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STUDIES IN THE SUBTRIBE HABENARIINAE (ORCHIDACEAE) IV. HABENARIA, PERISTYLUS, AND CYNORKIS FROM THE FIJI ISLANDS

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SUMMARY

The following seven *Habenaria* species have been reported from the Fiji Islands: *H. aliformis* C. Schweinf., *H. cynosorchidacea* C. Schweinf., *H. maculifera* C. Schweinf., *H. scrotiformis* L.O. Williams, *H. superflua* Reichb. f., *H. supervacanea* Reichb. f. and *H. tradescantifolia* Reichb. f. A critical study has demonstrated that only two of this list – *H. superflua* and *H. supervacanea* – show the essential characters of the genus. The following three – namely *H. aliformis, H. maculifera* and *H. scrotiformis* – have to be transferred to *Peristylus*. It is noteworthy that among the subtribe Habenariinae the genus *Peristylus* is dominating in the Polynesian region.

The situation of *H. tradescantifolia* Reichb. f. is somewhat confused: the type quoted by the author ('*Seemann no. 608*, ex parte') does not correspond with the published description. From this inhomogeneous entity, the component deviating from Reichenbach's diagnosis has been separated by Schlechter as *H. cyrtostigma*, which is, according to our findings, conspecific with *Peristylus papuanus* (Krzl.) J.J. Smith from New Guinea. No authentic specimen has been found in herbaria matching *H. tradescantifolia* Reichb. f., s.str. (in conformity with the description); the nature of this taxon remains therefore obscure.

Finally *H. cynosorchidacea* turned out to be identical with *Cynorkis fastigiata* Thou. from the Mascarenes. The disjunct dispersal of this plant is discussed.

According to our present knowledge the following members of the Habenariinae can be recognized for the Flora of Fiji: *Habenaria superflua* Reichb. f., *H. supervacanea* Reichb. f., *Peristylus aliformis* (C. Schweinf.) Renz & Vodonaivalu, *P. maculiferus* (C. Schweinf.) Renz & Vodonaivalu, *P. papuanus* (Krzl.) J.J. Smith, *P. scrotiformis* (L.O. Williams) Renz & Vodonaivalu, and *Cynorkis fastigiata* Thou.

Habenaria s.str. is not a profusely dispersed genus in the Pacific region. From the seven taxa reported for the Fiji Islands by Parham (1972), four have to be transferred to *Peristylus*, as the structure of their column with the typical arrangement of the stigmata is a distinct generic character. These are *H. aliformis, maculifera, scrotiformis*, and also in a limited sense *H. tradescantifolia*. The status of the first three is as follows:

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Peristylus aliformis (C. Schweinf.) Renz & Vodonaivalu, *comb. nov.* – Fig. 1a.

Habenaria aliformis C. Schweinf., Bernice P. Bishop Mus. Bull. 141 (1936) 17, fig. 6a (*'alaeformis'*). — T y p e: *Smith 257*, Fiji Islands, Kandavu Is., Mt Mbuke Levu, in dense forest, 200–500 m, 23.10.1933 (AMES, no. 41969).

D i s t r i b u t i o n. Fiji Islands.
E c o l o g y. Forest plant.

