl. i-XLVI, 1-10. Shibundo, Tokyo, in Japanese with Latin nomenclature.
- Ridley, H. N., 1893. On the flora of eastern coast of the Malay Peninsula. Trans. Linn. Soc. 2. s. Bot. 3: 359-378.
- Satomi, N., 1978. A new locality of *Lecanorchis trachycaula* Ohwi. J. Geobot. 26: 5, in Japanese.
- , 1982. Ran-ka (Orchidaceae), 187-235, pl. 170-208. In Satake, Y. et al., Nippon no Yasei Shokubutsu, Sōhon (Wild flowers of Japan, Herbaceous plants) I. Heibonsha, Tokyo, in Japanese with Latin nomenclature.
- Sawa, Y., 1980. Spontaneous orchids in the intermediate zone of Kochi Prefecture. Res. Rep. Kochi Univ. 29, Natur. Sci.: 59-71, in Japanese with Latin nomenclature and diagnoses.
- & M. Torikoshi, 1986. On the chromosome numbers of 3 spp. in *Gastrodia* and 4 spp. in *Lecanorchis*. Summaries of autumnal meeting 1986 for reading research papers, Jap. Soc. Hort. Sci. p. 567, in Japanese.

- Schlechter, R., 1911. Die Orchidaceen von Deutsch-Neu-Guinea. Fedde, Rep. Sp. Nov., Beih. 1: i-ii, i-lxvi, 1-1079.
- , 1919. Orchideologiae Sino-Japonicae Prodrömus. Fedde, Rep. Sp. Nov., Beih. 4: i-iv, 1-319.
- , 1923. Figuren-Atlas zu den Orchidaceen von Deutsch-Neu-Guinea. Fedde, Rep. Sp. Nov., Beih. 21: t. 1-372.
- Seidenfaden, G., 1978. Orchid genera in Thailand VI, *Neottioideae* Lindl. Dansk Bot. Arkiv 32(2): 1-195.
- Smith, J.J., 1905. Die Orchideen von Java. Flora von Buitenzorg 6: i-viii, 1-672. Brill, Leiden.
- , 1908. Vorläufige Beschreibungen neuer papuanischer Orchideen. Bull. Dép. l'Agr. Indes Néerl. no. 19: 1-39.
- , 1909. Die Orchideen von Niederländisch Neu-Guinea. Nova Guinea 8, Bot., Livr. 1: 1-148, pl. 1-46.
- , 1910. Die Orchideen von Java. Zweiter Nachtrag. Bull. Dép. l'Agr. Indes Néerl. no. 43: 1-77.
- , 1918. Ditto. Fünfter Nachtrag. Bull. Jard. Bot. Buitenz., 2<sup>e</sup> sér. no. 26: 1-135.
- , 1923. Tafeln Javanischer Orchideen I. Bull. Jard. Bot. Buitenz., 3<sup>e</sup> sér. 5(4): t. 1-37.
- Sugino, T. & I. Suzuki, 1982. Enshu-chiho no Muyo-ran to sono hen'i (Lecanorchids and their variations in Enshu District). Enshu no Shizen 5: 39-50, in Japanese.
- Takahashi, H., 1986. A note on *Lecanorchis nigricans*. Nat. Hist. Rep. Kanagawa No. 7: 85-88, in Japanese.
- Tohda, H., 1971. Development of the embryo of *Lecanorchis japonica*. Sci. Rep. Tohoku Univ. ser. 4 (Biol.), 35: 245-251.
- , 1986. Seed morphology in Orchidaceae III. Tribe Neottieae. Sci. Rep. Tohoku Univ. ser. 4 (Biol.), 39: 103-119.
- Tuyama, T., 1955. A new saprophytic orchid, *Lecanorchis kiusiana*. J. Jap. Bot. 30: 181-187, in English and a brief Japanese note.
- , 1982. *Lecanorchis japonica* Bl. var. *suginoana* Tuyama, a new variety, with comments on the other taxa of the genus. J. Jap. Bot. 57: 205-211, in Japanese with a Latin diagnosis and English notes.
- Yamashita, I., 1982. Hamamatsu wo chushin-toshita Nishienshu-chiho no Muyorán-rui to Yatsushiróran-rui (Lecanorchids and Gastrodias of western Enshu District, centering around Hamamatsu). Enshu no Shizen 5: 25-37.