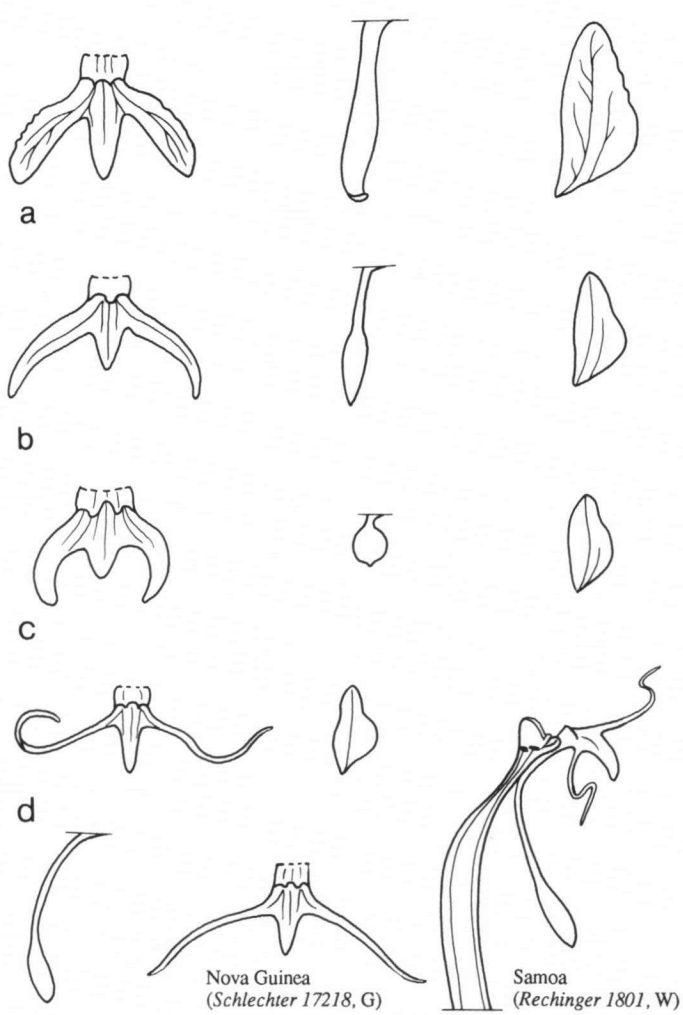

Fig. 1. Schematic drawings: lip (flattened), spur, and petal of a. *Peristylus aliformis* (C. Schweinf.) Renz & Vodonaivalu (*J.J. Smith 257*), b. *P. maculiferus* (C. Schweinf.) Renz & Vodonaivalu (*J.J. Smith 1911*), c. *P. scrotiformis* (L.O. Williams) Renz & Vodonaivalu (*Degener & Ordonez 13917*), d. *P. papuanus* (Krzl.) J.J. Smith (*Seemann 608* p.p.). All × 4.5.

Peristylus maculiferus (C. Schweinf.) Renz & Vodonaivalu, *comb. nov.* – Fig. 1b.

Habenaria maculifera C. Schweinf., Bernice P. Bishop Mus. Bull. 141 (1936) 18, fig. 1c. — Type: *Smith 1911*, Fiji Islands, Vanua Levu, Thakaundrove, eastern slope of Mt Ndikeva, in dense forest, 500 m, 6.6.1934 (AMES, no. 41968).

Distribution. Fiji Islands (Vanua Levu, Taveuni).
Ecology. Forest plant.

Peristylus scrotiformis (L.O. Williams) Renz & Vodonaivalu, *comb. nov.* – Fig. 1c.

Habenaria scrotiformis L.O. Williams in A.C. Smith, Sargentia (1942) 7, fig. 1: 5–11. — Type: *O. Degener & E. Ordonez 13917*, Fiji Islands, Vanua Levu, Thakaundrove, hills east of Valanga, Savu Savu Bay region, about 100 m, 10.12.1940 (AMES, no. 61023).

Distribution. Fiji Islands.
Ecology. Forest plant.

The column morphology of these three *Peristylus* species (fig. 1) is very much identical, but there are other useful delimiting characters. *Peristylus aliformis* and *P. maculiferus* are very similar in their vegetative appearance: the many leaves are arranged in a rosette approximately in the middle of the stem. *Peristylus scrotiformis* has leaves which are not clustered in a rosette but more or less evenly spread on the stem. Also the development of the spur makes these entities easily distinguishable from each other (fig. 1). *Peristylus aliformis* and *P. maculiferus* have an elongated spur, whereas a globular spur is characteristic for *P. scrotiformis* and for several other *Peristylus* taxa not occurring on the Fiji Islands.

Peristylus aliformis is in general appearance similar to *P. maculiferus*, but they differ mainly in the shape of the lateral lip segments (in *aliformis* oblong and somewhat obtuse; in *maculiferus* narrowly triangular to linear, tapering to a rather acute tip) and the spur (cylindric, the apical half somewhat swollen in *aliformis;* spindle-shaped in *maculiferus*).

A further *Habenaria* from Parham's list is *H. tradescantifolia* Reichb. f. (1868). For this entity Kores* proposed already the transfer to *Peristylus*. However, there are some inconsistencies about this plant. In Reichenbach's herbarium exists a sheet with a few plants collected by Wilkes (s.n.) from Fiji, which should be separated from Reichenbach's concept of *Habenaria tradescantifolia*, because of the very uniform development of the 3-lobed lip (lateral segments approximately 3 × longer than the middle segment). On the same sheet is also a sketch and a handwritten diagnosis of *H. tradescantifolia*, which has been literally taken over in Seemann's Flora

* P. Kores gave the following annotation on a sheet of the Reichenbach herbarium (W) for *Habenaria tradescantifolia* f. *pinquior* Fleischm. & Rechinger (1910), gathering K. & L. Rechinger, no. 732: 'Syntype of *Habenaria cyrtostigma* Schltr. = *Peristylus tradescantifolius* (Rchb. f.) Kores.' The f. *pinquior* is a vigorously developed plant with a long inflorescence (15–17 cm).

Vitiensis' (1868: 293). The sketch shows a lip which agrees with the text ('labello usque supra basin trifido, laciniis lineari-subulatis, media lacinia longiore'), but not with Wilkes' specimen or other collections attributed to *H. tradescantifolia*. This discrepancy has also been recognized by Schlechter (1910), when separating from this inhomogeneous complex the plants with elongated lateral lip segments as *Habenaria cyrtostigma* Schltr. In his comment the author expressively points to this difference between his new species and Reichenbach's *tradescantifolia* ('Reichenbach sagt ausdrücklich, dass die seitlichen Zipfel des Labellums kürzer seien'). The length of the segments of the lip and petals is not always a character of taxonomic importance within the genus *Habenaria*. The Fijian *H. supervacanea* Reichb. f. shows e.g. in this respect a certain variability. But not so with *Peristylus*, certainly not with the above mentioned Fijian taxa, where the relative dimensions of the labellum segments are fairly constant. The plants from Fiji and Samoa which have been labelled in herbaria (W, G) as *H. tradescantifolia* and which have been examined by us (from Fiji: *Seemann 608* (W, G), *Wilkes s.n.* (W); from Samoa: *Rechinger 732, 1146, 1802* (all W)) do not correspond with Reichenbach's description and belong therefore to *H. cyrtostigma* Schltr. The collection *A.C. Smith 8157* (SUVA) from Taveuni Is. labelled as *H. tradescantifolia*, is identical with *Peristylus maculiferus*, recently found by one of us (S.V.) abundantly on Taveuni Is. at c. 400 m altitude.

The concept *Habenaria tradescantifolia*, as understood so far by various authorities, includes, as we have seen, the two entities *H. tradescantifolia* Reichb. f. s.str. and *H. cyrtostigma* Schltr., the latter belonging also to *Peristylus*. The study of these plants convinced us of a close relationship of the Fijian *H. cyrtostigma* with the New Guinea *Peristylus papuanus* (Krzl.) J.J. Smith (1913). The typical arrangement of the lanceolate acuminate leaves, clustered in the middle of the stem, and the usually much elongated, very narrow, and mostly rather loose inflorescence are characteristic features for both plants. The floral structure is also very much identical, especially the development of the column, lip, and spur (fig. 1d). As we cannot find seizable dividing characters we consider the plants from Fiji and New Guinea as being conspecific. The synonymy reads as follows:

Peristylus papuanus (Krzl.) J.J. Smith

Peristylus papuanus (Krzl.) J.J. Smith, Nova Guinea 12, Bot. (1913) 3. — *Habenaria papuana* Kränzlin in O. Warburg, Plantae Hellwiginae in Engl. Bot. Jahrb. 18 (1893) 188. — T y p e: *F. Hellwig 585*, Nova Guinea, Sattelberg bei Finschhafen, Essimbu, 10.4.1889 (B, lost).

Habenaria cyrtostigma Schlechter in Fedde Repert. 9 (1910) 83, syn. nov. — S y n t y p e s: *K. Rechinger 732* (W, G), *1802* (W), Samoa, Upolo, *K. Rechinger 1146* (W), Savaii.

D i s t r i b u t i o n. New Guinea, Fiji, Samoa.
E c o l o g y. Forest plant.

So far, we have seen no herbarium material of a plant corresponding with Reichenbach's sketch or description of *Habenaria tradescantifolia*. This sketch in Reichenbach's Herbarium (fig. 2) supports a possible relationship to the genus *Habenaria*, because the slightly intimated stigmatic processes and the elongated anther canals are characteristic for the genus. The description, however, gives no

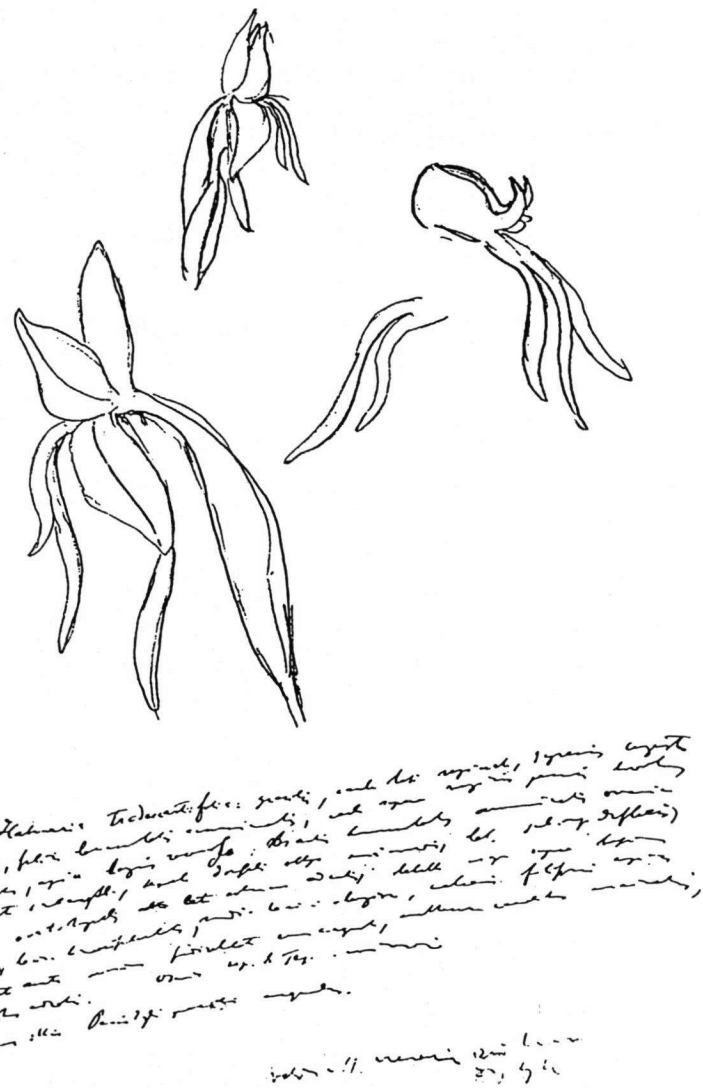

Fig. 2. *Habenaria tradescantifolia* Reichb.f. (*Seemann 608* p.p.), sketch from Herbarium Reichenbach f. (W).

allusion to the structure of the column. One can ask why Reichenbach was led into the discrepancy between the type specimen *Seemann 608* on one side and the sketch and the description on the other. A confusion with *Habenaria supervacanea* Reichb. f., a plant occurring also in the montane forest of Fiji and Samoa and having a similar lip, is hardly probable, because the latter has 2-parted and not entire ovate-

triangular petals, as it is clearly reproduced in Reichenbach's sketch. Therefore, the nature of *H. tradescantifolia* Reichb. f. remains still unclear.

The New Guinea and Polynesian *Peristylus papuanus* are in their general aspect somewhat near to *P. gracilis* Blume (1825) from Malaya and Indonesia, but the remarkable development of the staminodes seems to be an important feature for the latter (see the description and illustration in J.J. Smith, 1913, and G. Seidenfaden, 1977).

We have seen that four of the seven taxa, attributed to *Habenaria* in Parham's list from Fiji, have to be transferred to *Peristylus*. For *Habenaria tradescantifolia* Reichb. f. s.str. it is still doubtful whether it should be shifted to *Peristylus* or not. Only the two taxa *H. superflua* and *H. supervacanea,* both described by Reichenbach f. (1868), possess the typical generic characters of *Habenaria.* They are nearly related to *Habenaria salaccensis* Blume (Blume, 1825) from Java and to *Habenaria stenopetala* Lindl. (Lindley, 1835), a plant widely distributed from Western Himalaya to Eastern Asia, Taiwan and the Ryukyu Islands. Schlechter (1906) described from Samoa *Habenaria monogyne,* also allied to *H. salaccensis.* In a latter paper (1910) he cited the collection *Rechinger 1392* (W) from Samoa (determined by Fleischmann & Rechinger, 1910, as *H. supervacanea*) under *H. monogyne.* A specific feature of *H. monogyne* is according to Schlechter the development of the stigmatic processes, which are described as being united nearly to the tip ('processibus stigmatiferis usque infra apicem connatis' and in the comments 'durch zusammengewachsene Narbenfortsätze ausgezeichnet'). We examined Rechinger's specimen *no. 1392* and could not confirm this statement. The processes are free, but closely parallel to each other, with slightly outwardly diverging tips. This plant is indeed what we consider to be *H. supervacanea* Reichb. f., corresponding with the type, collected by Graeffe, *s.n.* (W) from Fiji.

Fleischmann & Rechinger (1910) quoted *H. superflua* as occurring in Samoa, documented by the gathering *Rechinger 81* (W). Schlechter (1910), however, doubts whether this entity is identical with Reichenbach's original plant from Fiji and associates the Samoan plant with *H. samoensis* F. Muell. & Krzl. (Kränzlin, 1893), a plant which Kränzlin (1898) combines with *H. tahitensis* Nadeaud (Nadeaud, 1873) from Tahiti and the Marquesas. We have studied *Rechinger 81* and found it to correspond well in vegetative and floral details with Reichenbach's description and the type specimen of *Habenaria superflua.* The three entities *superflua, samoensis,* and *tahitensis* are certainly an aggregate of nearly related *Habenarias*; they might be conspecific, but we do not want to go more into detail, without having seen living plants or the type specimens of *samoensis* and *tahitensis.*

Finally, from Parham's seven species of *Habenaria* from Fiji, an interpretation of the remaining *H. cynosorchidacea* C. Schweinf. (1936) is necessary. Already Schweinfurth, by naming this plant, made allusion to the genus *Cynorkis,* certainly impressed by the similarity in appearance with certain members of this genus, all indigenous in Africa and the Mascarene Islands. Examination of the column structure of living plants from Fiji and comparison with individuals from the Seychelles supports clearly the fact that the Polynesian plant has to be considered as a member of *Cynorkis* and not of *Habenaria.* In addition all the vegetative and floral characters

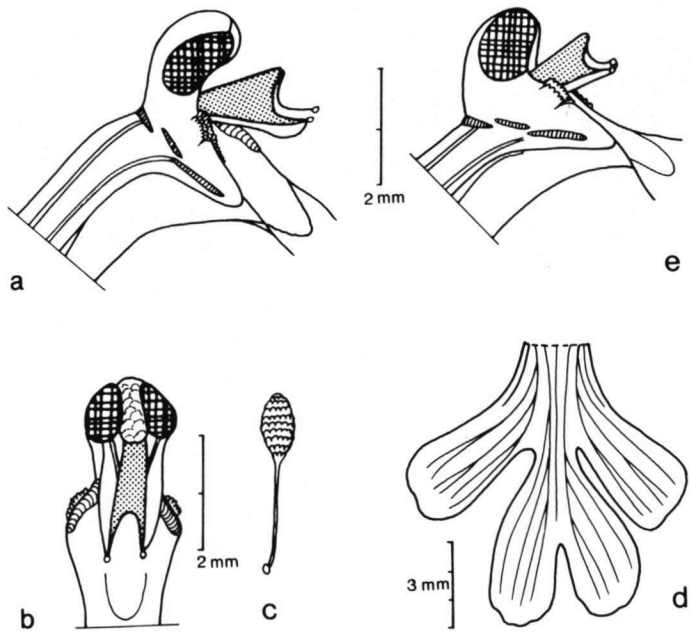

Fig. 3. *Cynorkis fastigiata* Thou. from Fiji (*Renz 14711*); a. column, side view; b. column, ventral view; c. pollinarium; d. lip. – *C. fastigiata* from the Seychelles (*Renz 13030*); e.column, side view.

indicate undoubtedly the identitiy with *Cynorkis fastigiata* Thouars, a native of the Mascarene Islands, with the Seychelles, so far, as northeasternmost locality. Schweinfurth, when comparing the Fijian plant with *Cynorkis fastigiata,* reported that the structure of the column is different and according to his findings 'rostellum prominently and subequally 3-lobed, the stigmatic processes short, stout' it could have been regarded as belonging to *Habenaria*. The column of the plant we have collected in Fiji has the very prominent mid-lobe of the rostellum, and the stigmata are adnate to the edges of the lip, both characters in accordance with those for *Cynorkis fastigiata* (fig. 3). The prominently hooded mid-lobe of the rostellum, overtopping the anther, is a peculiarity which can be observed to a certain extent with some *Habenaria* species, as e.g. in *H. pratensis* (Lindl.) Reichb. f. from Brasilia; but in this case the stigmata are located distinctly on free arms.

The following is a diagnosis of the Fijian *Cynorkis*.

Cynorkis fastigiata Du Petit-Thouars – Figs. 4, 5.

Cynorkis fastigiata Du Petit-Thouars, Hist. Orchid. (1822) fig. 13. — T y p e: *Du Petit-Thouars,* Crescit in insulis Mauritii en Bourboniae.

Habenaria cynosorchidacea C. Schweinfurth, Bernice P. Bishop Mus. Bull. 141 (1936) 18, syn. nov. — T y p e: *Smith 1364,* Fiji Islands, Moala, on Ndelaimoala, in open places among grasses and sedges, 400 m, 22.3.1934 (AMES, no. 4167).

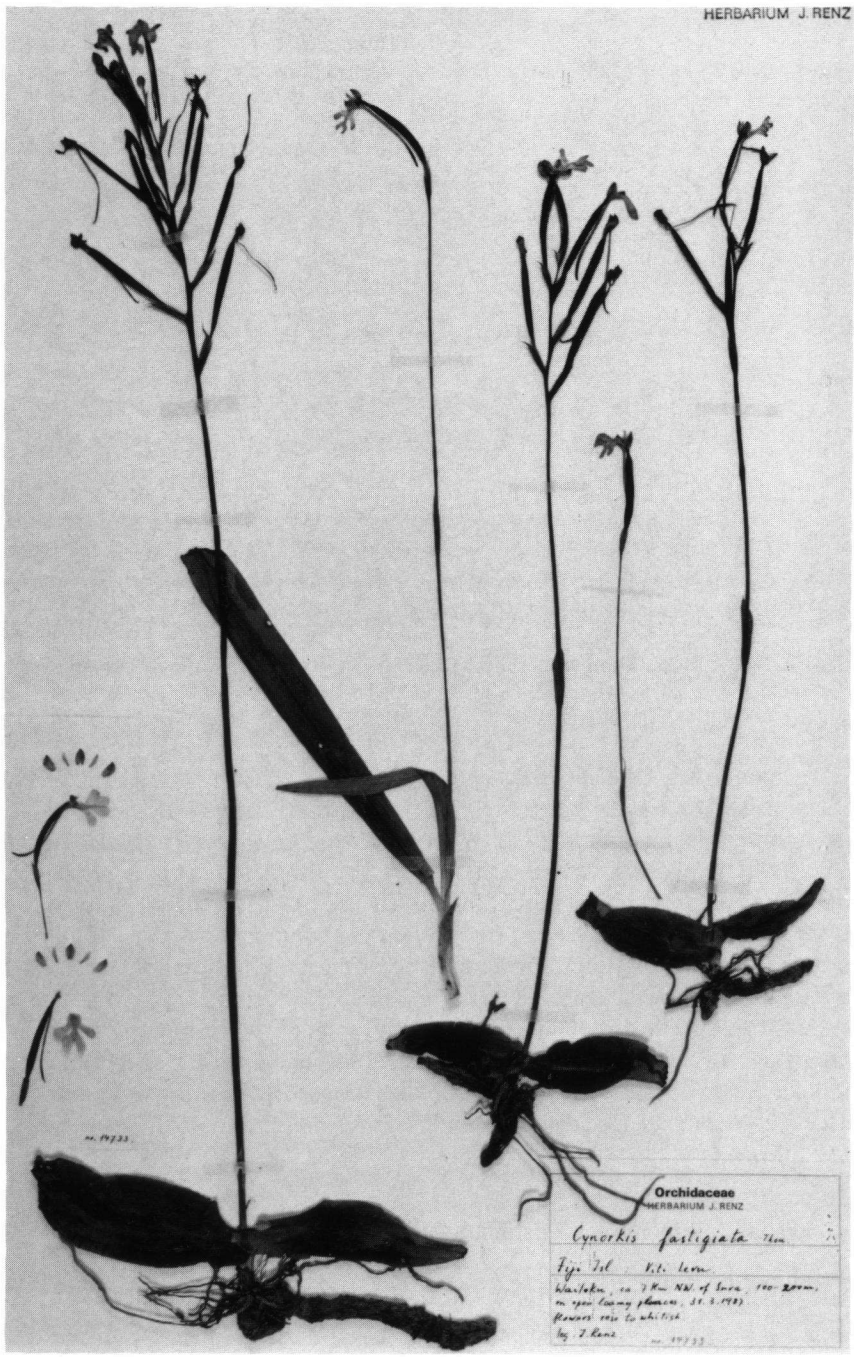

Fig. 4. *Cynorkis fastigiata* Thou. from Fiji (*Renz 14733*).

Terrestrial plants with sessile elongated turnip-shaped tubers. *Leaves* 2, basal, sessile, normally different in size on the same plant, lanceolate, oblong-lanceolate to ovate-lanceolate and stem-clasping with cordate base, lying more or less flat on the soil. Stem slender, straight, with one infundibuliform sheath. *Inflorescence* with 1–12 flowers. Bracts small, acuminate, exceeding slightly the length of the pedicels. Ovary + pedicel 3–4 cm long. *Flowers* small, pale rose-purple, sometimes nearly white. The dorsal sepal and petals ± connivent, forming a helmet. *Sepals* 5 mm long, acute; the dorsal ovate, laterals deflexed, obliquely ovate, concave. *Petals* about as long as the sepals, oblong-lanceolate, with rounded apex, narrowed towards the base, broadest near the apex. Lip surpassing 2.5–3 times the sepals, stretched forwards, deeply 3-lobed, the mid-lobe bilobed, lobes with rounded tips, 10–12 mm long, when flattened 10–12 mm broad between the side-lobes. *Spur* elongate, filiform, 2.5–3 cm long, ± parallel with the ovary. *Column* c. 2 mm tall; rostellum projecting forwards, having a prominent mid-lobe and elongated sidelobes; pollinaria separate, c. 3 mm long, with very slender caudicles and tiny glands; the stigmata forming cushions, firmly adnate to the staminodes and edges of the lip basis. *Ovary* narrowly cylindric, when becoming ripe lengthened to 5 cm.

Distribution. Madagascar, Réunion, Mauritius, Seychelles, Fiji, Futuna*.

Ecology. Flowering time during the rainy season from October to May.

The following compilation of localities of *Cynorkis fastigiata* on the Fiji Islands demonstrates the wide distribution in the forested, rainy, eastern side of the main island Viti Levu and on the southern side of Vanua Levu:

VITI LEVU: Wailoku, NW of Suva, 100–200 m, on open dark red and yellow, loamy soil, 31.3.1987, *J. Renz & S. Vodonaivalu 14733* (Herb. Renz, Basel). — Lomalagi, near Forest Station, 900 m, among grasses on border of planted *Pinus* forest, 7.4.1987, *J. Renz, obs.* — Nadarivatu, 16.8.1942, *R.S. Lever DA 2730* (SUVA); 15.1.1940, *B.E. Parham DA 3110* (SUVA); 800–850 m, 15.1.1940, *B.E. Parham DA 2418* (SUVA), *DA 3730* (SUVA). — Namosi, 60 m, 28.12.1984, *S. Vodonaivalu DA 20162* (SUVA). — 23 km NW of Suva, 8 km inland from Quercus Road, 80 m, 23.1.1979, *D. Young & P. Lowry 1708* (SUVA). — Nausori Highland Road, 800 m, 10.3 km E of junction with main road to Nadi, 25.1.1979, *D. Young & P. Lowry 1719* (SUVA). — Mt Korobaba, Rewa, 210 m, 5.10.1970, *A.R. Chagham L 17998* (SUVA). — Dakaivuna, Tailevu, 100 m, 13.11.1957, *M.K. Ledua DA 11023* (SUVA). — Tonia, Tailevu, 30 m, 15.2.1956, *D. Koroiveibau & Kaliova DA 10000* (SUVA). — Colo-i-Suva/Naitasari, 210 m, 6.1.1956, *S. Nand DA 9824* (SUVA); 11.1.1963, *I. Kuruvoli & I. Vakuruivalu DA 12990* (SUVA). — Vatuwaga (RA), 50 m, 5.5.1954, *D. Koroiveibau DA 7892* (SUVA). — Hills W of Waiwunu Creek, between Galoa and Korovou, 50–150 m, 23.11.1953, *A.C. Smith 9460* (SUVA); 300 m, 24.4.1969), *A.C. Smith, I.W. Parham, P.B. Tomlinson & D. Koroiveibau DA 16553* (SUVA). — Matavatucon (Tailevu), sea level, 23.4.1953, *F. Raigiso DA 7756* (SUVA). — Tailevu, hills E of Wainibuka River, in vicinity of Dakuivuna, 100–200 m, 14–26.4.1953, *A.C. Smith 7010* (SUVA). — Naduruloulou (Naitasari), 25 m, 20.4.1949, *M.E. Turbet DA 5547* (SUVA).

VANUA LEVU: Muanivatu Road, near Saverekareka (Savusau), 30 m, 1.11.1954, *D. Koroiveibau DA 8855* (SUVA).

In Viti Levu *Cynorkis fastigiata* is not limited to the lower littoral zones, but is growing also in the montane region up to altitudes of approximately 1000 m. The

* Pers. comm. (Jan. 21, 1989) from P. Kores, Tulane Univ., New Orleans, Louisiana 70118, USA.

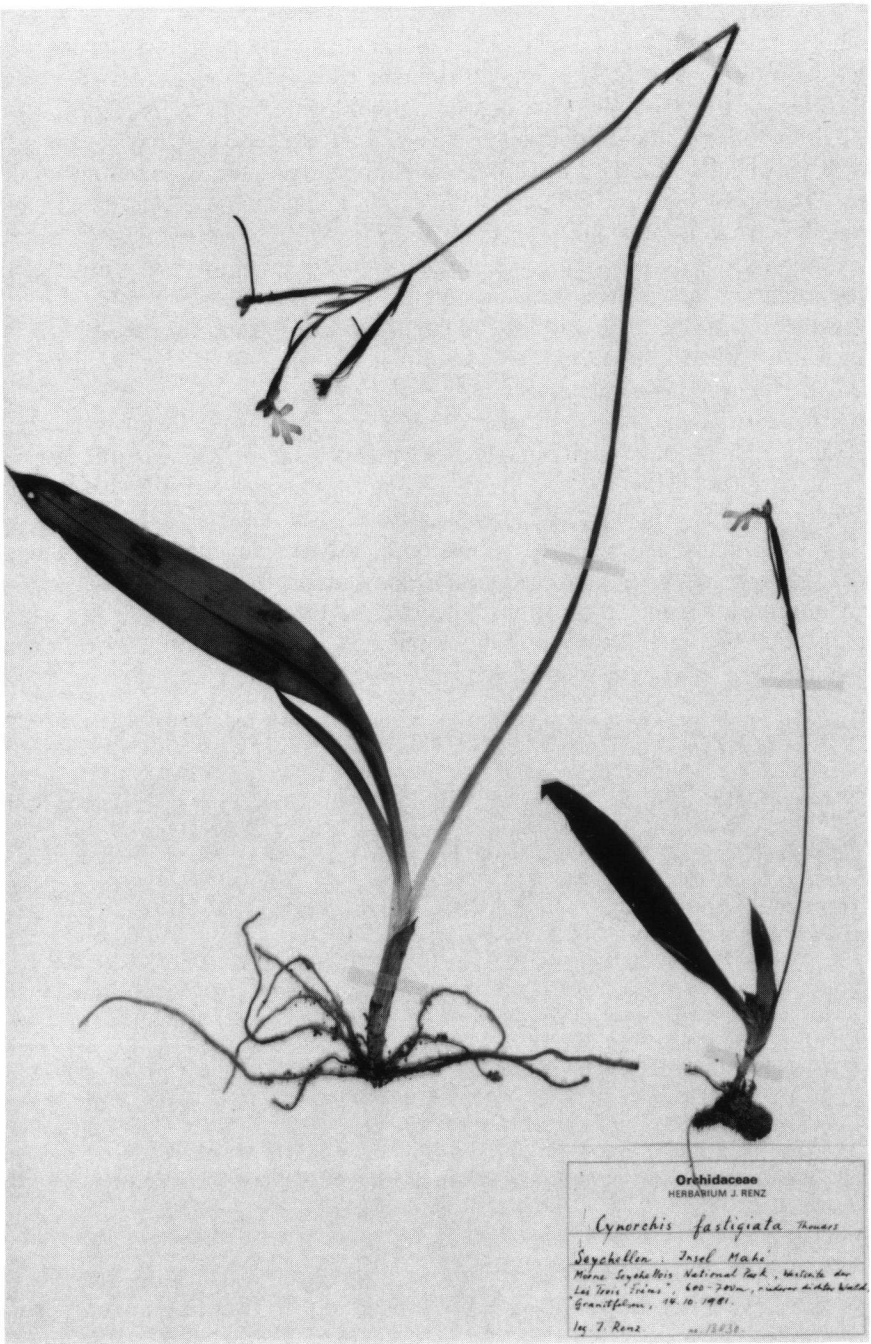

Fig. 5. *Cynorkis fastigiata* Thou. from the Seychelles (*Renz 13030*).

general appearance is somewhat variable, especially with regard to the size of the plant and the development of the inflorescence. In Fiji, as in the Mascarenes, plants with a single flower or with up to a dozen flowers are growing together in small populations with only scattered individuals. The favourite habitats are open places in densely forested areas, such as edges of forest or abandoned pathways or gutters of old road-sides, constantly affected by heavy rains, where the plant prefers loamy places, often more or less bare of other vegetation.

Cynorkis is primarily an Old World genus, with a centre of development in Madagascar and the islands of the Mascarene Archipelago. The question arises about the origin of *Cynorkis fastigiata* in Polynesia. It seems to us unlikely that it has been introduced by man. *Cynorkis* is not a conspicuous plant, as e.g. showy Himalayan *Arundina graminifolia,* which is perfectly naturalized and grows in Fiji luxuriously in the wild. *Arundina* might have been brought in the last century by immigrants from India for ornamental purposes. *Cynorkis* had probably not a comparable history, although the inhabitants of Fiji were experienced sailors, navigating also to far remote places. Another possibility could be aerial transportation of diaspores to overcome oceanic and other barriers. A migration from the Mascarenes to the East is not really favoured, as in the Polynesian region the SE tradewind prevails. The eastern side of Viti Levu has therefore throughout the year a wet climate, giving rise to a luxurious vegetation, where also *Cynorkis* and *Arundina* find favourable conditions. And on such places both plants can perfectly withstand the competition with the rapidly growing tropical vegetation.

Perhaps a more suitable interpretation of the disjunct distribution pattern of *Cynorkis fastigiata* is the possibility that formerly it had occupied a larger territory, parts of which have been eliminated by some adverse circumstances. In this respect *Cynorkis* would not be a particular case. A somewhat similar transoceanic dispersal is also characteristic for the terrestrial orchid *Eulophidium pulchrum* (Thou.) Summerhayes (1957; and Garay, 1964) and the epiphytic *Bulbophyllum longiflorum* Thou. both occurring also in Fiji. In contrast to *Cynorkis,* these two taxa are also widely spread in habitats ranging from tropical Africa, Madagascar, the Mascarenes, Seychelles to India and through Indonesia, Philippines to New Guinea, New Caledonia, Vanuatu, and Fiji. For *Cynorkis fastigiata,* however, a gap exists between the Seychelles and Fiji (and Futuna), from where the plant has not been recorded up to now.

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